An Assessment of the Impact of Limestone Mining on Agricultural Activities around Kalambaina Area, Wamakko Local Government, Sokoto State, Nigeria

Hayatu Dangaladima

Department of Geography, Faculty of Arts and Social Sciences, Sokoto State University, Sokoto, Nigeria

***Abstract*: - Mining has been linked to various environmental challenges such as land degradation, landslide, soil erosion and flooding. Land degradation is believed to be one of the major ways in which mining of minerals affects agricultural production in areas where such activities takes place. This paper is aimed at assessing such effects of mining on agriculture around Kalambaina area of Wamakko Local Government, Sokoto State, where limestone is been mined by the Cement Company of Northern Nigeria, Plc. A total number of 338 questionnaires were distributed to respondents randomly selected to represent different households in the study area. The result of the study reveals a reduction in crop yield among farmers in the study area, which could be attributed to the impact of land degradation due to the mining activities around the area. Though the Peason's correlation used in testing the hypothesis fails to reveal a significance relationship between the mining activities by the Company and the low crop yield experienced in the study area. The study recommended for more efforts particularly on land reclamation and adequate compensation by the Company to the affected farmers so as to cushion these effects.**

***Keywords*: Mining, Limestone, Land Degradation, Crop Yields.**

I. INTRODUCTION

Mining generally refers to the extraction or removal of ore from the ground. According to Acheampong (2004), it is the removal of minerals from the earth crust in the service of man. It is the selective recovery of minerals, and materials, other than recently formed organic materials from the crust of the earth. From the above definitions, it can be deduced that mining is human activity that deals with the excavation and extractions, it can be deduced that mining is a human activity that deals with the excavation and extraction of valuable materials from the earth crust other than agricultural products. Such materials mined by humankind are broadly grouped as fuels, metals, and non-metabolic minerals. Metallic ores/minerals are those ores of the ferrous metals like iron, manganese, molybdenum, and tungsten, the base metals like copper, lead, zinc, and tin, the precious metals like gold, silver, the platinum group metals, and the radioactive minerals like uranium, thorium, and radium. The Non-metallic minerals also known as industrial minerals are the nonfuel mineral ores hat are not associated with the production of metals. These include among others phosphate, potash, halite, troha, sand, gravel, limestone, sulphur. Fossil fuels also known as mineral fuels are the organic mineral substances that can be utilized as fuels, such as coal, petroleum, natural gas coal bed methane, gilsonite, and tar sands among others (Adekoya, 2003).

According to (Akabzaaet'al, 2001) the process of excavating the earth surface for valuable materials employs the use of two main methods which include Open cast and Underground mining. Open casting or surface mining is a type of strip mining that involves the extraction of ore deposit that are located near the earth surface or ones that has a low stripping ratio. This method which excavate and extract ore/mineral deposits at a substantial underground depth necessitate the removal of layer upon layer of overburden as well as the creation of a pit that extends below the groundwater table. The removal of overburden usually involves logging of trees and clear-cutting or burning of vegetation above the ore deposit with the use of heavy machinery like bulldozers and dump trucks, this renders it as the most environmentally destructive type of mining, especially within tropical forests. Irrespective of its environmental destruction nature, open cast mining is however the predominant exploitation procedure used worldwide to excavate and extract almost all minerals excluding petroleum and natural gas (Fyleset'al, 1985 and Akabzaaet'al, 2007). According to reports of National Mapping Division, U.S. Geological Survey (1995), it produces about 85% in the United States with about 98% of metallic ores, 97% of non-metallic ores and 61% of coal. It major advantage over the underground mining method however includes high productivity, low operating cost as well as good safety conditions. This is the most common method used for mining limestone within the country in general and the area in particular. Underground mining on the other hand refers to any sub-surface vertical or horizontal excavations that are made for the extraction of minerals. This method has little effect on the vegetation and ecosystem in general as minimal amount of overburden in remove to gain access to the ore deposit. Access to ore deposit using this method is however gained through tunnels or shafts. Although underground mining is a less environmentally destructive, it is often more costly and entails greater safety risks than open-pit mining. While most large scale mining projects involve open-pit mining, many large underground mines are in operation around the world (Akabzaaet'al, 2001).

