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Comparative Analysis of the Causes of Gully Erosion in Nkpor and Obosi in Anambra State of Nigeria

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Abstract
The study conducted a comparative analysis of causes of soil erosion in Nkpor and Obosi. In doing this, questionnaires were administered randomly to the residents. The data generated were analyzed using cross tabulation, descriptive statistics, two sample T-Test and Z-Tests statistical techniques due to their nature. The results showed there is no serious variation between the causes of erosion in both communities. In addition, the result also proved that anthropogenic factors induce gully erosion in the community. Consequent upon the findings, the following recommendations were made: That there is a great need for agro forestry and green belt development, the nutrient level of the soil should be enriched to help in the growth of trees whose roots will help in the improvement of the organic content of the soil and reduce detachability due to rain drops, there should be development of an Integrated Environmental Management Programme (IEMP) for the state based on the principles of sustainable development to help tackle both the challenges of erosion and other environmental hazards. .

INTRODUCTION

BACKGROUND TO THE STUDY

According to Montgomery (2003), soil degradation is a concern worldwide. It is observed that humans carry out various activities on the soil and these activities consequently lead to the degradation of the soil in the form of landslides and soil erosion (Olori, 2006). Soil erosion is the single most threatening environmental degradation problem in the developing world (Ananda and Herath, 2003).It is identified as one of the direct causes of environmental deterioration and poverty in many parts of the world (Beijing Times, 2002).

STATEMENT OF PROBLEM

In Anambra State, the word erosion is synonymous with death and destruction. Over 20% of the total landmass of Anambra state is being devastated at one stage or another by flooding and gully erosion (Egboka, 1993). Of all the states in the South Eastern Zone, Anambra State has been identified as the worst hit having about 1,000 active erosion sites in its domain (Egboka, 1993).

In contemporary times, it can easily be put as the greatest scourge ravaging the state (Nnodu, 2005). Gully erosion and landslides are terminal and cancerous ecological diseases that destroy within minutes or at most hours; land formed over million of years (Egboka, 1993).

According to Egboka (2007), the problems resulting from soil erosion in the state are so many and are varied too. They include human, material, political, psychological, sociological, economical and spiritual all rolled in one.

Nkpor has a landmass of 13.88 Sq km with a total projected population of 106, 413 people (NPC, 2006). The Community has more than 7 erosion sites in various stages of development (Egboka, 1993).

About to 2.09sqkm of the landmass of Nkpor has been lost to soil erosion, this constitutes 15% of the total land area (Ministry of Environment, Awka, 2006). The implication is that 16, 023 people have been made homeless or affected in one form or the other. Some of these sites cover up to one square kilometer and range from 10 – 15 meters in width to 15 – 25 feet in depth (Ministry of Environment Awka, 2006).

Obosi has a landmass of 16.973 sq km with a total projected population of 140, 141 people. The community has more than 14 erosion sites at various stages of development (Egboka, 1993). About 4.02 sq km of the landmass of the area has been lost to soil erosion, this constitutes 23.7% of the total land area (Ministry of Environment Awka, 2006). The implication is that 33, 191 people have been made refugees or abandoned their homes in this community. The gully sites usually cover more than one square kilometer and range from 10 – 15 meters in width to 15 – 30meters in depth (Ministry of Environment Awka, 2006).

Unfortunately most of these sites are located at the heart of these urban centers. Moreover, these towns are known for multiplied economic activities like trading, agricultural activities, industrialization and transportation activities. Going by how soils of the areas are being ravaged, that these activities are in serious danger of being badly affected. The implications of this are that the inhabitants of the area and even people from distant places who depend on these activities are in serious danger of losing their means of livelihoods. This definitely will affect their lives.

It is to this effect that this study seeks to assess the socio-economic impacts of gully erosion in Obosi and Nkpor with a view to proffering solution to the menace.

AIM OF STUDY

The aim of this study is to comparatively analyze the causes of gully erosion in Nkpor and Obosi in Anambra State of Nigeria with a view to proffering a lasting control measure to the problem.

STUDY AREA

The figure 1 below is the map of Nigeria showing Anambra state while figure 2 presents the map of Anambra State showing the study area.

