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SOCIAL IMPACT OF GULLY EROSION ON THE RESIDENTS OF KURMIN GWARI SETTLEMENT, KADUNA STATE

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Abstract
Soil erosion increment results in an unsustainable development of the living standard of the people. Sustainable development is the positive socio-economic change that does not undermine the ecological and social systems upon which communities and social systems are dependent. The aim of this study is to assess the impact of gully erosion on the residents of Kurmin Gwari settlement, Kaduna State, Nigeria. The Primary sources of data are direct observation from fieldwork and the use of questionnaire, while the secondary source include topographic map and library materials. Descriptive statistical tools were applied to deal with the techniques of summarizing and describing data collected. Percentages, proportion and mean were applied to get other parameters such as expected frequencies. The result revealed that the adverse social effects of gully erosion in Kurmin Gwari settlement, At Layin Pumpo 65% of respondents are affected by destruction of ancestral homeland by gully erosion. 100% are affected by loss of source of water supply. The study recommended that due to gully erosion and other natural environmental disasters, the need for an integrated environmental planning is paramount. What is required is the creation of forum where thought would be harmonized, and an adequate strategy formulated to co-ordinate and sustains environmental programmes. Because of the need to help with the impacts of gully erosion in the area we recommend strongly the establishment of society for environmental problems.

Key Words: *Gully Erosion, Resident, Impacts, Environment, Kurmin-Gwari*

Introduction

Erosion is the process by which the agents of soil erosion wear away, eat into, loosen, or carry away soil material and transport it from one locality to another where it is eventually deposited (Egboka and Nwankor, 2011; Egboka *et al*., 2015; Egboka *et al*., 2016). Soil erosion is a complex process caused by wind, water and physical disturbances, encompassing detachment, transport and deposition of weathered rock. Soil erosion reduces land productivity, challenges agricultural sustainability and degrades environmental quality through contaminants attached to the sediments. Stocking, (2004); Stocking, (2009) and Sheng, *et al*., (2011).

Soil erosion is caused and complexed by a variety of factors such as natural phenomena of neotectonics and paleotectonics, soil/rock features (pedology/geology), wind/water dynamics; and human phenomena such as population density, anthropogenic activities including engihanic effects (Egboka *et al*., 2015; White *et al.,* 2015). In the execution of colossal or small-scale projects of Industrial or engineering nature, the textural, coherence and plasticity characteristics of the soil are not considered. Irrigation schemes, major road network, small and large dams, urbanization, deforestation, sand and laterite mining are carried out without cognizance of the warnings of environmental experts and/or professionals. Similarly, sensitive drainage areas, wetlands and flood channels are encroached upon by hungry land developers. In view of these activities, sheet, rill and gully erosion are known to progressively develop over several years. All over the world man is a more important agent of environmental change than Nature (Press, 2010). Soil erosion problems are now endemic in many parts of southeastern Nigeria (Egboka *et al.,* 2016). Increased awareness of erosion impacts on land, air, water quality and global climate, raises new challenges for erosion researchers. In some conditions, these impacts are so severe that they reduce the quality of life and economic well-being and can threaten survival.

Statement of the Problem

Soil erosion is one of the most striking features on the land surface of southeastern Nigeria, especially in Anambra State, though spreading across the Northwestern states like Kaduna, Kano, etc. Several non-responsive human activities by both the Government and the inhabitants have culminated in the devastating gully erosion in this area. Some of these activities include excavation of red earth (laterite) and sand in the process of sand/regolith mining, construction of roads without drainage channels, uncontrolled population growth and poor agricultural practices. Buildings are congested on top of groundwater recharge areas. The geology of the area (Kurmin Gwari Sandstone) is composed of weak, friable soils which are poorly consolidated.

At Kurmin Gwari, each rainy season is associated with nightmares, particularly for inhabitants living at the proximity of erosion sites. Each gully incidence is accompanied by landslides and slumping, leaving at the end of each event inhabitants crying and mourning for loss of agricultural lands, ancestral lands, homes and economic trees (Ofomata, 2000 and Onyegbule, 2015). The cumulative effect is that the affected inhabitants are left homeless and/or jobless. The threats posed by gaping and daunting large gullies to farmlands, settlements, roads and human are enormous. Most communities in Kaduna State have been ravaged by soil erosion of different dimensions. Sheet erosion is common, and it has resulted in the reduction of soil fertility. Rill erosion is also common in many communities.

