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ISSN (Online): 2455-7838

SJIF Impact Factor (2016): 4.144

EPRA International Journal of

# Research & Development (IJRD)

Monthly Peer Reviewed & Indexed  
International Online Journal

Volume:2, Issue:3, March 2017



Published By :  
EPRA Journals

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## ADVERSE EFFECTS OF UNREGULATED AGGREGATE EXPLOITATION IN SOUTH-EASTERN NIGERIA

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### ABSTRACT

Quarry products are mostly sand, gravel, dimension stone, riprap and crushed rock. They are indeed the core building material in all community buildings and infrastructure. Without the existence and use of aggregates in construction there would be no built environment. However, the process of exploitation of aggregates causes immense damages to water; land, vegetation, biodiversity and the environment in general. This aim of this work is to establish the extent of the effect of unsustainable quarrying activities on the local vegetation cover in the study area. Field observation, in-depth interviews, measurements, photograph recording, simple regression analysis and 390 questionnaires were analyzed. Garmin eTrex GPS was used to obtain the co-ordinates of the quarry sites. Geographical Information System and Global Positioning System were used for producing a map of the area and fixing the geographic positions of the locations of the quarry sites respectively. The result of the study revealed that the total area of vegetation cover destroyed was 402.855 hectares. Field measurements showed that the percentages of land lost in the local government areas were quarrying activities are intensified with 35.2% at Ivo to 3.7% at izzi. The socio-economic effect felt by the inhabitants of the area as obtained from the respondents was the destruction of land resources to the extent of 58% due to stone quarrying. The  $R^2$  value obtained from simple regression analysis was 0.843 that means 84 percent of quarrying activities has affected vegetation cover as explained by the model. Observations, interviews and photographs identified that the original landform is permanently altered and deformed. The original vegetation cover is equally destroyed. The study recommended that the Government and public agencies concerned should develop and enforce policies and strategies to achieve a balanced, coordinated and sustainable development in the State.

**KEYWORDS:** Adverse, exploitation, environment, quarrying activities, erosion, vegetation cover and sustainability.

## 1. INTRODUCTION

According to Akabzaa and Darimani (2001) quarrying is an open excavation from which any useful stone is extracted for building and engineering purposes. A quarry is a type of open-pit mine from which rocks or minerals are extracted. Quarries are generally used for extracting building materials such as dimension stones, construction aggregate, riprap, sand, and gravel. No doubt quarrying operations can bring about economic benefits such as employment, purchase of locally-produced goods, foreign exchange to the country and developmental projects to the host communities where the stones are quarried (Sosa et al., 2001, Bradshaw, 2005 and Bridge, 2008).

However, they also have negative effects on the local vegetation cover in developed and developing countries including Nigerian cities where most of the extraction processes are unregulated. Mining and quarrying activities have a long history in Ebonyi State including the earliest dated lead/zinc mines located at Ishiagu. The process of excavation has a number of common stages each of which has potentially-adverse effects on the natural environment, safety of quarry workers, and communities based in close proximity to operations (Akabzaa et al, 2004).

These stages of operations include blasting, excavation, crushing, screening, stockpiling and transport of aggregate. These have been found to be environmentally disruptive considering the fact that proper siting, design, construction, operation and follow-up monitoring are mostly not provided in the course of quarrying (Environmental Guidelines, 1993). This results in haphazard quarrying practices and the destruction of lands, water, widespread erosion and loss of vegetation becomes unavoidable (Ogezi, 2005 and Sklenicka et al .2004). The large scale indiscriminate quarrying activities have caused severe damage to land resources around the world. This can eliminate the exiting vegetation, destroying farmlands and alteration of soil profile (Mallo, 2012, Aspinall, 2001 and Mummey et al 2002). The unregulated manner of operations by companies in order, to acquire maximum profit at the detriment of the environment and host communities is a threat to the stability of the environment. Undoubtedly, the after effects are immense damage of lands, vegetation loss, disturbance of landscape, with ugly and distorted topography, agriculturally unproductive terrain, creation of pools of water for breeding pest, deforestation, and a general degradation of the ecosystem with air, land and water pollution in

Nigerian cities like Karimo, Mpape, Chika, Kuje and Gwagwalada areas in Abuja ( George et al.2011).

