

### *Full Length Research paper*

# Perceived Effects of Quarry Activities on Arable Crop Production in Calabar Agricultural Zone, Cross River State, Nigeria

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Quarry activities are important to modern day life and the socio-economic development of local communities. However, their effects on agriculture are serious and remain unabated. This study examined the perceived effects of quarry activities on arable crop production in the Calabar agricultural zone, Cross River State, Nigeria. A multistage sampling technique was used to select 120 household heads. Quantitative data were collected using structured questionnaires and were analyzed using descriptive statistics. Majority (94.2%) of farmers identified marble and granite extractions as main types of quarry activities practiced. Two most severely perceived effects of quarry activities on crop production were: pollutants from quarry activities affecting yields of crops (Mean Score {MS}: 4.42), and particulate matter released

during quarry activities makes vegetables unattractive (MS: 3.97). Significant effects of quarry activities on the health of farmers were: prevalence of cough/catarrh (MS: 4.88), asthma (MS: 3.83), and respiratory diseases (MS: 3.67). Use of face masks to protect nostrils when farming (MS: 4.42), planting early maturing crops (MS: 4.32) and diversification of farm enterprise (MS: 4.03) were the first three coping strategies adopted by farmers. The study recommended that quarry industries should provide funds for reclaiming damaged arable lands and free medical check-up to farmers.

**Keywords:** Quarry activities, arable crop production, coping strategies

## INTRODUCTION

Agriculture remains one of the key strategies to rural poverty reduction not only in Nigeria but in developing countries at large (Thompson and Agbugba, 2013). According to Shanta *et al.* (2017), close to two-thirds of the world's poor live in the rural areas of these countries and depend on subsistence farming and other natural resources for their livelihood. However, due to the decline in agricultural output over the years as a result of challenges such as climate change and postharvest losses, the reliance solely on agriculture as a source of livelihood is no longer tenable (Ming'ate and Mohamed, 2016). As a result, more than 500 million people in developing countries have been compelled to engage in non-farm activities such as surface mining (to a small extent) and quarrying to enhance their standard of living

(Wang *et al.*, 2010). The difference between mining and quarrying is that quarrying extracts non-metallic rocks and aggregates while mining excavates the site for metallic mineral deposits (Lameed and Ayodele, 2010).

Quarry is defined by Keeperman, (2000) as an act of exploring and exploiting rocks from the earth's crust. Nwachukwu *et al.* (2018), on their part defined it as a land use method that engages in the extraction of non-fuel and non-metal minerals from rocks. The resulting products emanating from quarry activities are sandstones, lime-stone, perlite, marble, ironstone, slate, granite, rock salt and phosphate rock. These products serve as raw materials for rail, road, building, and other industrial and civil constructions. Some of these products are also used for making ceramic tiles and traditional hard

floors (Lameed and Ayodele, 2010). Quarry is also a significant promoter of local socio-economic development; it enhances trade and internal revenue generation, and provides job opportunities for the poor residing in the quarry regions (Eshiwani, 2014).