1.1 History of Mining

Mining operation is second only to agriculture as the world's oldest and important activity and its history is parallels to the history of civilization. In its simplest form, mining began with Paleolithic humans during the Stone Age where pieces of close masses of rock outcrops where used as crude materials for chipping and shaping flint into tools and weapons (Lewis et'al 2009). However, the oldest known underground mine, a hematite mine at Bomvu Ridge, Swaziland is from the Old State Age (Gregory, 1980). Metallic minerals also attracted the attention of prehistoric humans where metals were obtained by washing river gravel in placer deposits. With the advent of the Bronze, Iron Ages and Nuclear Age, however, humans discovered smelting and learned to reduce ores into pure metals or alloys, which greatly improved their ability to use these metals resulting into advancement of the mining industry (Lewis 2009).

The history of organized mining in Nigeria however dates back to the colonial are around 1903 with the creation of Mineral Survey of the Northern and Southern Protectorates by the British Colonial Government. Subsequently, in 1940s, Nigeria was a major producer of tin, columbite, and coal but with the discovery of oil in 1956 more concentration was subsequently given to oil extraction to the detriment of soil mineral extraction industry (Ministry of Soil Minerals Development, Adekeye and 2001; Adetunji, et al, 2005.

After Nigera's independence the major economic policies emanating from the new government was that of important substitution with emphases on local production of hitherto imported consumer goods. According to Oyebanji (1983) and Adekeye (2001), these policies encouraged investments not only in the oil and gas sector but also in the solid mineral sector so as to reduce the country's over dependence on revenues from oil and gas which was the main stay of the economy. Consequently, several large scale industries were built by the various levels of governments within various states of the federation. The Cement Company of Northern Nigeria Plc (CCNN), was founded by the Premier of the then Northern Region, Alhaji Sir Ahmadu Bello, Sardauna of Sokoto. It was incorporated in 1962 and commenced production in 1967 with an initial installed capacity of 100,000 tons per annum at the Kalambaina plant(Encyclopedia 2019) Also the discovery of limestone traces in Mbayion Gboko Local Government Area of the Benue State in 1960 sprouted both the Federal and State Government to initiate a plan of building a cement plant within the region. Eventually, Benue Cement Company (BCC) was founded in July 1975 with its first operation on August 1980 with the Factory Premises situated by Kilometre 72 Makurdi-Gboko Road, Tse-Kucha, Gboko Benue State (Vetiva Research, 2010).

1.2 Land Degradation

United Nation International Strategy for Disaster Reduction define land degradation as the Reduction of the capacity of Environment to meet social ecological objective and needs, when natural resource are depleted the environment is degraded. Society everywhere, are closely linked to natural environment in which they are embedded, human productive, social activities, social structures and relation are shaped to a significant degree by the natural resource in particular or in natural condition in general. Land degradation including depletion of renewable and non-renewable resources and pollution of air, water and soils, which can be a significant source of stress upon societies. It can act on soil integration indirectly, through the constraint that it puts on productive and it can also have more direct social impacts.

Manufacturing of cement has generally led to serious localized land degradation due to exploitation of limestone all over the world. Land degradation is very rampant all over the world, were this limestone has been exploited for the purpose of making cement and other building construction (Ajakiaye, 1985).

Land degradation is fast becoming recognized as a key issue in the world today, as much planet earth is degraded, or at risk of degradation. Since the Second World War, cement and concrete has come to be used more often as a construction material and has resulted in extensive quarrying of chalk or limestone.

1.3 Statement of the Problem

Mining of limestone by Cement Company of Northern Nigeria, Sokoto, has created a lot of land degradation problem to the area. Agriculture which is the major economic activity of the local populace has been seriously affected due the mining activities, the top soil which contain the essential required nutrients for the growth of plant have been tempered with, and available farmlands has also been degraded thus affecting their output, this degradation also resulted in depletion of renewable and non-renewable resource, and pollutions of air, water and soil to a large extend. It is against this background that this paper intends to assess the effects of this mining activities on the major occupation of the inhabitants, which is farming.