Figure 1: Map of Nigeria Showing Anambra State

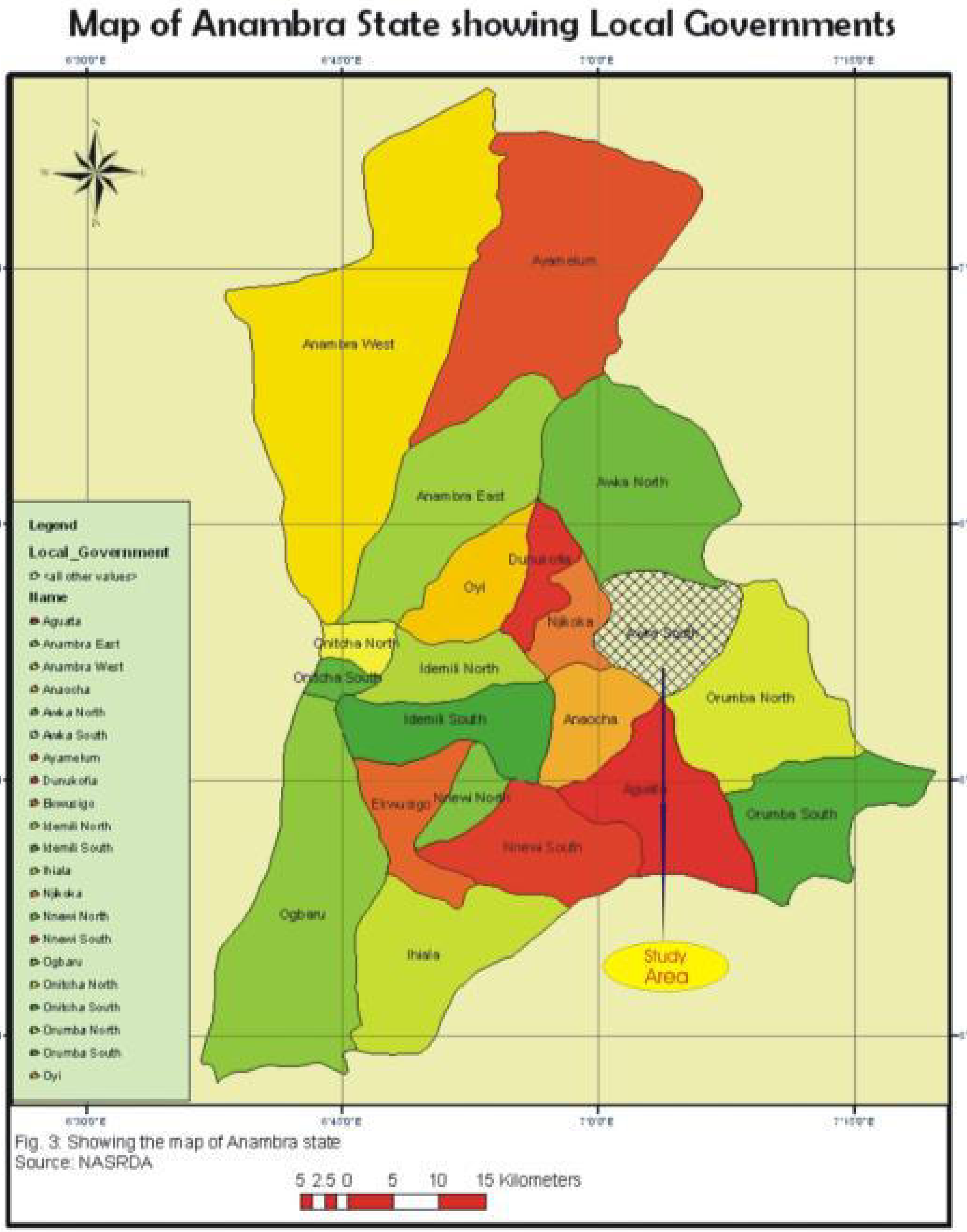


Figure 2: Map of Anambra State Showing the Study Area

LOCATION AND EXTENT

Anambra State is located within latitude 6° 48' Nand Longitude 6° 37'E on the North and Latitude 5° 40'N and longitude 7° 27'E on the South. It has a total land area of 4,416sqkm (Geological Survey Awka, 2000). Based on the 1991 population census conducted in 2006, the population of Anambra State rose to 7,821,858 with a density of 863km^2 (NPC, 2006).

OBOSI AND NKPOR

Obosi and Nkpor are communities that make up Idemili North Local Government of Anambra State. Obosi has latitude of 5° 43' and longitude of 6° 35'E with a landmass of 16.973sqkm. It is bounded on the North by Onitsha, on South by Oba, on West by Atani and on East by Umuoji. Nkpor has latitude of 6° 12'N and longitude of 6° 36'E. It is bounded on the North by Ogbunike, on South by Obosi, on West by Onitsha and on East by Ogidi. It has a landmass of 13.885km. They have a population of 246, 554 people (NPC, 2006).

LITERATURE REVIEW
CAUSES OF SOIL EROSION

This section reviews different works of people on natural and anthropogenic / human factors of soil erosion across the globe, including Nigeria.

2.2 NATURAL CAUSES

Fournier (1960) studied the relationships between soil erosion and climate as a factor in enhancing erosion in Paris, France using field observation. His outline served as a general guide in the attempt to correlate the two parameters.

Again, Fournier (1972), worked on erosion at Zanesville and Ohio, using the rainfall kinetic energy calculations developed by Hudson in 1965, for a period between 1934 and 1942. He collected 183 rain events from different places and the result showed that the average loss per rain event increase with intensity and duration of the storm.

From his work, he concluded that erosion as a result of rainfall kinetic energy can be reduced by the presence of vegetation cover.

Morgan (1979), conducted a research in London on soil erosion. In his work using experimental analysis, he showed that soil with a restricted clay fraction between 9 and 30% were the most soils susceptible to erosion, he also reported that sand particles of more than 0.3mm were not easily eroded by flowing water. He concluded that the soil type evident in an area amount to the severity of erosion in the area.

In addition, a similar work carried out in England by Evans (1980), using laboratory analysis, showed that the soils in England with more than 30 per cent clay content would generally be coherent and form stable soil aggregates, which would be resistant to rain splash impact and splash erosion.

Again, in 1978, the Australian soil conservation Agency (ASCA) studied the rate of erosion in Western and Eastern parts of Jordan valley. They collected 84 rain events from these different parts; and the results identified that 96% of the Western parts of the valley had rainfall more than 250mm and 93.2% of Eastern part had raining all less than 250mm, and heavily affected by different types of erosion.

Weggei and Rustom (1992) studied soil erosion by rainfall and runoff in the United States of America, with the use of both experimental analysis and the Revised Universal Soil loss Equation (RUSLE), in studying soil loss from field plots for a period of ten years. The results obtained showed that each raindrop size has an impact in detaching soil particles and is responsible for sediment transport by rainfall and overland flow. They further recommended that soil loss due to rainfall can be controlled with the aid of mulching.

Mbagwu and Bazzofi (1998), worked on “Soil Characteristics Related to the Resistance of Breakdown of Dry Soil Aggregation by Water Drops”. Fifteen surface soil samples were collected from North Central Italy and were analyzed in the laboratory. The result showed that soil properties determined the resistance of the soil aggregates to water drop impact, using the clay content which was the highest.

Following this, Schmittner and Giresse (1999) of the United States studied the impact of the atmospheric sodium in erodibility of clay in Mediterranean region. They collected fifteen soil laboratories. The result obtained showed that sandy or silty soils on steep slopes are the most erosive. They concluded that soils with greater proportion of clay that receives less intense precipitation, and are on gentle slopes tends to be less erodible.

Stocking (1981) studied the causes and prediction of advancement of Gullies in Bangkok, Thailand using modeling method. He noted that in Bangkok, erosion widens, deepens and extends headwords during the wet season.

Also, in 2003, the food and Agricultural Organization concluded a research on the loss of productivity land through erosion in Brazil. Laboratory analysis was used in determining eighteen soil samples. The result they got showed that the amount of soil carried away is influenced by two related factors, speed and plant cover. Considering the aspect of speed, it was revealed that the faster the water moves the more soil it can erode. Also, plants protect the soil and in their absence, wind and water can do much more damage than one can imagine.

Again, a laboratory study on “Slope Shape Effects on Erosion” by Zapp and Nearing (2005) in India showed that from measurement on the rates and patterns of erosion on complex shaped slope where surface morphology changes; that slopes shape have significant impact on rill patterns, sediment yield and runoff production. Through their observation, it was discovered that the soil topography led to flow convergence and divergence, resulting in a non-uniform distribution of rill spacing and efficiency.