The implications of these operations tend to undermine the goals of sustainable development. As these operations are carried out by quarrying firms that are not in compliance with the Nigerian Minerals and Metal Act, Mining regulations and other extant laws such as that of the council of Nigerian Mining Engineers and Geoscientists (COMEG). Hence, environmental degradation becomes inevitable leaving the environment susceptible to vegetation loss, deformation of the landscape and erosion gullies that threaten human and animal life. Most affected communities in most occasions have to forgo their vegetative lands, which are their most important natural resource (Minerals Commission, 2001).

This makes poverty unavoidable on the host community as members are denied gainful employment and other developmental benefits that should come to them as a result of hosting such minerals in their community. Majority of the quarrying companies seem not to have made steps to improve the conditions of the area within the quarrying sites and the surrounding communities. They do not include corporate social responsibility project plans made towards these communities. Guardian Newspaper (2008) reported the plight of people living within localities were quarrying operations are prevalent. It was recognized that gravel extraction and excavation is the most dangerous man- induced activity that has helped worsen the woes of the community.

Additionally, the people in rural communities where quarries are sited are also deprived of their livelihood. The government regulatory agencies or local authorities give the land out to the operators without holding comprehensive consultations with the communities. They forget that most of these rural communities mostly depend on agriculture production. According to EBSEEDS, (2004), over 60 percent of Ebonyi State population (over 1.2 million people) is rural based, with agriculture engaging close to 80 percent of the rural dwellers.

However most agricultural production in Ebonyi State is still at subsistence level relying on traditional methods of production, whose productivity is marginal. They depend on their land for their survival and it is the only consolation the people are entitled to. In such communities, the compensation that is paid to them is based on the crops they lose to the quarry operation serves as a means of upkeep. However, this is woefully inadequate and rather worsens the plights of those who are the unfortunate victims or whose land is

taken over by the quarry firms (Delbridge & Lowe, 1998).

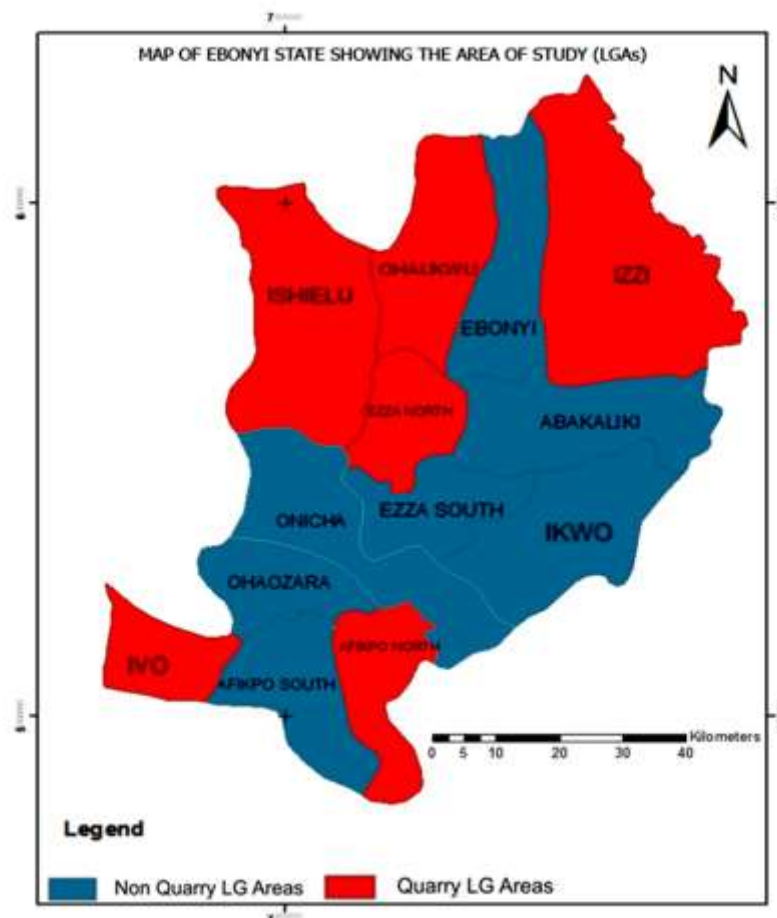
### STUDY AREA

The study area is Ebonyi State located in the south eastern region of Nigeria. The State is situated between longitudes 7° 30' and 8° 30'E and latitudes 5 ° 40' and 6 °54'N. It has a land area of 5,935 sq. Km and it a population of 2,176, 947 based on the 2006 census. It has an annual growth rate of 3.5% per annum (National Population Commission, 2000).

