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Impact of Quarrying Activities on the Surrounding Vegetation in Ogun State, Nigeria

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Abstract

Quarrying of rock for construction purposes is a significant industry in any economy but has its negative impact. This study examined the impact of quarry activities on surrounding vegetation in Ogun State. Geographic Information System approach was used to map the various quarry locations present in different Local Government Areas in Ogun State; of which eight sites were selected namely Isara, Idode, Iwaye, Ogbere, Ilagbe, Adelokun Baaki Ake and Igodo. Vegetation composition analyses were carried out on the eight sites using Haga Ultimeter and chlorophyll content analysis. Data were subjected to descriptive and inferential statistics using SAS package (9.4 version). Sixty quarries were identified with Odeda Local Government Area (38.3%) having the highest percentage of quarry. The vegetative compositions analyses showed that *Albizia zygia* had the highest frequency (7) among identified plants in the quarries. The chlorophyll content of *Albizia zygia* in the wet season (492.2 mg Chl/m^2) was significantly higher than dry season (464.4 mg Chl/m^2) in all locations. However, Baaki Ake (*Albizia zygia*) chlorophyll content was highest among other locations in both seasons. In conclusion *Albizia zygia* showed highest resistance to quarry activities, hence common among other plants identified around the quarries.

Key Words: surrounding, rock, exploration, effect, vegetation

Introduction

The green plants especially, by virtue of their photosynthetic activities occupy an important position in the existence of life because of their ability to maintain a balance in the volume of Oxygen and Carbon dioxide which leads to the purification of the environment (Wang 2007). They supply man with food, drugs, fibres, fuel, building and other raw materials and serve as ornamentals. Plants, by virtue of their activities, influence and determine the type of fauna to be expected. However, any change or tilt in their composition affects the animal life in terms of food, shelter, security and comfort. Such vegetation changes are the main concern of environmental botanists and ecologists in recent years who have advocated the careful and cautious approach to activities promoting such changes (Nyapala and kamwele 2015).

However, the expansion of human population and the unfolding human's horizon to exploit resources for economic and other purposes tend to destroy such indigenous resources (plants) and can even put some species into extinction. Air pollution, especially dust from quarry sites are known to be responsible for vegetation injury, crop yield loss and a threat to the survival of plants in industrial areas (Iqbal and Shafig 2001; Kuzu et al. 2011). Air pollution is not only adversative to respiratory system, it can also have

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negative effects on the surrounding plants by blocking and damaging their internal structures, the abrasion of leaves and cuticles, and exerting chemical effects which may affect their long-term survival (Guach 1999). Dust from quarrying has been reported to stall the growth and flowering of crops, because it settles on surfaces of leaves thereby interfering with the normal photosynthetic and other exchanges that take place at the leaf and atmosphere interface (Madhaven and Sanjay 2005; Bamgbose et al. 2014). Dust fall and rock remains do not only contaminate the soil for agricultural practices but also hinder the plant leaf functions thereby reducing the chlorophyll content, impairing carbon oxide exchange, and ultimately photosynthesis rate. The damage caused to plants by pollution include necrosis (dead areas on leaf structure), chlorosis (loss or reduction of chlorophyll leading to yellowing of leaf), epinasty (downward curvature of the leaf due to higher rate of growth on the upper surface), and abscission of leaves (premature fall). This will no doubt affect the physiological activities of the plants (photosynthesis and respiration) most especially those around the quarry sites. The implication of these is that some of the plants may have retarded growth, while others may be eliminated (Lameed and Ayodele 2010; Ogbonaya and Phi-Eze 2020). No doubt, the exploitation of solid minerals such as granite has caused a lot of damage to the vegetation; because quarrying of this rock involves large scale activities of heavy machines and explosives; besides, such sites are abandoned without rehabilitation and restoration of the damaged land after quarrying that would in turn destroy the vegetation around them. Hence, changing the floristic composition in the concerned area (Ndace and Danladi 2012; Akanwa et al. 2017).

Likewise, it was observed that the forest vegetations were at the verge of being displaced (Lameed and Ayodele 2010). However, most of the plants that cannot withstand the pressure from quarry activities are waiting for environmental signals such as the structure of the land, disturbance of the remaining forest ecosystem, and interruption in their foods from the soil due to quarry activity before going to extinction (Lameed and Ayodele 2010). Akanwa et al. (2017), IUCN (2004) asserted that nature has provided wildlife and biodiversity with certain form of habitats but quarrying has greatly change it. The study area (Ogun state) is naturally a rainforest vegetation but human activities, most importantly quarry activities have reduced most part to a secondary forest. Hence, prompted this study; the impact of quarrying activities on the surrounding vegetation in Ogun State.