Theoretical Framework

The Davison theory is the earliest cause and effect-oriented theory on soil erosion. It holds that steep slopes are faster eroded than gentle slopes and that stream or runoff velocities are solely dependent on bed slopes, which got their derivation from this axiom. This law is tantamount to an obvious conclusion by Davis (2000) that the rates of change of landforms as

well as other geometric impact magnitudes are functions of local relief. It therefore implies that the progressive changes on the terrain by the effects (impacts) of soil erosion are accepted to be universally associated with a progressive landscape evolution where the geometry of individual landforms and the rate of their erosion changes are both subject to sequential transformation through time.

Interaction Matrix Approach (IMA) has been earlier put forwards by Leopold in Onyegbule, (2015) as the first environmental impact assessment approach. It consists of ten (10) general categories of action on the abscissa or horizontal axis. This consist of about eight hundred and eighty-eight (888) environmental factors or characteristic such as soil, flora and land uses. The vertical axis or ordinate has four (4) general categories with many impact characteristics. There are eight thousand eight hundred (8800) cells (that is 100 x 88) on a full matrix. It is denoted by (M/I) where M is the magnitude of interaction and I is the importance of Interaction (Egboka *et al.,* 201; Egboka *et al.,* 2016).

Consequently, Kates (2012) concluded that hazard occurrences merely represent the extreme of natural processes and their distributions and in a slightly different context would often be regarded as natural resource. The study is based on this theory.

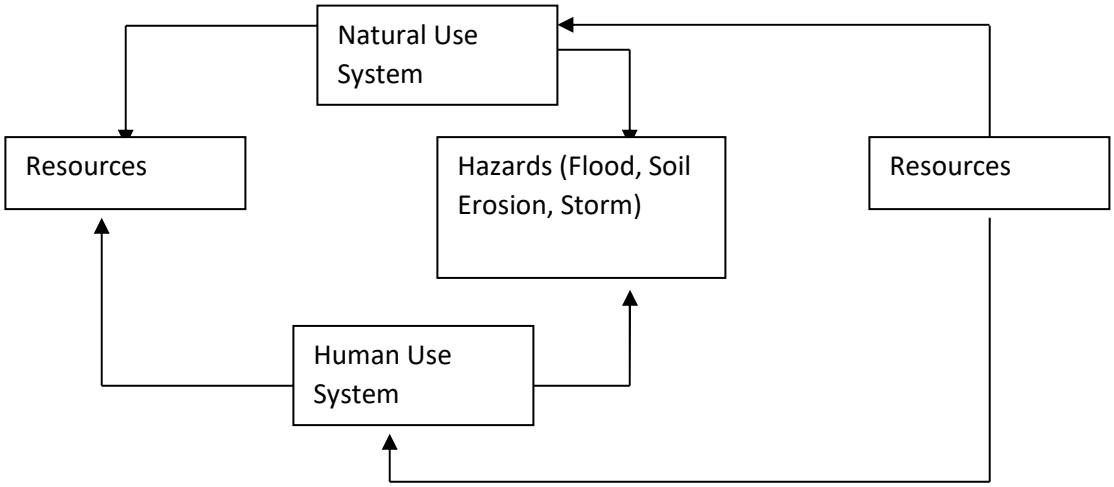

Fig. 1: Natural Hazard as an Ecological Framework.
Source: Onyegbule, (2015)

This study is mainly on the assessment of gully erosion effect on the inhabitants of Kurmin Gwari. Burtons *et al.,* (2010) and Egboka *et al.,* (2016) utilizes questionnaire as a tool for psychological enquiries into hazards. This will be employed in this study. This model gives man a central role and it is armed with ecological frameworks that involve the use of psychological enquiries.

Study Area

Kurmin Gwari is located within Kaduna South Local government Area. It is located between latitude 10° 20′ and 10° 33′ North and longitude 7° 45′ and 7° 55′ East and occupies an area of

approximately 453 square kilometer and has a population of 166,562 thousand (NPC, 2006).

Cross Bed Analysis

The palaeocurrent direction showing a unimodal pattern in a north-east current direction and other supporting evidences can be used to trace the possible source of the Sandstone in the study area. Palaeocurrent study reveals a Northeastern provenance. The general strike direction is N285W, S105E with average dip amount of 35^{o}.

