Investigating the Causes of Erosion in Kaltungo Local Government Area, Gombe State, Nigeria

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Abstract – *This research investigated the causes of erosion and measures to be taken to prevent/control erosion in kaltungo Local Government area of Gombe State, Nigeria. The study employed the administration of a questionnaire to obtain relevant data. Relevant literature on erosion was reviewed to retrieve the causes of erosion and its preventive measures. Based on the review, 8 factors responsible for erosion were selected, and 9 measures to control and prevent erosion were selected. 200 persons were sampled with 20 representing each erosion site studied. A total of 187 out of the 200 administered questionnaires were retrieved and data obtained were analyzed using tables and figures. It was discovered that running water, deforestation, and grazing are the major causes of erosion in Kaltungo Local Government Area with mean item scores of 4.6, 3.68, and 3.34 respectively. Devaluation of assets, depletion of land, poor topography, destruction of houses, desertification, water pollution, and land degradation are the major effects of erosion in the area; while construction of drainages, afforestation, and grazing control are the most important erosion control/prevention measures needed with mean item scores of 4.58, 4.31, and 3.73 respectively. It was recommended that drainages should be constructed by relevant authorities at strategic locations. Also, cutting down trees should be highly discouraged and punishment meted on perpetrators while significant steps should be taken in reforestation. Grazing should be properly managed through the provision of grazing reserves.*

*Key Words***:** *Causes, Erosion, Investigation, Kaltungo*

1. INTRODUCTION

A desktop review of extant literature by the researchers reveals that erosion is a phenomenon enhanced by both natural factors and human activities and which occurs in all landscapes and under different land uses (Onwuka, 2008; Ibimilua and Ibimilua, 2011). As a host of animate and inanimate beings, the soil is the most vital natural resource on earth (Okin, 2002). Unfortunately, over 65 percent of the soil on earth is said to have displayed degradation phenomena as a result of erosion. Erosion according to Onuoha et al (2014) is the physical movement of soil particles from one location to another primarily caused by water forces or wind. He further stated the most common types of erosion include sheet, rill, and gully erosion. According to Quinton (2014), erosion is a globally significant environmental process that degrades the soil upon which we rely for food production, clean water, and substrates for building and infrastructure. In agreement, Jeje (2005), and Adegboyega (2006) opined that erosion destroys infrastructures such as highways, roads, and buildings. According to Ananda and Herath, 2003, soil erosion is the most threatening environmental degradation problem in the developing world. The Beijing Times (2002) also identified erosion as the direct cause of degradation and poverty, threatening the sustainability of plants and animals in many parts of the world. An unprecedented increase in soil loss and its economic and environmental impact have made erosion one of the leading global environmental problems (Zhang et al., 2009).

Nigeria is undoubtedly facing many environmental problems requiring urgent attention with erosion being one of them. This was confirmed by World Bank in 2009 when they listed erosion as one of the top 5 hazards threatening the Nigerian environment (Mbaya, 2013). Without a doubt, erosion is a subset of environmental degradation in North Eastern Nigeria where Gombe State is located. According to Mallam (2016), erosion is one of the greatest environmental disasters in the northern part of Nigeria which has affected hundreds of people every year. This is because the soils in North-Eastern Nigeria are naturally prone to erosion due to their fragile nature (Oguike and Mbagwu, 2009). Mbaya (2013) argued that erosion is active and at an alarming rate around Gombe State due to soil structure and texture, slope, rainfall, and human activities such as deforestation, overgrazing, excessive cultivation, and bush burning. He further stated that residents of Gombe have expressed concerns about the accelerated erosion rate, which has caused the loss of personal properties but also caused damages to infrastructure such as Culverts and roads as well as public and private buildings.

Natural causes of erosion included rainfall, soil texture and structure, and slope, while human causes of erosion include deforestation, excessive cultivation, overgrazing, and bush burning (Mbaya, 2013). Other causes of erosion are construction works, sand, and stone quarrying (Ubuoh, 2013), the nature of soil and topography (George et al., 2008), nature of topography (Igwe et al., 1999), excavations and mining, and climate (Igbokwe et al., 2008). Igbokwe et al (2008) state that settlement patterns can also cause erosion. Favorable condition is created for erosion when settlement is not planned, and houses are built indiscriminately without

consideration of natural flood paths. When infrastructure such as roads is built without a proper environmental assessment. The dangers posed by erosion according to Igwe (2005) include loss of land for agriculture and habitation. Effects of erosion also include the destruction of properties such as houses, infrastructure, and utilities, a threat to vegetation, loss of lives, loss of soil nutrients, deposition of debris, land degradation, poor topography, and isolation of settlements (Danladi and Ray, 2014; Abdulfatai et al., 2014; Anejionu et al., 2013).