In Belgium, Bennet et al (2000) evaluated the effect of different soil moisture contents and bulk densities on the rate of gulling. They observed that high soil moisture content and lower bulk density caused low rates of erosion, while beds with relatively lower soil moisture content and lower bulk density caused high rates of erosion.

Similarly, Morew et al (2003) conducted a study on soil surface roughness as a parameter highly suited to study soil susceptibility to wind and water erosion in Seattle. They employed the methodology for quantifying

SSR using multi fractal analysis of soil elevation measurements collected at the intersections on a 2 by 2cm3 grid in a 200 by 200cm2 plot. Their result showed that MFA was able to effectively reflect the heterogeneity and complexity of soil surface roughness as a causative factor of soil erosion in the area.

Torbert and Potter (2003) used the submerged jet method in determining soil erodibility coefficients. It was tested on six samples in Central Mexico of varying texture and predominant clay mineralogy near the end of the corn growing season. The resulting erodibility coefficients generally segregated soil of similar texture and mineralogy, soil with silt plus fine sand percentage's plasticity index were identified as important soil properties affecting soil erodibility.

Furthermore, a study on "The Effectiveness of Erosion Control Measures along the Qinghai – Tibet highway in Tibetan Plateau China", was conducted by Xianli et al (2006). They took field measurements to investigate the magnitude of runoff and soil loss from the road embankment. The runoff and soil loss were measured in the summer of 2003 and 2004 using runoff plots. The results indicate that soil erosion via soil loss in the area was due to high altitude, low summer rainfall and permanently poor vegetation covers. They recommended that soil loss can be minimized by the construction of flood channels and the planting of cover crops.

Montgomery (2007), performed a study in the United States of America (USA) on soil erosion and agricultural sustainability in some conventional plowed fields. He used data which were compiled from a growing body of studies on rates of soil production, long term geological erosion, erosion under native vegetation and agricultural fields. The compiled data encompasses 1, 673 measurements drawn from 201 studies. He found out that the geological rate of erosion (1mm/year) is greater than the conventional plow based field erosion. From the results, he stated that the geology of the area has a hand in the rate of erosion compared to the activities performed by man.

Lately, Truvan et al (2007), studied "Variable Rainfall Intensity and Tillage effects on Runoff, Sediment and Carbon Losses From a Loamy Sand Over simulated Rainfall in Coastal Plain Soils of Georgia". From the experimental analysis conducted, they discovered that low carbon soils and intensively cropped coastal plain soils of Georgia are susceptible to runoff and lead to the consequent removal of the soil.

Shrestha et al (2007), studied soil Aggregate and Particle Associated Organic Carbon Under Different Land Uses in Nepal. Through laboratory analysis conducted on water stability of soil aggregate and Soil Organic Carbon (SOC) associated with aggregates and primary particles in surface (0 – 10cm) and sub-surface (10 – 20cm) layers of cultivated land and forest land. The result showed that the forest soils contained more sand (639 – 834 gKg-1) than the cultivated soils. Soils under natural forest however were characterized by higher Soils Organic Carbon (SOC), which made the soils less erodible as they had greater water stability aggregates than the cultivated land.

Peterson (2008) in his work in China, studied soil erosion and conservation, for a period of six months using measurements on runoff and analytical methods on soil samples. His work showed that climate and geology were the most important influence on erosion with soil characteristics and vegetation being independent upon them as they interrelated with each other. From his work; he stated that the web of relationships between the factors which influence erosion is extremely complex. There were also works on erosion in the African continent, Othieno and Laycock(1997) at Kericho Kenya carried out a research work aimed at finding the influence of different tea cultivation practices on runoff and soil erosion. They showed that rainfall intensity was the major cause of erosion in the area. They found out that erosion losses were significantly correlated with rainfall intensity, runoff and percent ground cover which accounted for as much as 86% of variability in soil erosion. It was noted that significant amount of erosion was recorded only when rainfall intensity exceeded about 20mm/h.

Ramphele and Dowell (1999), carried out a research in Pretoria, South Africa on "Restoring the land in the Post-Apartheid South Africa". Through different measurements which were taken for the period of five months, the result showed that the steeper slope, the greater the erosion, as a result of increased velocity (swiftness) of water flow. They concluded that the crest of the slope is usually well drained as soil moisture moves downhill, leaving air in the pore spaces most of the time and overtime, the fine (clay) particles are carried down slope, leaving the soil sandy. These soils have lower erosion potential and are normally more stable than that of the sandy which have higher erosion potential and are less stable. They were of the opinion that the advent of soil erosion can be minimized, if activities performed on the slope will consider the slope factor.

In Nigeria, Ofomata (1965) carried out an experimental analysis on soil erosion in Enugu State for duration of two years. His results showed that the nature of surface materials influenced the rate of infiltration and thereby affects the rate of erosion. He observed that if the soil was left bare, it can be easily attacked by erosive rainfall.

Also, Nwajide (1979), studying the Nanka formation in Anambra State, as he went through 57 soil samples, observed that there was preponderance of medium to coarse (0.56 – 1.00mm) grain size and paucity of fine and matrix particles smaller than 0.063mm in size are less than 5% in most samples from the formation. The soil lacks cement materials like iron oxides and carbonates making it porous which admits water and promote soil failure.

According to Igbozurike (1989) who studied the socioeconomic implication of soil erosion in Owerri, South Eastern Nigeria, using questionnaire, soil removal occurs primarily during the rains between March and October and in Northern Nigeria, it occurs during the dry season.

Inyang (1975), studied the climate of the rainforest zone of Eastern Nigeria using zonation, he divided Eastern Nigeria into five climate regions. The study areas fall within the fourth regions with eight months of rainy season and four months of dry season. According to him, these seasons were typical of the tropics and thus, one of the factors affecting soil erosion.

Furthermore, Muoghalu and Ikegbunam (1997) studied “Gully erosion in Abagana, Anambra State”, using the experimental analysis and Horton’s calculation of slope length. The eroding force per unit area was calculated for various slopes at 17 locations. From the result derived, it was discovered that slopes between 2.3^o and 7^o were found in the lowland areas and it was in those areas that most of the gullies abounded at a general elevation of 122mm to 18m.