Table 1: Statistical Data for Cross Bed Analysis

Class Interval (30)	Frequency	Frequency (%)	Scale 5:1
30-59	6	20	4
60-89	15	50	10
90-119	-	-	-
120-149	-	-	-
150-179	-	-	-
180.209	-	-	-
210-239	-	-	-
240-269	-	-	-
270-299	6	20	4
300-329	3	10	2
330-359	-	-	-

The abundance of poorly sorted, sub-rounded quartz grains in the Sandstone of the Kurmin Gwari Sandstone suggest long transportation and weathering in the humid region from the source rock to the place of deposition.

Description of Gully Complex

Kurmin Gwari settlement reveals frightful scenic environments. These areas show the existence of tracts of base lands devoid of topsoil from sheet and gully erosion farmlands.

Plate 1: Kurmin Gwari Gully Erosion Site

Lateritic soil overburden measuring up to 18 meters in Kurmin Gwari erosion site has been dissected, exposing beds of unconsolidated sands. Most of the gully sections consist of this upper homogenous and cohesive reddish-brown soil unit and a lower cohesion-less unit having this Shale/Mudstone interbeds.

Research Methodology

The study is non-experimental in design, because it portrayed the current socio-economics impacts of gully erosion on the affected people of Kurmin Gwari settlement in Kaduna State, Nigeria. The study is descriptive survey research as opinion was sampled with the use of questionnaire. The study also relied on field survey, direct observations and measurement of Dip and Strike of lithologic formations to determine the palaeoccurent directions.

Sampling Method and Sample Size

Simple random sampling was adopted in the course of this research for the purpose of selecting households and respondents affected by gully erosion living at the gully proximate areas. Respondents were also selected from heterogeneous populations that make up gully affected migrants and other unaffected living populations of Kurmin Gwari settlement. Respondents comprise only of stakeholders from Layin Pumpo, Layin Kolta, Layin Gidan Sarki, Layin Asibiti and Konan Kasuwa communities of the area.

Table 2: Collation of Questionnaire Instrument

Erosion Area	Number Distributed	% of the No. Distributed	Number Collected	Percentage (%) Return Rate
Layin Pumpo	80	20	80	100
Layin Kolta	80	20	80	100
Layin Gidan Sarki	80	20	78	97.5
Layin Asibiti	80	20	62	77.5
Konan Kasuwa	80	20	72	90.0
Total	400	100	372	93

Four hundred (400) questionnaires were distributed to the five (5) gully erosion prone areas of Kurmin Gwari settlement, between May 2020 and August, 2020. The distribution was evenly done, eighty (80) to each of the gully affected areas. The percentage return rate of the questionnaires is 93%, showing that 400 questionnaires were distributed, and 372 questionnaires were returned and properly filled.

Research Hypothesis

The research questions and objectives translate to the following research hypotheses that are applied to this study.

H_0: The adverse social impacts of Kurmin Gwari Erosion on the Residents in the Erosion affected areas do not differ significantly from the social situation in the unaffected Areas.

Result and Discussion

The study accessed the social and economic effects of gully erosion in Kurmin Gwari settlement. The study hinged on questionnaire survey, thus the questions asked were geared towards generating information on the social and economic effects of gully erosion in the area.

The data collected for this study are presented and statistically analyzed in this chapter. Frequency distributions, proportions, percentages, tables and graphs are used in the presentations. Data for this study are analyzed and presented based on the research questions and hypothesis that guided the study.

To start this presentation, the summary of information on the general demographic characteristic is thus presented.

Table 3: Demographic Characteristics of Respondents

S/No	Response	Layin Pumpo		Layin Kolta		Layin Sarki	Gidan	Layin Asibiti		Konan Kasuwa	
		No.	%	No.	%	No.	%	No.	%	No.	%
1.	Male	31	38.75	34	43.59	27	33.75	23	37.10	30	41.67
2.	Female	49	61.25	44	56.41	53	66.25	39	62.90	42	58.33
TOTAL		80	100	78	100	80	100	62	100	72	100

Table 3 shows the demographic characteristics of the respondents. At Layin Pumpo 38.75% are males, 61.25% are females. At Layin Kolta 43.59% are males and 56.41% females. At Layin Gidan Sarki, thetable shows that 33.75% are males and 66.25% are females. At Layin Asibiti and Konan Kasuwa 37.10% and 41.67% are males, whereas 62.90% and 58.33% are females respectively.