Ebonyi's population is largely rural, it has an average rurality index with an estimated 75 percent

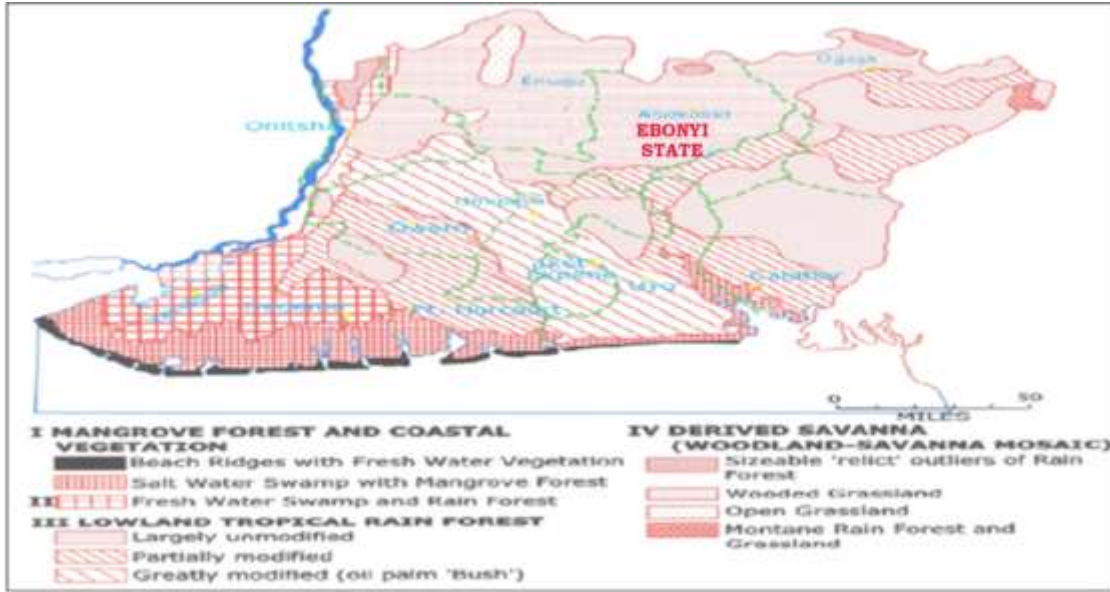
of the population (over 1.2 million people) living in rural areas.

It is made up mainly of hydromorphic soils which consist of reddish brown. They are gravely and pale coloured clayey soil and loamy clayey soil, shallow in depth, and of shale parent material. It falls within the Asu-River Geologic Group (Lower Cretaceous), Eze-Aku shale formation and Nkporo Formations. This is responsible for the abundance of solid minerals exploitation and mineral-based industries (Edet *et al.* 2011).



**Fig. 1: The Map of Ebonyi State showing the Area of Study (LGAs)**

*Source: National Geo-Hazard Centre, Awka*



**Fig. 2: The Vegetation distribution map of the southeastern Nigeria**

Source: (Floyd, 1969)

## 2. MATERIALS AND METHOD

The data for this study was collected through direct field observation, questionnaire administration, in-depth interviews, photograph recording and field measurements. Data was analyzed using simple regression analysis. 400 questionnaires were distributed, but 390 were finally recovered, analyzed on the quality of the lands located within the quarrying area. The need to establish the association between the extent of quarrying activity and local vegetation cover in Ebonyi State necessitated the adoption of the analytical tool. The Garmin eTrex GPS was used to obtain the coordinates of the quarry locations. The census data were collected from the National Population Commission office, Ebonyi State. Then field visits to site was carried out to obtain ground control points for geo-reference and ground truth sampling. The Surveyors measuring tape was used to calculate the

extent of vegetation cover degradation as result of quarrying in the area. Geographical Information System and Global Positioning System were used for producing a map of the area and fixing the geographic positions of the locations of the quarry sites respectively. The data so collected were collated and analyzed for 27 quarry locations selected from six local government areas where quarrying activities are heavily concentrated and currently active.