Ezechi (2000), in his work on the influence of runoff and lithology in the rate of Gullies in the Eastern Nigeria, using the geological model, he reported that in certain areas of the South Eastern region where lithologies are weak and the eroding energy of runoff maximum, the susceptibility of such areas to gully erosion was high. He urged that before any construction activity, the lithology of the area should be adequately examined.

Finally, Igbokwe et al (2007), conducted a study on soil erosion in South Eastern Nigeria using satellite imageries. It was observed that areas with low vegetation cover and high altitude were prone to erosion in Abia, Enugu and Anambra States.

2.3 ANTHROPOGENIC CAUSES

Thapa and Weber (1991) studied soil erosion in developing countries and using combined methodology of field survey, questionnaire survey and interviews. Their results revealed that the major forces causing erosion is the expanding of socio-political power and the necessity of the poor to fulfill their requirements of food, fuel wood and fodder. They concluded that unless vast masses of poor people are integrated into the national mainstream through the implementation of equitable and redistributive development policies, it is impossible to control the accelerating rate of soil erosion.

Midmore et al (1996), studied Soil Erosion and Environmental Impact of Vegetable Production in the Cameroon Highland in Malaysia.Using geographical information system, (GIS), landsat imagery and digital elevation model; with a 1992 farm survey of 10% of the farmers. Results showed that soil erosion in Cameroon highlands resulted from vegetable cultivation as a result of extensive use of irrigation, chicken manure, lime and organic fertilizers. He advised that the use of organic farming should be encouraged in order to prevent the incidence of soil erosion.

From the work done by Herber (1999) on “Engineering Geomorphology at the Cutting Edge of Land Disturbance, Erosion and Sediment Control on Construction Soils in Alaska”, it was found that areas of per construction conditions. He concluded that such areas were important components of non-point source (NPS) pollution that degrades surface water quality.

Also, in Bangladesh, Kashem and Islam (1999) studied “The Use of Indigenous Agricultural Technologies by Rural Men and Women”, using Oral interviews method. From the result, it was revealed that one major cause of erosion is the use of non-indigenous technologies for farming in the area. Therefore, they were of the opinion that rural farmers should go back to the way of farming done in a traditional way.

Stuart and Edward (2006) studied soil Erosion in England, using field survey and observation. Their results showed that one of the main causes of erosion is from the result of slash and burn treatment of tropical forests. They concluded that when the total ground surface is stripped of vegetation and then cleared of all living organisms, the upper soils are vulnerable to both wind and water erosion.

Vermeire et al (2005) studied “Fire and Grazing Effects on Wind Erosion and Soil Water Content in Sand Sagebrush in mixed Prairie. They selected 24, 4ha ploys. 4 plots were burned during autumn and four for each of two years. Cattle were given unrestricted access to burned patches and measured utilization was 78%. The soil water content and wind erosion rates were measured monthly. Results showed that wind erosion was about 2 to 48 times greater on autumn burned plots than non-burned plots. Also, soils of burned plots were 1^o to 3o warmer than those of non-burned plots, having lower water holding and deep percolation capacity.

Zimmerer (1993) studied land degradation and soil erosion, causes and effects in Andes mountain of South America, using economic analysis. He found that employment in non-farm work has led to labour shortage in peasant land use and consequently worsening soil erosion,Specific macro economic policies were found to have fuelled these economic and environmental changes at the farm level. His study showed that diminishing labor availability in peasant production spurred erosion inducing changes in farm technologies and practices in the Bolivian Andes.

Again, Antle and Stoorvogel (2001), conducted a study on soil quality and the effect in Northern Ecuador, using simulation models. They found that change in soil quality can be highly site specific and that changes take place at the field and sub-field scale in response to land use and management practices. According to their research, 1.2% of the top soil of Northern Ecuador is completely removed by this process.

Olderman (1991) estimated the human induced soil degradation of inhabited land in various continents of the world using GIS, the result is as follows: Africa 27%; Asia 0.3%, Europe 26%, Oceanic 19%, North America 21% and South America 18%.

In the African continents, Mushala (1997) worked on "Soil Erosion and Indigenous Land Management in Swaziland". He used questionnaire survey, which were distributed to farmers on local farm pots. His result showed that the problem of soil erosion in Swaziland is due to the context of land management of communal grazing lands.

In South Africa, Arbur (2004), worked on "Humans Cause More Soil Erosion than Nature". Through field survey and experimental analysis, she found out that erosion occurs when farming practices are not compatible with the fact that soil can be washed away or blown away. These practices are:

- Overgrazing and over stocking
- Inappropriate farming techniques such as deep ploughing land 2 to 3 times a year to produce crops.
- Lack of crop rotation
- Planting crops down the contour instead of along it.

In Nigeria, Grove (1951) did a work on "Soil Erosion and Population Problems in Southern Nigeria" using questionnaire and field observation. His results showed that erosion problems in the South Eastern Nigeria was due to population pressure as further development depend largely on full use being made of the soil.

Okoye (1998, studied on the Comparative analysis of factors in the Adoption of Traditional and Recommended Soil Erosion Control Practices in Nigeria. Through the data he got from the distributed questionnaire and oral interview of 125 small farmers, his result showed that in highly erosion prone Anambra State, one of the major causes of erosion is the non-adaptation of farmers to use the right agricultural practices.

From the work by Muoghalu and Ikegbunam (1997), on Soil erosion I Abagana; using population on data and field survey. It was observed that population growth heavily gave rise to erosion in the community. They concluded that increase of population with fixed law diminished. Hence, they advised that an administrative approach should be adapted in controlling population pressure in the state.

GAPS IN LITERATURE

From the works reviewed above some undeniable gaps are very glaring and this constitutes the core of this work. Firstly, even though there are documented works on the different causes of erosion in Nigeria, none documented soil characteristics as a major cause of erosion.

Also, even though there are documented works on erosion reviewed, some of them are now outdated and there must have been reasonable variations e.g. Higgins (1960), Fournier (1960, 1972) etc.

Moreover, among the works done in South Eastern Nigeria like Ofomata (1979), Nwajide (1979), Igbozurike (1989), none conducted a study on Nkpor and Obosi even when there is glaring evidence of serious erosion problems, this study thus becomes necessary.