Though quarry activities are important to modern day life and development, these activities are known to have negative environmental and health effects. According to Oyegbile *et al.* (2017), some of the negative effects of quarry activities on the environment include: air, water and soil pollution, poor human and animal health, poor crop yields, and damage to buildings. Nwachukwu *et al.* (2018) opined that when quarry activities such as exploration, blasting, transportation and disposal of waste rocks are employed, the resultant effect is the destruction of vegetation and natural habitats, and the release of dust particles in the air leading to air pollution. With respect to the natural drainage systems, quarry activities cause soil erosion and river silting leading to subsequent damage of arable lands. The noise and vibrations emanating from quarry activities can form micro cracks that may eventually become mega cracks with time, leading to landslides and the collapse of nearby structures such as dams, buildings, bridges etc. Quarry activities are well known to cause loss of farm land, threaten underground and surface water thereby impairing directly the environmental quality and ecosystems (Naik and Somashekar, 2006; Omosanya and Ajibade, 2011; Ming'ate and Mohamed, 2016). A study by Bewiadzi *et al.* (2018) showed that quarry activities contributed to land degradation, erosion, destruction of forests, arable lands, loss of habitat for some animals and plant species. Anand, (2006) posited that damage of biodiversity is one of the principal negative impacts of quarry activities as vegetation is cleared in order to expose rocks. According to Anand, (2006), the negative effect of air pollution on plants causes necrosis or dead areas on the leaf structure; chlorosis which is the loss or reduction of chlorophyll leading to yellowing of plant leaf; epinasty or the downward curvature of the leaf due to higher rate of growth on the upper surface; and abscission or premature fall of leaves. According to Eshiwani (2014), the results of studies conducted by Adekoya, (2003) and Aigbedion, (2005) on farms within a close radius to quarries showed a decline in crop outputs and these declines were attributed to dust pollution on crop leaves and flowers which disrupted the process of photosynthesis leading to reduction in crop yields. Socially, quarry activities may lead to displacement of communities as a result of landslides, destruction of cultural sites and conflicts between the quarry operators and host communities.

In the Calabar agricultural zone of Cross River State, the extraction of quarry products is an economically important and widespread activity located mainly in the Akamkpa block of the agricultural zone where it has existed since historical times. Limestone deposits in the

area have attracted the establishment of the United Cement Industry (UNICEM) of Nigeria, which is one of the leading cement companies in the country to the area. There are other quarry industries operating in the area some of which are Julius Berger Nig. Ltd.; Raymond Construction Company (R.C.C) Nig. Ltd.; Expanded Nig. Ltd, Wing of Heaven Nig. Ltd.; Star Advantage Nig. Ltd; Two Brothers Nig. Ltd.; and Saturn Nig. Ltd (Ogbiji and Ogbiji, 2016). However, in spite of the remarkable contribution of these quarry activities towards the economic development of the agricultural zone and the state at large, the adverse effects of quarry activities on arable crop production which is the main source of livelihood in the area has remained a cause for concern. The study therefore examined the perceived effects of quarry activities on arable crop production in the Calabar agricultural zone, Cross River State, Nigeria. Specifically, the study sought to identify the types of quarry activities practiced in the study area, ascertain the perceived effects of quarry activities on arable crop production; assess the perceived effects of quarry activities on the health of arable crop farmers; and identify the coping strategies adopted by farmers to curb the adverse effects on arable crop production.

## MATERIALS AND METHODS

The study was carried out in Cross River State, which is a coastal state situated in the South-South geopolitical zone of Nigeria. The state is made up of three agricultural zones namely: Ogoja, Ikom and Calabar. The Calabar agricultural zone comprises seven blocks as follows: Bakassi, Akampa, Biase, Calabar South, Odukpani, Akpabuyo, and Calabar Municipal. A multi-stage sampling technique was adopted to select the respondents for the study. In the first stage, purposive sampling was used to select the Akamkpa block due to the presence of the highest number of quarries (36 quarry sites) in the state. In the second stage, purposive sampling technique was employed to select four (4) cells (Oban, Awi, Eku and Mbarakom) out of the ten (10) cells that make up the block because of the presence of functioning quarry sites in these areas. A list containing registered number of arable crop farming households was obtained from the Cross River Agricultural Development Programme (CRADP) and it showed that there were 1276 registered arable crop farming households in the selected cells. In the third stage, simple random sampling was used to select ten (10) percent of household heads in each of the selected cells to constitute the sample size. This gave a total of 120 arable crop farmers. A set of structured questionnaires was used to elicit primary data from the farmers. Descriptive statistics such as frequencies, percentages, means, and ranking were used to analyze the data. In order to ascertain the perceived effects of quarry activities on arable crop yields, a five point likert

scale was used with response categories of Strongly Agreed (SA), Agree (A), Undecided (U), Disagree (D) & Strongly Disagree (SD) and with values 5, 4, 3, 2 and 1 respectively assigned to them. These values were summed up and divided by 5 to obtain the mean score (MS) value of 3. Any factor with mean score  $\geq 3$  was considered to have a severe effect on crop yields; while any factor with mean score  $< 3$  was considered to have a less severe effect. A similar procedure was used to assess the perceived effects of quarry activities on the health of the farmers as well as to identify the coping strategies adopted by farmers to curb these adverse effects.