## 3. RESULTS AND DISCUSSION

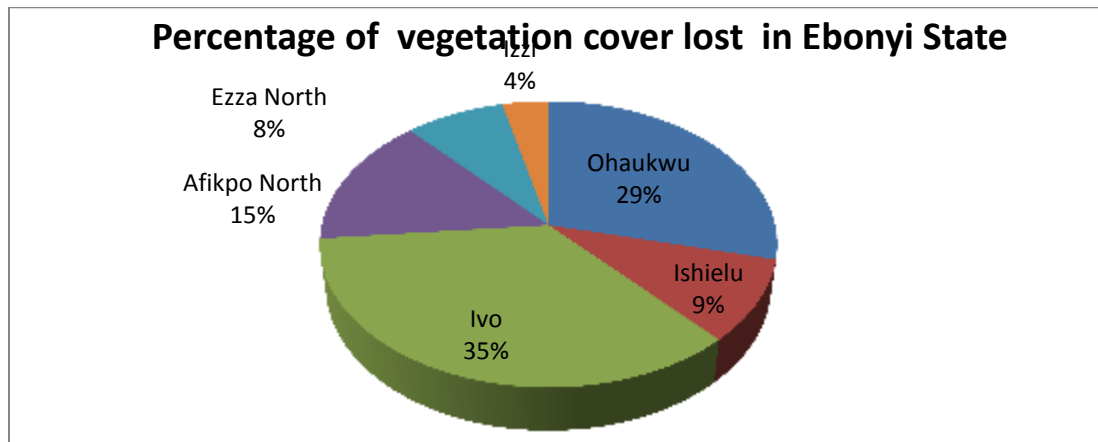
Table 1.1 showed the total area of vegetation cover lost due to quarrying activities and their percentages respectively in each of the Local Government Area of Ebonyi State. Ivo L.G.A has the largest amount of vegetation loss with 35.2% and Izzi LGA has the lowest vegetation loss of 3.7%. A total of 40,286 hectares of vegetation cover has been lost in Ebonyi State due to quarrying operations.

**Table 1.1: Percentage of Excavated Vegetation by Quarrying Activities.**

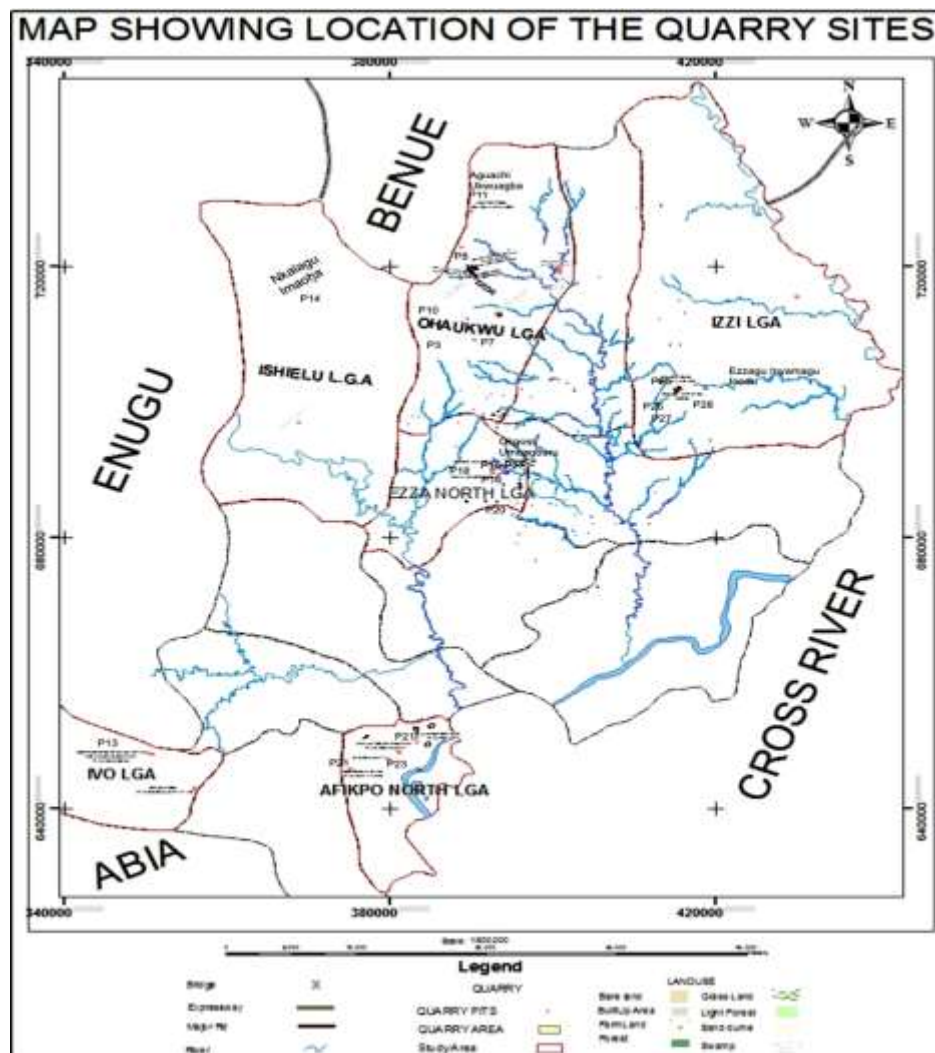
Active Quarry L.G.A Areas	Total Area of vegetation lost by Quarry pits	% of area occupied by the quarry pits	Total Area of L.G.As
Ohaukwu	1,157,050m <sup>2</sup>	28.7	597,010,762m <sup>2</sup>
Ishielu	377,325m <sup>2</sup>	9.3	104,334,573m <sup>2</sup>
Ivo	1,422,000m <sup>2</sup>	35.2	322,711,402m <sup>2</sup>
Afikpo north	595,350m <sup>2</sup>	14.7	553,091,458.5m <sup>2</sup>
Ezza North	323,825m <sup>2</sup>	8.0	32,801,991m <sup>2</sup>
Izzi	153,000m <sup>2</sup>	3.7	115,626,233m <sup>2</sup>
Total	4,028,550m <sup>2</sup>	100	4,000,441,598