METHODOLOGY

The study adopted survey design. In the survey design, questionnaire method was employed in collecting information on the causes of erosion in Nkpor and Obosi, the effects of soil erosion on social and economic activities, and impacts of soil erosion on the residents of Nkpor and Obosi.

The number of questionnaires distributed was determined using the Yaro Yamine (1994) formula.

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

Where N = Population of the number of household.

I = Unity (Constant)

e = Error estimate (0.05)

But following Nwana (1981), if the population is a few hundreds, a 40% sample will do, if many hundreds, a 20% sample will do. If a few thousands, a 10% sample and if several thousands, a 5% or fewer sample will do

Since Nkpor and Obosi population figures for 2006 have not been released. The Census figures of the 1991 for the two towns were 64, 732 and 85, 249 (NPC, 1991). The figures were projected to 2009 using the exponential growth formula with a growth rate of 0.028 as used by the Population Commission in their 1996 projection.

The population figures obtained was 106, 413 and 140, 141 for Nkpor and Obosi respectively. The total number of households obtained was 31, 820 and 40, 000 (NPC, 2006).

Table 3.1: Sample Size Distribution of Questionnaire

Communities	Number of questionnaires distributed	Number of Questionnaire returned	Percentage (%) returned rate
Nkpor	99	72	73
Obosi	99	66	67
Total	198	138	

Source: Author's Field Work (2009)

In analyzing the data obtained from the questionnaire to meet up the objectives of the study, appropriate descriptive statistical tools were employed. In determining the average value of the parameters studied and for easy computation and testing of the hypothesis, the mean which is measure of central tendency was applied. The mean was determined by the formula:

$$X = \frac{\sum X}{N}$$

Where X is the value obtained for each sample.

N is the number of samples

$\sum$ is the summation

Source: Pelosi et al (2003).

The responses from the questionnaire survey were analyzed using cross Tabulation, Mini Tabulation and Means.

In testing for the three hypotheses, the one sample T-Test, Two-Sample T-Test and Z-Test were used.

For testing hypothesis about the population distribution of samples

($n < 30$), we use the following formula:

$$t = \frac{\underline{X} - \mu}{S/\sqrt{n}}$$

Where:

$\underline{X}$ = Sample Mean

μ = Population Mean

S = Sample Standard Deviation

n = Number of observations

For two Samples T-Test, the formulae is:

$$t = \frac{X_1 - X_2}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}}}$$

Source: Pelosi et al (2003).

Also, for testing hypothesis about the differences between two populations means when normal distribution of Samples ($n > 30$), we use the formula:

$$Z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

OR

$$Z = \frac{(\bar{X}_1 - \bar{X}_2) - 0}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

Where $\bar{X}_1$ and $\bar{X}_2$ – the sample means of the two different random samples.

n_1 and n_2 - Size of the samples.

S_1^2 and S_2^2 – the standard deviation of the 1st and 2nd populations respectively

When the population standard deviations are unknown, the sample variances S_1^2 and S_2^2 were used to approximate them (Pelosi et al 2003).

DATA PRESENTATION / ANALYSES

This section analyses data on general information that is bio-data, using cross tabulation. The cross tabs were on sex-age, sex-length of stay, sex-education and sex-occupation.

Table 1 Cross – Tabulation on Sex-Age

Issues Raised	Outcome (Age Interval)							
Sex * Age	18-21	22-25	26-30	31-40	41-50	51-60	> 60	Total
Male	6	10	10	20	12	6	2	66
Female	10	16	12	10	14	2	8	66
Total	16	26	22	30	26	8	10	138

Source: Author's Field Work (2009).

From table 1, sex-age intervals was grouped into seven groups of 18-21, 22-25, 31-40, 41-50, 51-60, >60. Out of a total number of 138 respondents cross tabulated in both communities, the male have the highest number of 20 respondents which falls between age group of 31-40. The highest numbers of female were found to be 16 and it falls within the age interval of 22-25.

Also, the total numbers of female respondents were found to be 12 while that of male was 66. This implies that a greater number of female responded to the questionnaire distributed.

Table 2 Cross-Tabulation on Sex duration of stay

Issues Raised	Outcome				
Sex*Length of stay	<5 years	6-10 years	11-15 years	16 and above	Total
Male	12	16	22	16	66
Female	16	24	12	20	72
Total	28	40	34	36	138

Source: Author's Field Work (2009)

From the table 2, the Cross-Tabulation of sex with length of stay showed that greater number of female (24) have stayed between 6 – 10 years while the highest number of male (22) have stayed between 11 – 15 years. The last number 12 represents the lowest number of populations for both male and female which can be found within the age group less than 5 years and 11 – 15 years. The sum total numbers of 40 representing both sexes were recorded within the age interval of 6 – 10 years while the lowest numbers of 28 were recorded within age interval of less than 5 years. This can be seen in fig. 4.2 below:

Table 3: Cross-Tabulation on sex-level of education

Issues Raised	Outcome				
Sex*Length of education	WAEC or NECO	Sex*Length of education	WAEC or NECO	Sex*Length of education	WAEC or NECO
Male	22	Male	22	Male	22
Female	34	Female	34	Female	34
Total	56	Total	56	Total	56

Source: Author's Field Work (2009)

Table 3 above showed that out of 138 respondents, 56 of the respondent's were school certificate holders. This could be as a result of predominance of commercial activities in the two communities which are in close proximity. 44 represent the respondents holding NCE, OND and TCII which were found in primary and post primary schools. The last number 4 were found among those with First School Leaving Certificate (FSLC). The majority of the respondents 34 representing female were school certificate holders while 26 representing the highest number of male were holders of other degrees.

Table 4 Cross-Tabulation on Sex Occupation

Issues Raised	OUTCOME					
Sex*Occupation	Medical Practitioners	Civil Servants	Farmers	Traders	Students	Others
Male	12.1	18.2	15.2	42.4	3.0	9.1
Female	2.8	25.0	11.1	36.1	19.4	5.6
Total	14.9	43.2	26.3	78.5	22.4	14.7

Source: Author's Field Work (2009)

From table 4 above, 78.5% representing the highest was recorded for traders. This is as a result of prevalence of various economic and commercial activities. Some examples are machine spare parts (Mgbuka), Electrical market and Afor Nkpor etc. The lowest number of population was 14.9% representing others occupation not indicated. Civil servants recorded 43.2% while 26.3% represents the farming population. The total number of students was 22.4%.