1.4 Aim and Objectives

Aim

The aim of this paper is to assess the effect of limestone mining on agricultural activities in Kalambaina Area of Wamakko Local Government, of Sokoto State.

Objective

(i) To find out the extent of land degradation in the study area.
(ii) To find out the extent of farmland lost to the activities of limestone extraction in the area.
(iii) To identify other environmental problems associated with limestone mining in the area.

(iv) To assess the reclamation effort been undertaken by the company.
(v) To suggest solutions to the problems identified.

1.5 Hypothesis

Ho:- There is no significant relationship between low crop yield and the activities of limestone mining by the cement company in the area.

1.6 The Study Area

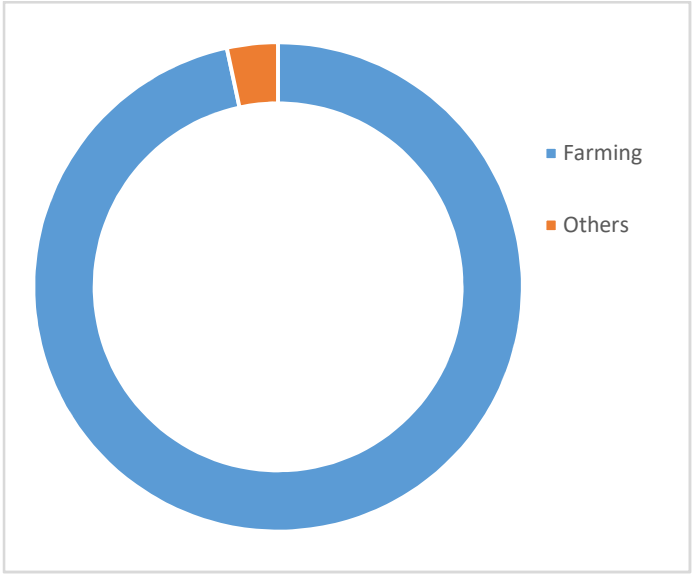
Kalambaina town is in Arkilla District of Wamakko Local Government, Sokoto State which lies between latitude 12° N and 13° 58 N and longitude 04° 8′ E and 6° 54 E. The geology of the area forms the third category of the Sokoto State's relief and geology which consists of two main formations, the Dange formation consist of clays and shale, while the Kalambaina formation which overlies the former made up of limestone. (Abdullahi, 2007). Annual average temperature is 28.3 ^{O}C (82.9 ^{O}F), (Abdullahi, 2007) the rainy season is from June to October. The showers rarely last and are a far cry from the regular torrential showers known in many tropical regions. Rain starts late and end early with mean annual rainfall ranging between 500mm and 1,300mm. The two major seasons in the area are wet and dry. The dry season starts from October, and lasts up to April and may extend to May or June. The wet season on the other hand begins in May and lasts up to September, or October. The hammattan, a dry, cold and fairly dusty wind is experienced between November and February. General dryness of the area allows for few crops, millet perhaps being the most abundant, complemented by maize, rice other cereals, and beans (Abdullahi, 2007). The vegetation falls within the Sudan type savannah characterized mainly by thorny species trees with deep tap root system, broad or umbrella like branches, thick barks and they shed their leaves during dry season. Species found in the area include: azedirachtaindica (neem tree), adansoniadigitata (boaba tree), mangiferaindica (mango tree), acacia albida, acacia nilotica and balanitesaegyptica (Abdullahi, 2007)

II. MATERIALS AND METHODS

In conducting this research two data sources were explored in the process of data collection were used that is primary and secondary data. The primary data was gathered with the aid of questionnaires and physical survey of farmlands as well as interviews with farmers. The secondary data on the other hands was obtained through textbooks, the internet, journals and other electronic and printed materials. Simple random sampling was adopted in the administration of the questionnaires, the result was presented using descriptive statistics while the hypothesis was tested using the Peason's correlation.