Depending on the prevailing type of erosion, many control measures must be adopted. These include grazing control, control of tree felling, soil cover, and repair of existing erosion sites. Okoroafor et al (2017). Valentine et al (2005) found that many techniques have proved to be effective for erosion prevention and control, including zero or reduced tillage, vegetation cover, stone pitching, stone bunds, terracing, and check dams. Obiadi et al (2011) and Okorie (1997) advocated for effective reforestation/afforestation of gully erosion-prone areas by planting trees such as pine caribaea, gemelina or arboea, food /fruit trees like Irviniga spp, freculina Africana, and shrubs like Dactyladenia bartieri and Alchornea cordifolia.

Despite the identification of erosion by a plethora of previous research to be a major source of environmental disasters in North Eastern Nigeria, and despite the existence of prevailing erosion in Gombe State, relatively few research have been carried out to investigate erosion in the state, with no research so far on the causes and effects of erosion in Kaltungo Local Government Area. Therefore, the aim of the current study is to investigate the causes of erosion and measures to be taken to prevent/control erosion in Kaltungo Local Government area of Gombe State, Nigeria. This research is carried out in 2023.

2. MATERIAL AND METHOD

Relevant literature on erosion was reviewed to retrieve the causes of erosion and its preventive measures. Based on the review, 8 factors responsible for erosion were selected, and 9 measures to control and prevent erosion were selected. 200 persons were sampled with 20 representing each erosion site studied. A total of 187 out of the 200 administered questionnaires were retrieved and data obtained were analyzed using tables and figures.

2.1. Questionnaire Design

A well-structured questionnaire was developed and used to obtain information on the causes, effects, and control measures of erosion in the study area. The questionnaire comprised 3 sections; Section A contains questions on the respondent's personal data such as age, sex, academic qualification, and how long the respondent has been in the study area. Section B contains questions on the causes and effects of erosion in the study area, while section C contains

questions on the control measures to be adopted in managing erosion in the study area.

2.2. Pilot Study

In verifying the appropriateness of the designed questionnaire in meeting the research objectives, a pilot study was carried out. Draft questionnaires were sent to 10 respondents, with each respondent representing a Ward in Kaltungo Local Government. The questionnaires were administered at this point to assess their content validity and to give constructive criticism. Upon retrieval of the 10 questionnaires, the draft questionnaire was modified based on their feedback.

2.3 Data Presentation and Analysis

Data collected were presented in Charts and Tables, while Mean Item Score (MIS) was adopted in analyzing and ranking the data on causes of erosion and measures required to prevent/control erosion, whose responses are based on a 5-point Likert scale ranging from 1-5. The mode was used to analyze the effects of erosion within the study area.

2.4 Reliability Check

Statistical Package for Social Science (SPSS) was used to check the consistency of the data. According to Pallant (2007), a reliability coefficient of 0.70 and above is generally acceptable. In supporting this view, Oyedele et al (2003) opined that the alpha value is expected to be greater than 0.70 and that a higher alpha value equates to greater reliability.

The data for this research is therefore found to be consistent as seen in the table below

Table 1. Cronbach's Alpha Reliability Check

NO.	ITEMS EVALUATED	CRONBACH'S ALPHA	N OF ITEMS
1	Causes of erosion	0.805	8
2	Measures for preventing/controlling erosion	0.826	9

3. RESULTS AND DISCUSSION

3.1 Demographic Characteristics of the Respondents

Fig. 1–4 shows the demographic characteristics of the respondents.

The analysis of the respondents' occupations reveals that 59% are civil servants, 15% are farmers, 12% are businessmen/women/traders, 8% are students, 4% are

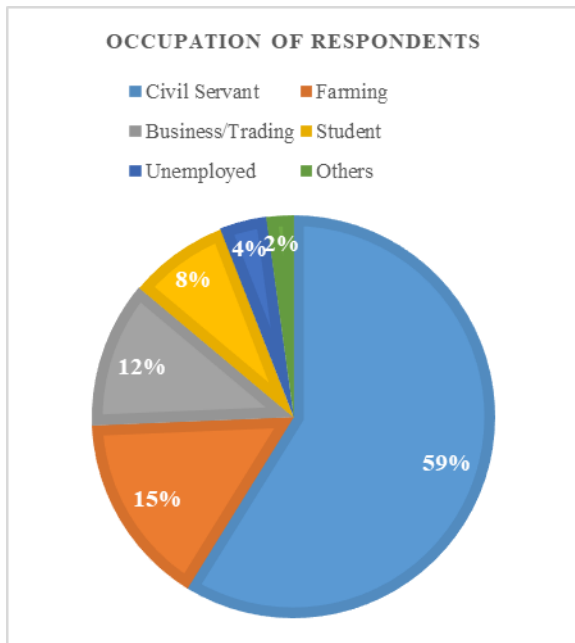unemployed, and 2% are found to be in other categories as seen in fig. 3.1 below.