SECTION B

This section treats the analysis of descriptive statistics on causes of erosion. According to Pelosi et al (2003), using the 5-point Likert Scale, when the mean statistics of the responses is 3.00, it implies that there was no opinion on a particular question. Mean statistics greater than 3.00 indicates a positive response i.e. a general agreement on a particular question while mean statistic less than 3.00 indicates a negative response i.e. a general disagreement on a supposed question. The information is presented on tables, graphs and charts.

Table 4.5 Descriptive Statistic for Causes of erosion in Obosi

Descriptive Statistics for causes of erosion in Nkpor

	N	Sum	Mean		Std.	Variance
	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
cause1	72	296	4.11	.087	.742	.551
cause2	72	276	3.83	.136	1.151	1.324
cause3	72	152	2.11	.118	1.001	1.002
cause4	72	302	4.19	.111	.944	.891
cause5	72	148	2.06	.128	1.086	1.180
cause6	72	174	2.42	.132	1.123	1.261
cause7	72	284	3.94	.128	1.086	1.180
cause8	72	196	2.72	.152	1.292	1.668
cause9	72	248	3.44	.110	.933	.870
cause10	72	290	4.03	.127	1.074	1.154
Valid N (listwise)	72					

Source: Author's Field Work (2009)

From the table above, there was a strong agreement that the following causes erosion: felling of trees/deforestation urbanization, road construction, blockage of flood channels, over population and engihanic factors, having the following values 3.70, 4.09, 4.30, 3.85, 3.55 and 4.12 respectively.

Obosi is a community bordering Onitsha. Increasing urbanization, deforestation has led to new layouts such as Omagba Phase I, II and III; Odume layout etc. There is grand plan by the state government to decongest Onitsha by relocating of existing markets such as building materials etc` to nearby towns. This has caused as astronomical increase in infrastructural developments in Obosi with its attendant effects. Improper channeling of flood, inadequate drainage outlets were the major causes of erosion such as Irre Gully I, Irre Gully Irre village Obosi. Improper drainage and poor road construction were also the major causes of erosion in Ugamuma Gully I (Obosi Girls),Ugamuma II and Ugamuma III (St. Mary's Church) respectively.

Table 6 Descriptive Statistics for Causes of erosion in Nkpor

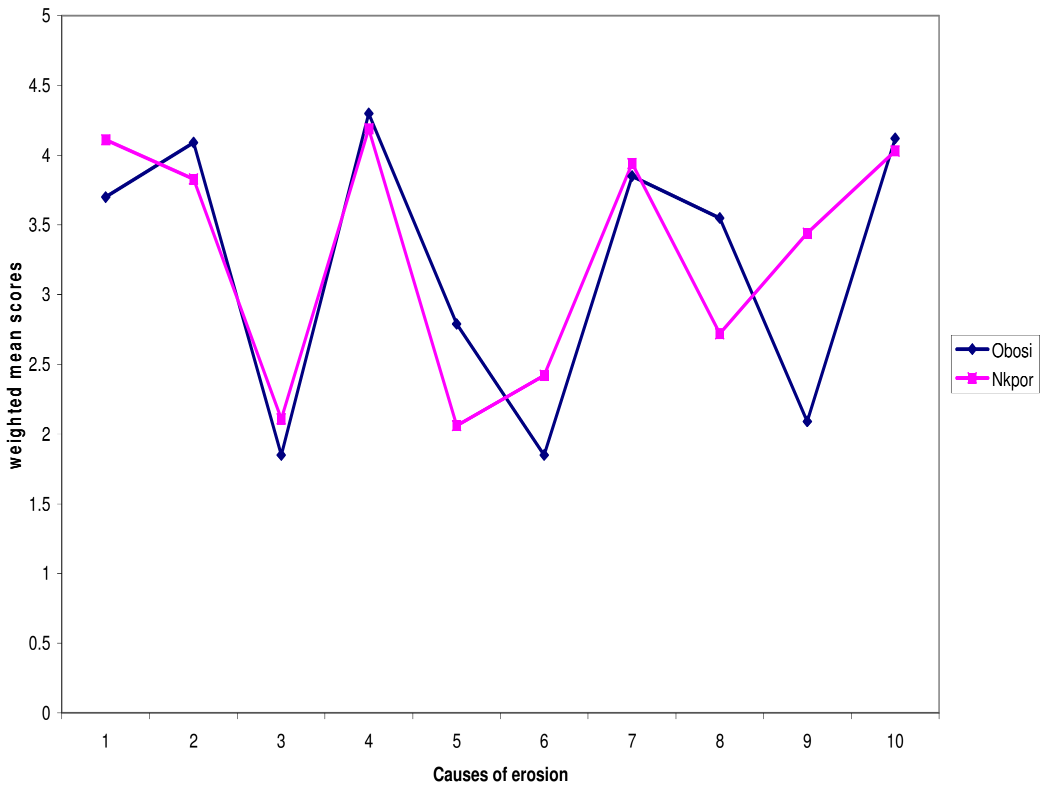
Descriptive Statistics for causes of erosion in Nkpor

	N	Sum	Mean		Std.	Variance
	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
cause1	72	296	4.11	.087	.742	.551
cause2	72	276	3.83	.136	1.151	1.324
cause3	72	152	2.11	.118	1.001	1.002
cause4	72	302	4.19	.111	.944	.891
cause5	72	148	2.06	.128	1.086	1.180
cause6	72	174	2.42	.132	1.123	1.261
cause7	72	284	3.94	.128	1.086	1.180
cause8	72	196	2.72	.152	1.292	1.668
cause9	72	248	3.44	.110	.933	.870
cause10	72	290	4.03	.127	1.074	1.154
Valid N (listwise)	72					

Source: Author's Field Work (2009)

From Table 6 above, using the Likert Scale with the natural point of 3.00, there was firm agreement that deforestation, urbanization, road construction, blockage of flood channels, bush burning and engihanic factor were the major causes of soil erosion in Nkpor. This could be seen from the mean statistics of 4.11, 3.83, 4.19, 3.94, 3.44 and 4.03 respectively. Those having above 4.0 represent a 98% agreement on the supposed causes. This implies that deforestation, poor road construction and engihanic factors lead to incidence of soil erosion in Nkpor such as Mgbachu gully erosion.