III. RESULTS AND DISCUSSION

Fig. 1 Distribution of Respondents by Major Occupation



Source: Author's field work. 2019

Figure 1. above shows farming as a the major occupation of people in the area. Though some of the inhabitants engages in other economic activities, 92% of the respondents affirmed that farming is their major occupation, with only 8% indicating that even though they are also into farming, it is not their major occupation.

Table 1: Distribution of Respondent by Years in Farming

Years of farming	Frequency	Percentage
Less than 10 years	-	-
10 – 20	58	17%
More than 20 years	280	83%
Total	338	100%

Source: Author's field work. 2019

Table 1 shows that 280 respondants representing 83% are into farming activities for over 20. While 58 of them(17%) have been into farming for between 10 and 20 years. None of the respondants indicated that he/she is into farming for less than 10 years. This clearly indicates that farming has been a household business in the area right from the onset.

Table 2: Distribution of Respondent by Their Farm Size

Size of farm land	Frequency	Percentage
Less than 1 hectare	310	92%
1 – 3 hectare	28	8%
More than 3 hectare	-	-
Total	338	100%

Source: Author's field work. 2019

Table 2. reveals the impact of land tenure system in the area which greatly affect farm sizes. The table indicates that 92% or 310 of respondents owned less than one hectare of farm land, with a meager 8% or 28 respondants cultiviating between 1 and 3 hectares of farmland. It also confirms that none of the respondants owned a farm that measures more than 3 hectares. Inadequacy of sizeable farmalnds is therefore established in the area.

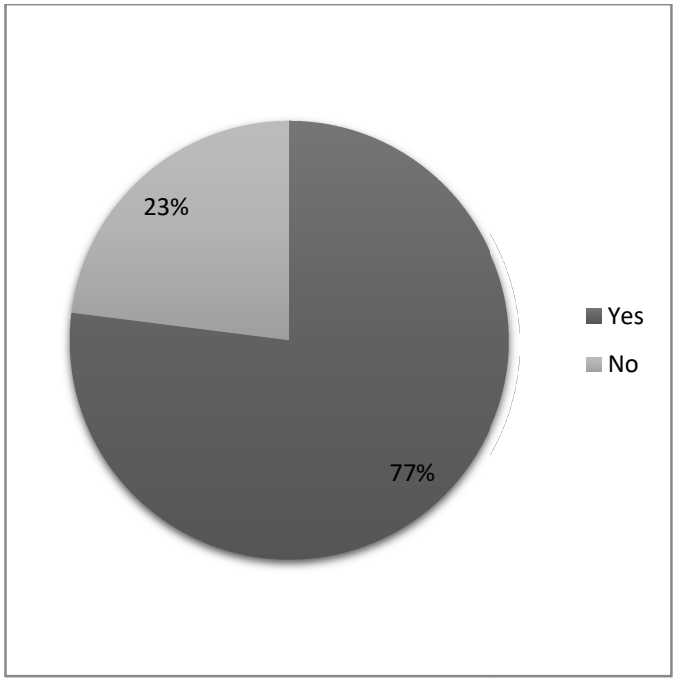
Table 3:Major Problems Encountering in the Area Due Limestone Mining by the CCNN.

Kind of problems	Frequency	Percentage
Land slide	13	4%
Soil erosion	60	18%
Loss of Farmlands	25	7%
Low crop yield	240	71%
Total	338	100%

Source: Author's field work. 2019

Problems associated with mining of limestone in the area are summarized in the Table 3 above, where low crop yield attributed to land degradation top the table with 240 respondants representing 71% affirming that they experienced low crop yeild on their farms as a result of mining activities carried out by the company. 60 respondants or 18% identified erosion as having a link with the mining activities, while 25 or 7% of the respondants stated that they lost some portion of their farmlands to the activity. 13 respondants (4%) identified the mining activities as the cause of landslides in the area.