## RESULTS AND DISCUSSION

### Types of quarry activities practiced

Table 1 presents the type of quarry activities practiced in the area. The results showed that the main types of quarry activities practiced in the area which respondents were aware of are: marble and granite extraction (94.2%), extraction of limestone and milling (93.3%), and limestone extraction only (84.2%). From the (Table 1) it can be inferred that all the listed quarry activities are practiced in the study area but the level of awareness of the specific quarry activities carried out by the quarry companies varies among respondents.

**Table 1.** Types of quarry activities practiced

Types of activities	Frequency
Marble extraction only	25 (20.8%)
Marble and granite extraction	113 (94.2%)
Milling of marble only	96 (80%)
Limestone extraction only	101 (84.2%)
Extraction of limestone and milling	112 (93.3%)
Milling of limestone only	93 (77.5%)
Feldspar extraction only	78 (65%)
Extraction of feldspar and milling	91 (75.8%)
Milling of feldspar only	43 (35.8%)

Source: Field survey, 2017, Note: Figures in parentheses represent percent.

### Perceived effects of quarry activities on arable crop production

The perceived effects of quarry activities on the yields of arable crops are presented in (Table 2). From the results, a mean score value of 3.00 was used to determine how serious the perceived effect was on crop production.

The results revealed that the most perceived effects of quarry activities on arable crop production are; pollutants from quarry activities affect yields of crop (4.42), particulate matter released during quarry activities makes vegetables unattractive (3.97), there are changes in the soil composition leading to soil infertility (3.73), it causes degradation of land/soil cover (3.73), it alters the quantity of sunlight received by plants (3.38), contaminants cause stunted growth/alteration in plant physiological and biochemical composition (3.33), there is high risk of crop failure each year (3.28), it has caused some farmers to abandon farm lands in search of other livelihood activities (3.18), and the amount of income derived from arable crop production has reduced drastically (3.15). The results of this study go to support the findings made by Adekoya, (2003) and Aigbedion, (2005) who discovered that yields of crops planted on farms within a close radius of quarries tend to decline. This they attributed to dust that settle on crop leaves and flowers, hindering the process of photosynthesis leading to decline in crop yields. Bamgbose *et al.* (2014) also concluded that dust from quarry activities covered up leaf surfaces, altered photosynthesis, decreased crop yields and reduced income derived from farming.

### Perceived effects of quarry activities on the health of arable crop farmers

The perceived effect of quarry activities on the health of arable crop farmers is presented in (Table 3). A mean score value of 3.00 was used as a benchmark to rank items which described the perceived effects of quarry activities on farmers' health. A mean score of 3.00 and above indicated a severe effect on farmers' health, while a mean score of less than 3.00 was considered to have a less severe effect on farmers' health. Results show that the severe effects were; prevalence of cough/catarrh (4.88), asthma (3.83), respiratory diseases e.g. nasal infection, sinusitis or allergies and irritations of sinusitis by dust particles and chemicals (3.67), skin rashes (3.28), and eye problems due to dust particles (3.23). On the other hand, the less severe effects were; heart diseases (2.93), skin cancer (2.83) and diarrhea (2.03). This finding corroborates that of Bamgbose *et al.* (2014) who stated that farmers are plagued by ailments like cough, eye problem and other irritations arising from dust from quarry sites. A study by Oyinloye and Olofinyo, (2017) also identified eye disease (eye irritation) and respiratory disease (cough, catarrh) as the most common diseases among respondents living around quarry areas.