Graph showing the weighted mean scores for Causes of erosion in Obosi and Nkpor



This graph seeks to compare the mean score of various factors causing erosion in Nkpor and Obosi so as to identify possible differences and potential agreements. The straight line represents Obosi community while the dotted lines represent Nkpor community.

From the graph above, there was a concurrence of the fact stated in the tabular analyses. There was sharp difference among the respondents where they disagree on overgrazing and agricultural activities, overpopulation and bush burning as major causative factor of soil erosion. The data showed that overgrazing, agricultural activities and over population results to soil erosion while those in Nkpor were of converse opinion. The Nkpor community agreed that bush burning and deforestation cause soil erosion.

The former great and evergreen rainforest belt in Nkpor and Obosi has been deforested up to about 80%. Deforestation is now posing major ecological problems. Soil and laterites are recklessly opened up all over the areas, easily leached and washed away as the lands are left threadbare. Rainfall intensity is falls direct on the naked land and soils. Infiltration capacity of the soils is highly increased. Solar radiation and heat waves impacts directly on the soil, and causes disaggregating of the soils; The giant trees, luscious vegetation and bushes were removed through excessive farming, urban development, building of markets, industries, churches, schools, roads, NITEL and PHCN lines etc. These unplanned socio-economic activities that have been heightened in recent times expose the weak acidic and laterite soils as well as the unstable geological sediments to erosion, gullies and landslides.

HYPOTHESES ONE

H0: There is no significant difference between the causes of erosion in Nkpor and Obosi.
Hypotheses 1 was tested using the two sample T-Test and Confidence interval. This compared causes of erosion in Nkpor and Obosi. The result is shown in table 7.

Table 7: Two sample T-Test and Conference interval comparing causes of erosion in Obosi and Nkpor

Two sample T for Obosi vs Nkpor

	N	Mean	StDev	SE Mean
Obosi	10	3.219	0.982	0.31
Nkpor	10	3.285	0.866	0.27

Source: Author's Field Work (2009)

95% CI for mu Obosi - mu Nkpor: (-0.94, 0.81)
T-Test mu Obosi = mu Nkpor (vs not =): T= -0.16 P=0.88 DF= 17
The test shows that the mean scores does not differ since P is equal to 0.88 i.e. greater than 0.05. Therefore, from the decision rule, P value is greater than 0.05. We accept null hypotheses and thus, concluding that there is no significant difference between the cause of erosion in Nkpor and Obosi.
The result can be verified from Table 8 below.
Test of mu = 3.000 vs mu not = 3.000
The assumed sigma = 1.42

Table 8: Z-Test for causes of erosion in Obosi and Nkpor

Variable	N	Mean	StDev	SE Mean	Z	P
cause1	138	3.913	1.064	0.121	7.55	0.0000
cause2	138	3.957	0.988	0.121	7.91	0.0000
cause3	138	1.986	0.912	0.121	-8.39	0.0000
cause4	138	4.246	0.911	0.121	10.31	0.0000
cause5	138	2.406	1.188	0.121	-4.92	0.0000
cause6	138	2.145	1.098	0.121	-7.07	0.0000
cause7	138	3.899	1.041	0.121	7.43	0.0000
cause8	138	3.116	1.262	0.121	0.96	0.34
cause9	138	2.797	1.215	0.121	-1.68	0.094
cause10	138	4.072	0.986	0.121	8.87	0.0000

Source: Author's Field Work (2009)

From the above, it was concluded that he communities agreed that the following factors deforestation, urbanization, road construction, blockage of flood channels, over population and other anthropogenic factors were the major causes of soil erosion. This is as a result of similarity in location and conditions.

CONCLUSION AND RECOMMENDATION

The study did a comparative analysis of causes of soil erosion in Nkpor and Obosi, Anambra state. The analysis of the result showed that anthropogenic activities such as deforestation, poor road construction practices, urbanization, over population, poor drainage channel were the major causes of soil erosion.
In addition the study analyzed the data obtained in order to test the stated hypotheses. From the results, there is no variation between the causes of erosion in Nkpor and Obosi. From the work done, the following conclusions are drawn:

- That anthropogenic activity like poor road construction, deforestation, bush burning, poor drainage

channels, over population, engihanic factors and urbanization trigger and aggravate soil erosion activities in both Nkpor and Obosi towns in Anambra state.
- That there is no significant variation between causes of social and economic effects of erosion in Nkpor and Obosi.

RECOMMENDATIONS

Based on the findings, the work recommended the following:

a. That there is a great need for agro forestry and green belt development in erosion prone areas. i.e. agricultural practices such as the planting of cover crops, mulching and the use of green manures should be encouraged.
b. The nutrient level of the soil should be enriched to help in the growth of trees whose roots will help in the improvement of the organic content of the soil and reduce detachability due to rain drops and the effects of the winds.
c. The development of an Integrated Environment Management Programme (IEMP) for the state based on the principles of sustainable development. This includes implementation of Environmental Impact Analysis (EIA) for every project in the state. This is to predict negative impact.
d. Involvement of experts such as environmental managers (that is person formally trained in environmental management) as the professionalsS to undertake issues pertaining to the environment and preparation of Environmental Impact Analysis (EIA) and Environmental Impact Statement (EIS).
e. Erosion Control Programs should involve a sub catchments management strategy where gullies are controlled as group units instead of the present adhoc wrong way of tackling individual gullies and their problems in a piece meal manner.
f. All Federal, State, Local government agencies must be made to change their planning, design, construction methods and techniques in gully erosion prone areas since their present methods are erosion causative and highly destructive.
g. An Environmental Management Institute and Erosion Research [EMIER] should be established to work out lasting solutions and strategies to combat the ecological problems on a continuous basis.
h. Erosion and Flood Control Programs and assignments must be worked out through involvement of people, individuals, communities and LGAs of the affected areas through people. Participation in projects such that people can take active part in gully erosion control projects. Therefore, a call is made to the government, law enforcement agencies and the public at large to join hands in combating this environmental problem in the state.
i. There should be massive constructions of catchment basins or Okwa Lakes, Sedimentation Basins, catchment pits, drainage channels, and other drainage facilities at several locations in flood and erosion areas.
j. There is need for attitudinal change to be effected on the following sets of people.
   -The general populace
   - The environmental law enforcement agents.
   - The government.

REFERENCES

Antle and Stoorvoge (2001*). "Soil Erosion Threatens farm land of Saharan African"*. Earth Times. January 10, 2001.