Figure 1. Occupation of respondents

Fig. 2 below shows that 90 respondents are senior staff in their place of work, 20 are junior staff, 29 are farm owners, 22 are business owners, 15 are apprentices, 7 are laborers, and 4 are in other categories.
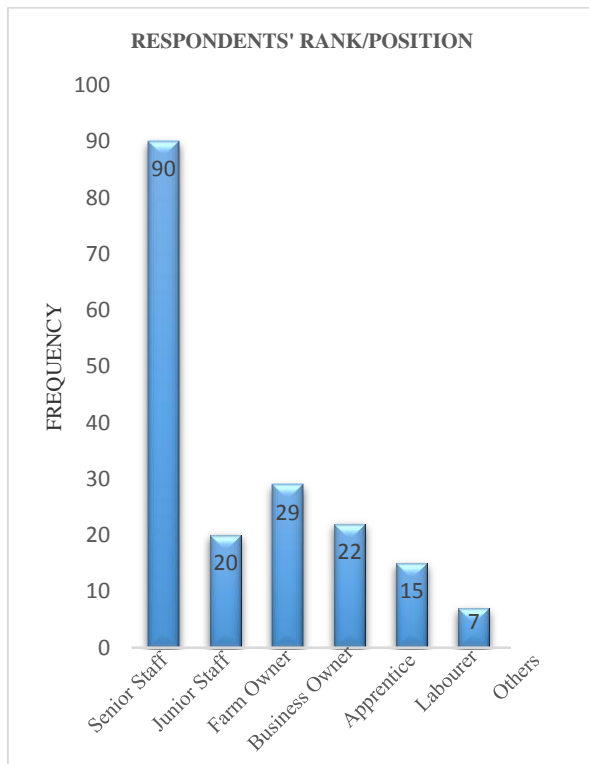

Figure 2. Respondents' rank/position

Fig.3 presents respondents' highest educational qualification with 58% of them having BSc/BTech/HND, 6% are MSc holders, 4% are Ph.D. holders, while 32% are in other categories such as OND, O'Level, FSLC, and non-formal education.
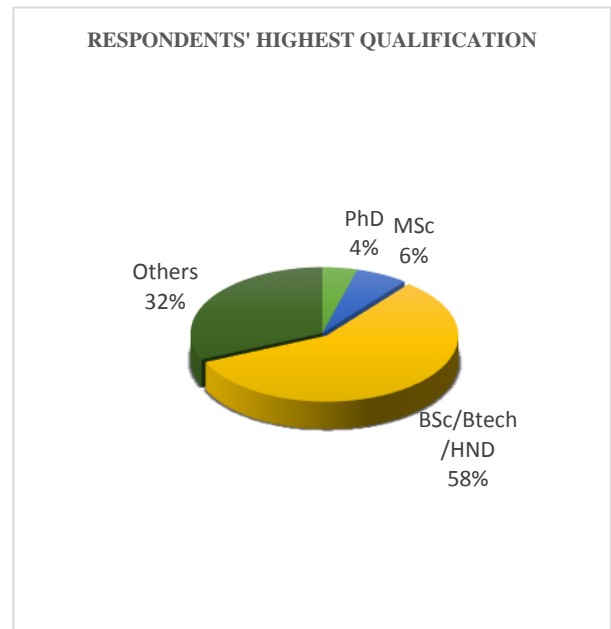

Figure 3. Respondents' highest qualification

Fig.4 indicates that 55 respondents out of 187 have spent between 11-15 years in their places of work/business, 40 have spent 21 years and above, 35 have spent between 16-20 years, 47 have spent between 5-10 years, while 10 respondents have spent less than 5 years.
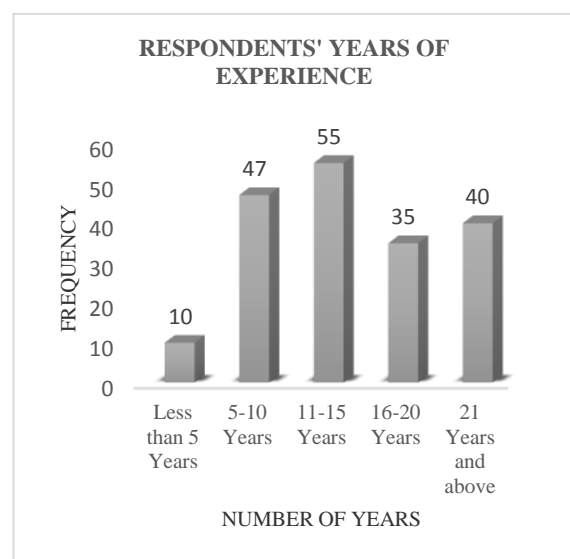