### Coping strategies adopted by farmers to curb the adverse effects of quarry activities on arable crop production

The results of the coping strategies adopted by the

**Table 2.** Perceived effects of quarry activities on arable crop production.

Perceived effects	SA	A	UD	D	SD	cum	MS	rank
Pollutants from quarry activities affect yields of crop	50(250)	42(168)	26(108)	2(4)	-	530	4.42	1 <sup>st</sup>
Changes in soil composition thereby leading to soil infertility	25(125)	42(168)	48(144)	5(10)	-	447	3.73	3 <sup>rd</sup>
It causes degradation of land/soil cover	14(70)	64(256)	39(117)	2(4)	1	448	3.73	3 <sup>rd</sup>
Contaminants cause stunted growth/alteration in plant physiological and biochemical composition	10(50)	32(128)	68(204)	8(16)	2	400	3.33	6 <sup>th</sup>
It has caused some farmers to abandon farm lands in search of other livelihood activities	10(50)	26(104)	62(186)	20(40)	2	382	3.18	7 <sup>th</sup>
There is high risk of crop failure each year	14(70)	29(116)	56(168)	18(36)	3	393	3.28	8 <sup>th</sup>
Particulate matter released during quarry activities makes vegetables unattractive	58(290)	26(104)	18(54)	10(20)	8	476	3.97	2 <sup>nd</sup>
The amount of income derived from arable crop production has reduced drastically	16(80)	27(108)	52(156)	9(18)	16	378	3.15	9 <sup>th</sup>
It alters the quantity of sunlight received by plants	19(95)	35(140)	49(147)	6(12)	11	405	3.38	5 <sup>th</sup>

Source: field survey, 2017

Note: SA = Strongly Agreed, A= Agree, U = Undecided, D = Disagree, SD = Strongly Disagree, cum = Cumulative score, MS = Mean score, \*Numbers in parentheses represent scores by respondents per respond category, \*the number of respondents is 120.

**Table 3.** Perceived effects of quarry activities on the health of arable crop farmers

Perceived effects	SA	A	UD	D	SD	cum	MS	rank
Eye problems due to dust particles	13(65)	13(52)	82(246)	12(24)	- 0	387	3.23	5 <sup>th</sup>
Respiratory diseases e.g. nasal infection, sinuses or allergies and irritations of sinuses by dust particles and chemical	4(20)	75(300)	38(114)	3(6)	0	440	3.67	3 <sup>rd</sup>
Diarrhea or gastro-intestinal infection	5(25)	5(20)	20(60)	48(96)	42	243	2.03	8 <sup>th</sup>
Skin itches/rashes or fungal dermatitis	8(40)	16(64)	81(243)	14(28)	1	376	3.13	4 <sup>th</sup>
Heart diseases	3(15)	8(32)	90(270)	16(32)	3	352	2.93	6 <sup>th</sup>
Cough/catarrh/sore throat	107(535)	11(44)	2(6)	-	-	585	4.88	1 <sup>st</sup>
Skin cancer	4(20)	8(32)	79(237)	21(42)	8	339	2.83	7 <sup>th</sup>
Asthma	11(55)	33(132)	67(201)	9(18)	-	406	3.83	2 <sup>nd</sup>

Source: field survey, 2017

Note: SA = Strongly Agreed, A= Agree, U = Undecided, D = Disagree, SD = Strongly Disagree, cum = Cumulative score, MS = Mean score, \*Numbers in parentheses represent scores by respondents per respond category, \*the number of respondents is 120

farmers to curb the adverse effects of quarry activities on arable crop production are presented in (Table 4).

A mean score value of 3.00 was used as a cut-off to ascertain significant coping strategies used by farmers.

**Table 4.** Coping strategies adopted by farmers to curb the adverse effects of quarry activities on arable crop production.