Source: Author's Fieldwork, 2016.





**Fig. 3: Percentage of Vegetation Cover lost in Ebonyi State.**



**Fig. 4: Map showing the GIS location map of quarrying Activities in the Ebonyi State**

Source: Inforgraph Consultants Nigeria, Limited, Enugu, 2016

Findings from the study showed that there are several quarries scattered in the six LGA where quarrying activities are prevalent in the State, and a considerable amount of them are operational. These operating quarries range in sizes from the very large, company-owned quarries to fairly large family owned quarries all located in remote sites and villages. (See fig. 4 quarry map). The company owned quarries are modern excavation which occupies a larger area especially at Ohaukwu, Omaoha and Akpoha areas, due to the use of powerful excavating machinery and modern production organization.

The study revealed that quarrying activities have serious effect on the vegetation and landform components and functions, leading to significant alteration of the original landscape and loss of the vegetation cover as well. Once quarry operations start, the landscape development in progress is disturbed, the original ecosystems are removed, the topography is significantly altered, the basic ecological relations are unchangeably disrupted, and biodiversity is grossly decreased.

This was confirmed from the field measurements that there has been large scale

exploitation of limestone and granite in Ebonyi State. It showed that 402.855 hectares of arable lands that have been destroyed by excavation of rocks. Ivo LGA happened to have the highest vegetation loss of 1422000m<sup>2</sup> represented by 35%. Also, Izzi LGA has the lowest vegetation loss of 153000m<sup>2</sup> represented by 4% in the area (See table 1.1). This inferred that based on the findings that the continuous quarrying of rock resources in the area has had a resultant negative effect on the arable lands and vegetation.

Also the unscientific approach to quarrying in the study area poses a serious threat to the environment. Observations and interviews with quarry workers indicated that there is huge negligence to environmental guidelines such as geology of the area, geotechnical planning, scheduling of earthmoving equipments, drill and blast technology. This has resulted in the vast reduction of forest cover in the quarrying communities, erosion of soil, pollution of air, water and land and reduction in biodiversity.

Furthermore, the output data from simple linear regression analysis shown in table 1.2 which indicates an adjusted high R<sup>2</sup> value of 0.804.