Figure 4. Respondents' years of experience

3.2 Causes of Erosion in Kaltungo Local Government Area

The overall perception of the respondents on the causes of erosion in their area is shown in Table 3.1. It can be observed from the Table that running water with a mean item score of 4.60 is the highest cause of erosion in Kaltungo Local Government Area, and is therefore ranked 1st. This was followed by deforestation with a mean item score of 3.68, and then grazing with a mean item score of 3.34. The table also shows that agriculture, construction, and mining activities are the lowest causes of erosion in the area with mean item scores of 1.03 and 1.03 respectively.

Table. 2. Showing causes of erosion in Kaltungo Local Government

S/No	Causes of Erosion	MIS	Rank
1	Running Water	4.60	1
2	Flooding	1.14	4
3	Agriculture	1.03	7
4	Grazing	3.34	3
5	Mining Activities	1.06	6
6	Construction	1.03	7
7	Wind	1.14	5
8	Deforestation	3.68	2

MIS = Mean Item Score

Source: Researchers' Analysis (2023)

3.3 Measures for Controlling/Preventing Erosion in Kaltungo Local Government Area

Table 2 shows the respondents' perception of the measures for controlling/preventing erosion in their area. In the respondents' opinion, the top 3 measures are the provision of drainages, reforestation, and grazing control with mean item scores of 4.58, 4.31, and 3.73 respectively. The lowest 3 measures as can be seen from the Table are mulching/plant cover, construction activities control, and mining control with mean item scores of 1.01, 1.01, and 1.04 respectively.

Table 3. Showing erosion control measures in Kaltungo Local Government Area

S/No	Measures of Controlling/ Preventing Erosion	MIS	Rank
1	Provision of Drainages	4.58	1
2	Flood Management	1.15	6
3	Mulching/Plant Cover	1.01	8
4	Grazing Control	3.73	3
5	Mining Control	1.04	7
6	Construction Activities Control	1.01	8
7	Effective use of Land	3.25	4
8	Reforestation	4.31	2
9	Shelterbelts	1.21	5

MIS = Mean Item Score

Source: Researchers' Analysis (2023)

3.4 Effects of Erosion in Kaltungo Local Government Area

Table 3 below shows the respondents' opinions regarding the effects of erosion in their area. Devaluation of assets is the leading effect caused by erosion with 260 appearances, followed by depletion of land and poor topography with 200 and 110 appearances respectively. The 3 lowest effects identified by the respondents are decomposed debris, loss of lives, and air pollution, each with 4 appearances.

Table 3 Effects of Erosion in Kaltungo Local Government Area

S/No	Effects of Erosion	Mode	Rank
1	Destruction of houses	105	4
2	Depletion of land	200	2
3	Loss of nutrients	48	8
4	Desertification	103	5
5	Water pollution	100	6
6	Destruction of roads	30	10
7	Decomposed debris	4	13
8	Destruction of crops	42	9
9	Land degradation	100	7
10	Loss of lives	4	13
11	Flooding	5	12
12	Poor topography	110	3
13	Devaluation of assets	260	1
14	Air pollution	4	13
15	Wind storm	6	11

Source: Researchers' Analysis (2023)

4. CONCLUSIONS

The extensive running water from hills, deforestation for urbanization, and overgrazing have led to the loss of

vegetation cover, reducing soil stability and increasing surface runoff. The impact of these factors on erosion rates in Kaltungo is consistent with findings by (Lopez et al., 2019; Olivares and López, 2019). The researchers, therefore, conclude that the factors most responsible for erosion in the area are running water, deforestation, and grazing.

The following recommendations are proposed based on the study findings:

- Encourage reforestation initiatives to restore vegetation cover and stabilize the soil.

- Cutting down trees should be highly discouraged and punishment meted on perpetrators.

- Implement erosion control measures such as drainage construction to minimize surface runoff and erosion.

- Grazing should be properly managed through the provision of grazing reserves.

By understanding the underlying causes and implementing appropriate control measures, policymakers and practitioners can effectively manage erosion and promote sustainable land use practices in the area (Guevara et al. 2012).

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