Social Effect of Gully Erosion

Table 4 shows the adverse social effects of gully erosion in Kurmin Gwari settlement, At Layin Pumpo 65% of respondents are affected by destruction of ancestral homeland by gully erosion. 100% are affected by loss of source of water supply. 72.5% find the gully site frightful. 92.5% experience trauma as a result of gully erosion in the area and 57.5% lost relatives.

Table 4: Social Effect of Gully Erosion

S/No	Response	Layin Pumpo		Layin Kolta		Layin Gidan Sarki		Layin Asibiti		Konan Kasuwa	
		Resp.	%	Resp.	%	Resp.	%	Resp.	%	Resp.	%
1.	Destruction of ancestral homeland	52	65	57	71.25	53	67.95	10	16.13	8	11.11
2.	Loss of source of water supply	80	100	80	100	78	100	62	100	72	100
3.	Frightful scenic environment	78	72.5	55	68.75	56	71.79	43	69.35	50	69.44
4.	Experience of Trauma	74	92.5	72	90.0	71	91.03	55	88.71	65	90.28
5	Loss of Relatives	46	57.5	52	65.0	40	51.28	36	58.06	32	44.44

In Layin Gidan Sarki 67.95% were affected by loss of ancestral homeland. All the respondents are affected by loss of source of water supply, while 71.79% and 91.03% find gully sites frightful and experience trauma respectively. 51.28%

lost relatives in Layin Gidan Sarki. At Layin Kolta 71.25% of respondents constitute those that suffered from destruction of ancestral homeland. 100% comprise those that lost source of water supply. 68% 75% and 90% are those that find the gully sites frightful and those that experienced trauma respectively as a result of gully erosion.

In Layin Asibiti 16.13% agree to have lost ancestral homeland, while 100% of respondents lost sources of water supply. 69.35% find gullies frightful, 88.71% experienced trauma as a result of gully erosion in the area, and 58.06% lost relatives. At Konan Kasuwa, 11.11% are affected by destruction of ancestral homeland, 100% lost source of water. 69.44% are frightened by the erosion, 90.28% experience trauma and 44.44% lost relatives.

Test of Hypothesis

Null hypothesis (Ho 1) I: Translate the (Ho) which states that "The adverse social impacts of Kurmin Gwari Erosion on the Residents in the Erosion affected areas do not differ significantly from the social situation in the unaffected Areas".

Table 5: Summary of Chi-Square Test for Social Impacts

Statistical Technique	Number of Cases	X^2 Value	df	Level of Significance	Critical Value	Decision
Chi-Square (X^2)	372	50.62	16	0.10	23.54	23.54
				0.05	26.30	26.30

The Chi-Square computed for social effect is 50.62. The critical values at 0.10 and 0.05 are 23.54 and 26.30 respectively. The decision rule is reject Ho if the calculated value of chi-square (50.62) is greater than the critical values at 0.05 which is 26.30, and at 0.10 the calculated chi-square value is greater than the critical value 23.54. Therefore, Ho is rejected.

Hence, accept the alternative hypothesis that "The adverse social effects of Kurmin Gwari Erosion on the Residents in the Erosion affected areas differ significantly from the social situation in the unaffected Areas".

The decision rule is, reject Ho if the calculated value of chi-square (0.2573) is greater than the critical values at 0.05 which is 2.353 and, at 0.1 the critical value 1.638. Therefore, Ho is accepted since the calculated value is less than the critical values. Hence it is concluded that "There is no significant relationship between the social and the economic impacts of gully erosion in Kurmin Gwari settlement".

Conclusion and Recommendation

The effects due to gully erosion and other natural environmental disasters make the need for an integrated environmental planning and studies urgent. What is required is the creation of forum where thought would be harmonized, and an adequate strategy formulated to co-ordinate and sustains environmental programmes. Because of the need to help with the impacts of gully erosion in the area we recommend strongly the establishment of society for environmental problems. This can be as coordinating consultants.

We also recommend that Government, Non-Governmental Organizations, Cooperate Organizations, Federal emergency relief agency and spirited individuals should get closer to the

affected settings and assist the victims. This requires urgent response.

Areas for Further Research

Flooding in the area is a factor of gully erosion and creates poorly drained marshes and stagnant water that provide pests and insects. These are veritable vectors of diseases that plague men and animals in the study area. Deep gorges created as a result of gully erosion also serve as habitat for snakes and other reptiles. Many people have experienced fatal or near fatal falls into these gullies. These constitute health problems and need urgent study.

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