**Table 1.2: Regression Model of Quarrying Activities and Local vegetation Cover.**

Model Summary(b)									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
	R Square Change	F Change	df1	df2	Sig. F Change	R Square Change	F Change	df1	df2
1	.918(a)	.843	.804	5.56594	.00843	21.489	1	4	.010

a Predictors: (Constant), local vegetation  
b Dependent Variable: Quarrying Activity

Source: Researcher's SPSS Computation, 2016

Table 1.3 showed that the adjusted R<sup>2</sup> value obtained was 0.804 with a P-value of 0.008 (< 0.01) significant levels. Therefore, the null hypothesis which states that "Ho: there is no significant

relationship between the quarrying activities and the local vegetation cover" is rejected. Consequently, the alternative is accepted.

**Table 1.3: Regression Model of Quarrying Activities and Local vegetation Cover**

Coefficients(a)								
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta	Lower Bound	Upper Bound	B	Std. Error
1	(Constant)	5.619	3.282		1.712	.162	-3.494	14.733
	Local vegetation cover	74.027	15.969	.918	4.636	.010	29.689	118.364

a Dependent Variable: Quarrying Activity

P<0.05 (significant at the 0.5 level).

Source: Researcher's SPSS Computation, 2016

Furthermore, the output results from the regression analysis clarify the fact that there is a very significant relationship between the quarrying of aggregates and local vegetation cover in the study area. The result of the simple regression analysis indicated that R is 0.918,  $R^2$  is 0.843 and the adjusted  $R_2$  is 0.804, the standard error of the estimate associated with the model is 5.56594. The total sum of squares is 63.339 of the value; the sum of squares associated with regression is 15.257, while that associated with the residual is 6.318. The F value is 0.010 and the associated p-value is 0.000 ( $<0.01$ ).

This is an indication that there is a high association between quarrying activities and vegetation cover of the area. Hence, the resulting equation is as follows:

$$\text{Quarrying activities} = 5.619 + 0.918 \times \text{vegetation cover} + 3.282$$

With R 0.843, it means that 84.3 per cent of the local vegetation cover was explained by the model. This follows that there is a significant relationship between extraction of rocks and the loss of vegetation cover in Ebonyi State. This explains why the quarrying areas and communities are littered with open spaces in the ground filled with water, destroyed lands with heaps of rock wastes, overburden that cannot be easily disposed off. The landscape of the area is covered with water ponds, heaps of quarry remains and widespread erosion in the area (See plates 1,2 and 3).



**Plate 1:** Quarry with large de-vegetated area at Ezzagu in Izzi LGA

**Source:** Photographed by Author, 2016





**Plate 2:** Quarry showing destroyed landform, landscape and erosion menace at Okposi Community. **Source:** Photographed by Author, 2016



**Plate 3:** The quarry pit at Akpoha, Juilus Berger filled with stagnant water that can endanger human and animal life. **Source:** Photographed by Author, 2016

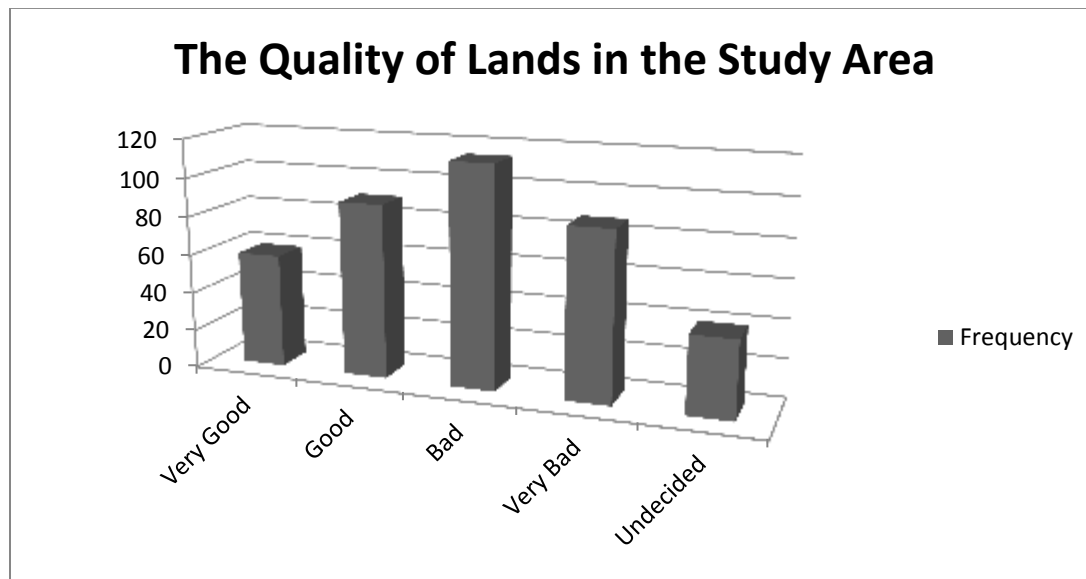
The study also sought for the perception of respondents regarding the quality of lands. Table 1.4 below, shows that 59 respondents, representing 15% indicated that the lands are in very good condition, 90 respondents representing 23% accepted that the lands are in good condition. Also, 114 respondents and 87