Ananda,J. And Herath, G.(2003)."*Soil Erosion In Developing Countries*; *A Socio Economic Appraisal*".Jounal Of Environmental Management, Vol 68,No.4,Pp343-353.

Bennett, S.J. Casali, J. Robinson, K, M, Kudary, K, C. (2000). *"Characteristics Of Actively Eroded Ephemeral Gullies Is On Experiemental Channel"*. Internal Symposium on Gully Erosion Under Change. Cath University of Leuven, Belgium, April 16 – 19.

Beljing Times(2002):"*Soil Erosion, Biggest Global Environmental Problem*". In Http://English.Peopledaily.Com.Cn.

Evans R. (1980): Soil Erosion and Its Impact In England Wales. London: Friends of the Earth Trust.

Ezechi,J.F.(2000) *"The Influence Of Runoff, Lithology And Water Table On The Dimensions And Rates Of Gullying Processes In Eastern Nigeria*" .International Symposium On Gully Erosion Under Global Change. Cath University Of Lerner, Belgium. April 16-19,Pp 28-29.

Egboka,B.C.E. (1993): "*The Raging War*".A Publication Of Anambra State Government of Nigeria, Awka.

Fournier, F.T. (1995): *"Land Use Soil Conversion in Parts of Onitsha and Owerri Province"*. Geological Survey of Nigeria. Bulletin No. 21.

Grove A.T.(1951). *"Land Use And Soil Conservation In Parts of Onitsha And Owerri Provinces"*.Geological Survey Of Nigeria.No.2,Pp 25-28.

Herber,J.(1999).*"Engineering Geomorphology At The Cutting Edge of Land Disturbance"*.. Erosion And Sediment Control On Construction Site. Journal Of Geomorphology Vol 31,No 4,Pp247-263.

Igbokwe, J., Akinyede J., Ono, Kneki, O. L. And Nnodu, V.C. (2007).*"Mapping The Spatial Distribution Of Gully Erosion In South Eastern Nigeria With Satellite Imageries"* , A Paper Presented At Costa Rica Capacity Building Conference,Nov 12-15.

Inyang, I. T. (1975): *"Climate Zonation Of The Rain Forest Zone of Eastern Nigeria"*. Geological Society Of Nigeria Annual Report. No 5127.

Igbozuruike, U.M. (1989*). "Erosion in the Agulu-Nanka Eastern Region of Nigeria. Suggestion on control measures"* Paper presented at the Conference of the Soil Science Society of Nigeria, Nsukka.

Kashem,M.A. And Islam,M.M(1999).*Use of Indigenous Agricultural Technologies By The Rural Men And Women In Bangladesh*" Journal of Sustainable Agriculture.Vol.14,No.2 And 3,Pp27-43.

Mbagwu, J.S,C. (1995). *"Effects Of Soil Erosion On The Productivity of Agricultural Lands In The Humid Tropics*". Soil Science Journal. U.N.N. Vol. 24, Pp 216 – 275.

Midmore, D. J., Hans, G.P. Jansen, R. And Doomsday, A. (1996). *"Soil Erosion And Environmental Impact Of Vegetable Production In The Cameroon Highlands, Malaysia"* Agriculture, Ecosystems And Environment, Vol 60, No 1, Pp 29 – 46.

Ministry of Environment (2006). *"Land Forms In Anambra State"*. Vol. 17. Anambra State

Mongomery, D.R, (2007). *"Soil Erosion and Agricultural Substainability"* Journal Of Environmental Management Vol. 104, No. 33, Pp 13268-13272.

Morew, G.R., Alvarez, M.C.D. And Refugos, S.A (2008). "Multifractal Analysis of Soil Surface Roughness". Vadoze Zone Journal, Vol. 7, Pp 512-520.

Morgan, R.D.C (1979*): "Soil Erosion"*. In Donald, D. and Davidson, J. (Eds) Topics In Applied Geomorphology (Pp 91-99) London: Longman Gorup Ltd.

Mushala, H.M. (1997*). "Soil Erosion And Indigenous Land Management: Some Socio-Economic Considerations*". Soil Technology Vol. 11, No. 3, Pp 301 – 310

Nnodu, V.C (2005): *"Environmental Renewal For Sustainable Development of Anambra State*". A Special Paper Presented at A 3 Day Stakeholders Workshop on Environment By Ministry of Environment. Awka; March 15 – 17.

Nwajide, C.A. And Hoque (1979). *"Gullying Processes In South-Eastern Nigeria"*. The Nigeria Field Journal. Vol. 44, No. 2 65 – 74.

Pelosi, M.K. And Sandifier, T.M (2003): Elementary Statistics From Discovering To Decision. New York; John Wiley And Sons.

Schmittner, K.E. And Giresse, P. (1999). "The Impact of Atmospheric Sodium on Erodibility of Clay In Coastal Region". `Environmental Geology. Vol. 37, No 3, Pp 195 – 206.

Shrestha, B.M., Singh , B.R Situala, B.K., Lal, R. And Baijrachaya, R.M. (2007). *"Soil Agreegate And Particle Associated Organic Carbon Under Different Land Uses in Nepal*". Soil Science Society of America Journal. Vol. 71, Pp 1194 – 1203.

Stocking, M. A (1981). *"Causes and Prediction of the advancement of gullies"* In T. Tangsanchalli and Egger (Eds) Problems of Soil Erosion and Sedimentation. SouthEast Asian Regional Symposium. Asian Institute of Technology, Bankok, Thailand.

Thapa, G.B. And Weber, E.K. (1991). *"Soil Erosion In Developing Countries: A Political Economic Explanation"*. Journal Of Environmental Management. Vol. 15, No. 4, Pp 461 – 473.

Weggei, R.J. And Rustom, R. (1992). *"Soil Erosion by Rainfall and Runoff – State of the Art"*. Geotextiles And Geomembrances. Vol. 11, No. 69. Pp 551 – 572.

Zapp, D.H.R. And Nearing, M.A. (2005*). "Slope Shape Effects on Erosion*: *a Laboratory Study"* Soil Science. Soc. Am J. Vol. Pp 1463-1471.

Zimmerer (1993a). *"Erosion Crop Productivity Relationships for Soils of Africa"*. Soil Science Society of America Journal. Vol. 59, Pp 661-667.

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