Coping strategies	SA	A	UD	D	SD	cum	MS	rank
Planting early maturing crops	56(280)	50(200)	12(36)	-	2	518	4.32	2 <sup>nd</sup>
Adoption of hardy or resistant crop varieties	18(90)	45(180)	42(126)	13(26)	2	424	3.53	11 <sup>th</sup>
Farm enterprise diversification	34(170)	64(256)	14(42)	7(14)	1	483	4.03	3 <sup>rd</sup>
Changing planting dates	35(175)	55(220)	25(75)	4(8)	1	479	3.99	5 <sup>th</sup>
Changing harvesting dates	29(145)	52(208)	23(69)	14(28)	2	452	3.77	8 <sup>th</sup>
Multiple cropping	29(145)	53(212)	15(45)	17(34)	6	442	3.68	10 <sup>th</sup>
Intercropping	37(185)	53(212)	18(54)	5(10)	7	468	3.90	6 <sup>th</sup>
Movement to different farm sites	13(65)	56(224)	32(96)	9(18)	10	413	3.44	12 <sup>th</sup>
Formation of pressure groups to enforce compliance with government laws on quarry activities	29(145)	51(204)	32(96)	5(10)	3	458	3.82	7 <sup>th</sup>
Use of traditional methods to treat ailments from quarry activities.	27(135)	54(216)	23(69)	14(28)	2	450	3.75	9 <sup>th</sup>
Reduction of number of farming days	56(280)	23(92)	30(90)	9(18)	2	482	4.02	4 <sup>th</sup>
Using face masks to protect the nostrils while farming	64(320)	45(180)	8(24)	3(6)	-	530	4.42	1 <sup>st</sup>
Going for regular medical check ups	55(275)	26(104)	25(75)	10(20)	4	478	3.98	6 <sup>th</sup>

Source: field survey, 2017

Note: SA = Strongly Agreed, A= Agree, U = Undecided, D = Disagree, SD = Strongly Disagree, cum = Cumulative score, MS = Mean score,\*Numbers in parentheses represent scores by respondents per respond category,\*the number of respondents is 120.

Results obtained revealed respondents had adopted various strategies to curb the negative effects of quarry activities. These coping strategies were ranked as follows: using face masks to protect the nostrils while farming (4.42), planting of early maturing crops (4.32), practicing farm enterprise diversification (4.03), reduction of number of farming days (4.02), changing in planting dates (3.99), intercropping (3.90), formation of pressure groups to enforce compliance with government laws on quarry activities (3.82), changing harvesting dates (3.77), use of traditional methods to treat ailments from quarry activities (3.75), multiple cropping (3.68), adoption of hardy or resistant crop varieties (3.53), and movement to different farm sites (3.44). The finding is in line with that of Nyong *et al.* (2007), Awotodunbo, (2012) and Farauta *et al.* (2012). In their studies, changes in planting/harvesting dates, multiple cropping, intensive manure application, intercropping, expansion of cultivated land area, movement to different farm sites, mixed farming, planting of early maturing crops, use of chemicals, use of resistant varieties, processing to minimize post-harvest losses were the coping strategies adopted by farmers to reduce the adverse effects of quarry

activities.

## Conclusion

Dealing with the inherent issues of quarry activities on arable crop production is a serious issue that remains unabated. This paper examined the effects of quarry activities on arable crop production in the Calabar agricultural zone, Cross River State. The paper concludes that quarry activities affect arable crop production in diverse ways. It reduces crop yield, decreases income derived from arable crop farming, depletes land available for arable farming and poses so many health challenges to farmers. In spite of the challenges posed, farmers have devised ways of coping in order to continue making a living from arable crop production.

## Recommendations

Based on the findings, the study recommended that:  
(a) Quarry industries should provide funds for reclaiming

damaged arable lands and that host communities should be involved in monitoring the land reclamation process.

(b) Quarry industries in the study area should be mandated backed by legislation to collaborate with qualified health personnel to administer free medical check-ups to farmers as part of their corporate social responsibility so as to address some of the health problems encountered due to their activities.

(c) Health facilities, particularly those that belong to quarry companies should also be made accessible to farmers at affordable charges.

### Authors' Declaration

We declared that this study is an original research that was carried out by our research team and we agree to publish it in the journal.

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