respondents which represented 29% and 22% respectively indicated that the lands are bad and in very bad conditions. However, 40 respondents, representing 10% indicated that they were not certain of the condition of the lands (See Fig.7 below).

**Table 1.4. The Quality of Lands in the Study Area**

Responses	Frequency	Percentage (%)
Very good	59	15
Good	90	23
Bad	114	29
Very bad	87	22
Undecided	40	10
Total	390	100

Source: Researcher's Fieldwork, 2016



**Fig.7: Showing the Quality of Lands in Study Area**

Source: Researcher's Fieldwork, 2016.

Undoubtedly, it is shown that unguarded quarrying practices in the study area have gravely affected the arable lands, vegetation and biodiversity. Reviewed works on quarrying activities by George et al, (2011) and Minerals Commission, (2001) to mention a few, studied in other areas also confirmed the fact, that stone quarrying has a destruction effect on the environment without future plans of restoration.

Reports from the media also confirm to the prevailing situation. Daily African (2013) reported that the Nigerian senate committee on environment have threatened to shut down the five stone quarrying companies operational at Mpape, a suburb of Abuja in Nigeria, for none compliance with environmental

safety laws. They threatened shutting down the quarrying operations of Hongyum company limited and also threatened the revocation of the license of Perfect Stone quarry.

Also, Daily Independent (2013) reported that in Cross River State fifteen (15) quarries were shut down as a result of non-compliance to the State policies and illegal operation. This is because they did not operate within the constituted laws guiding the sector. As part of measures to enforce the laws, the Perfect Stone quarry was denied of explosive renewal as a result of poor safety precautions and operations of the Hongyum quarry there was no renewal for further operations for the next five years

as everything about their activities proved environmentally wrong.

Considering, a similar situation was also voiced out by the youth leaders interviewed at Ohaechara, Opi in Amasiri who complained bitterly. It was observed that three quarry companies namely SG mineral, Global Lopet and Santoko Rock were shut by the villagers due to their loss of farmlands and forests, pollution of their rivers and disappearance of wild animals used for hunting and livelihood without considerable compensation.

Findings also showed that the lack of enforcement of bye-laws and guidelines for quarrying operations gave the companies and contractors the freedom to open and abandon quarries haphazardly without considering the proximity of the quarries to communities and their lands.

Previous similar incidences also concur with this research findings as Daily Times (2011) noted that Ebonyi State losses fifty million naira annually to fraudsters involved in illegal activities at the quarry site located in Umuogharu in Ezza North L.G.A. Some of the companies claimed to have obtained licenses from the government to carry out these excavations but this claim was denied by local authorities and community leaders. Also, in Ohaechara village in Opi community of Amasiri in Afikpo North Local Government Area, indigenes have sued the Conrock Company owned by Lebanese for exploiting their quarry stones without concrete agreement and license from the government (Premium Times, 2013).

#### 4. CONCLUSION AND RECOMMENDATION

It is necessary that companies and private miners must meet the required standards of the law which is centered on environmental compliance, royalty payments, employment of citizens, proper preservation/storage of quarrying explosives, provisions of a conducive working environment as well as meeting community social responsibility among others. The consequence being that when the resources have been depleted from the quarry pits, they are either abandoned or used as solid waste dump sites (Akanwa et al, 2011). This warrants the need to enforce the laws on quarrying operations mostly on the issue of restoration of depleted lands and vegetative areas. Owing to the fact that the present events in the study area portray that these problems are aggravated by the fact that the quarry operators do not comply with the existing environmental laws.

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