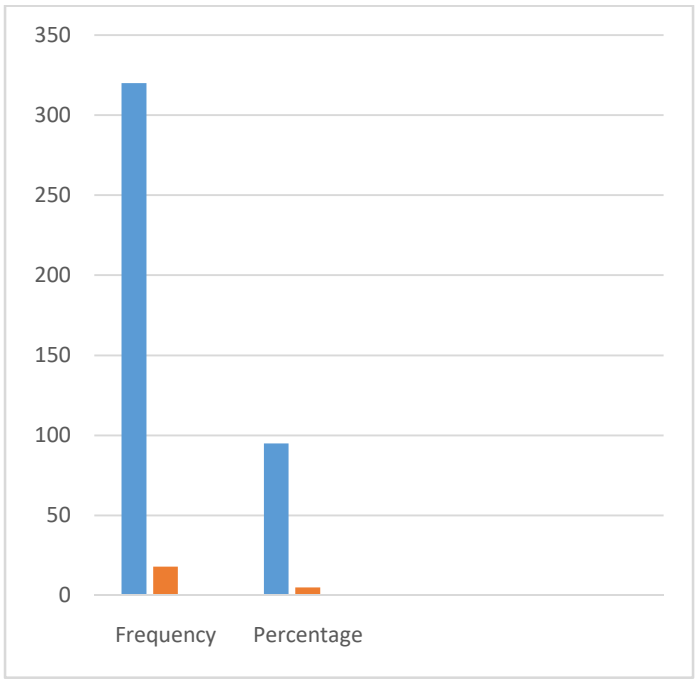
Fig. 2 Whether Compensation are Paid to Farmers due to Challenges Caused by the Company'sMining Activities



Source: Author's field work. 2019

Figure 2 above indicates that majority of the respondants (77%) do not agree that compensations are paid to farmers for damages caused to their farmlands as a result of limestone mining in the area, while 23% are of the opinion that, the company do pay compensation to farmers due to damages caused to them by the company. From the available data, it is evedent that compensation paid is not only inadequate but also lacks fairness in its distribution among the farmers.

Figure 3. Land Reclamation Efforts by the Company



Source: Author's field work. 2019

Figure 3 above revealed that about 95% of the respondants representing 320 answered yes, that there is reclamation effort being undertaken by the cement company while 5% of the respondents answered in the negative that there are no reclamation effort by the company to reclaim degraded land in their area. It is however clear that there are reclamation efforts in most of the quarry areas though more need to be done in this regard, giving the magnitute as well as the degree of the land degradation problem.

3.3 Test of Hypothesis

H_0: There is no significant relationship between low crop yield and the activities of limestone mining by the cement company in the area.

CORRELATION

Variable = LCY EFC

Print = TWO TAIL NOSIG

Missing = PAIRWISE

Correlation

		LCY	EFC
LCY	Pearson Correlation	1	.060
	Sig. (2-tailed)		.268
	N	338	.338
EFC	Pearson Correlation	.060	1
	Sig. (2-tailed)	.268	
	N	.338	338

Interpretation

The correlation between low corp yield and the activities of cement production is 0.06 significance level, we are to accept the hypothesis which stated that there is no significant relationship between low crop yield and the activities of limestone mining by the cement company in the area.This reveals that activities of limestone mining by the cement company for the production of cement do not have signifcant effects on low crop yield.

IV. CONCLUSION AND RECOMMENDATION

4.1 Summary

Results from the study reveals that

- Majority of the household in the study area practice full time farming as their major occupation and they have been into farming for long period of time.
- It was observed that farm sizes are relatively small with about 92%of the farmers in the area cultivating less than one hectare of farmland.
- There is low crop yield in the area which many respondents attributed to land degradation caused by the limestone mining in the area.
- That compensation effort to farmers for damages caused is inadequate.
- The cement company is making efforts to reclaim the degraded land in the study area and put it back into use.

4.2. Recommendations

The paper recommends as follows:

(i) Compensation efforts needs to be intensified in order to assist the subsistence farmers in the area.

(ii) The cement company should further intensity their social responsibility by extending it towards the provision of fertilizers and some important farm inputs for the communities surrounding the company so as to boost their productivity.

(iii) The cement company should also intensify its efforts on land restoration; this is a kind of rehabilitation of degraded land to a standard so that it can be put back into use.

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