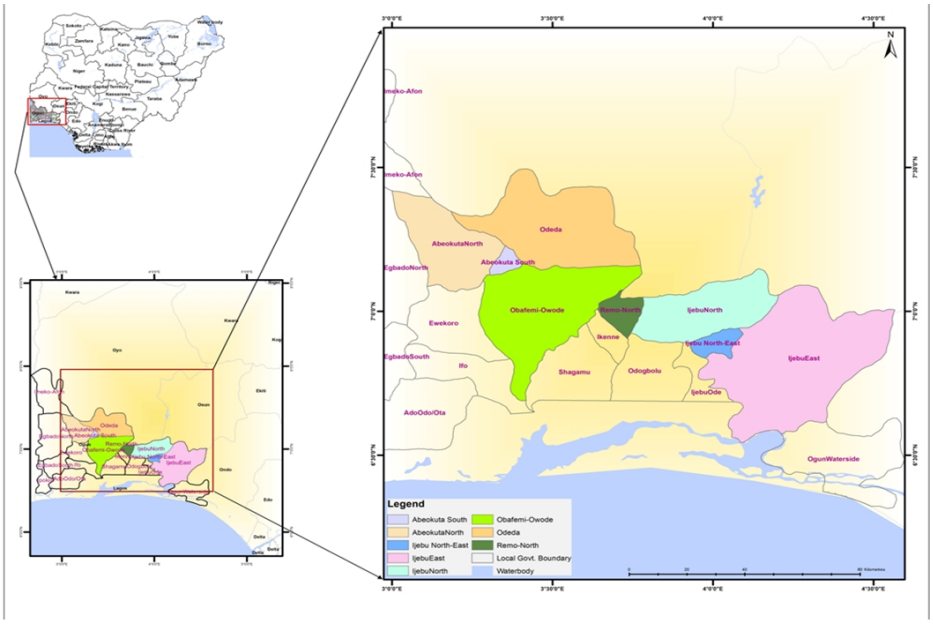

Fig. 1. Map of quarry sites local government areas in ogun state.

Materials and Methods

Study area

Quarrying is a very old industry in Nigeria and it is technologically simple. It is a small scale among other mineral extraction industries. However, there is a widespread distribution of quarry materials; particularly granite in Ogun state that cut across eight Local Government Areas (LGA) within three divisions of ethnic and cultural line namely, Egba, Ijebu and Remo. Ogun State lies between latitude 7.9031 and 6.3142° N to longitude 2.7073 and 4.5750° E. Ogun State covers a geographical area of 16,980.55 square kilometres with a population of about 3,751,140 (NPC 2006).The state is a rain forest and enjoys a tropical climate with distinct wet and dry seasons. Wet season in Ogun State lasts between seven and eight months; (April to October) and the dry season running through November to February (Hassan 2022). Fig. 1 shows the locations of quarry sites in the Local Government Areas of Ogun state.

Sample collection

Inventory of quarry sites

Identification of all quarry sites in Ogun State was carried out with Geographical Positioning System (GPS) between November, 2015 and July, 2017. Coordinates of each quarry site were taken and categorisation of those quarries, in term of status and sizes also carried out.

- The sizes were based on their landmass in square kilometre (km^2); any quarry less than 2 km^2 were classified as small; above 2 km^2 were classified as big quarry
- Number of crushers: less than two was small; more than two or at least two crushers used simultaneously was classified as big.
- Tonnes of granite produced per week; below 500,000 tonnes is classified as small and above that as big.

The status was based on whether the quarries are still in operation or not. However, a locational map of all quarries was produced (Fig. 2).

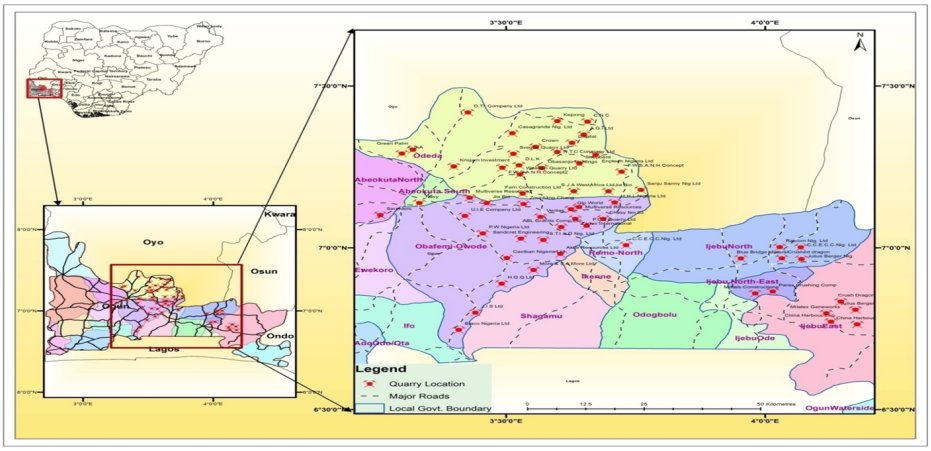

Fig. 2. Distribution of quarrying sites in local government areas.

Table 1. Selected quarry sites in Ogun State

Local government area	Locality or village	Industry	Long (E)°	Lat (N)°
Ijebu east	Ogbere	Julius Berger	3.557	6.889
Ijebu north east	Iwaye	Paras	3.631	7.175
Ijebu north	Idode	CCECC	3.4230	7.138
Remo north	Isara	CCECC	3.534	7.155
Odeda L.G	Igodo	F.W.S.AN.H.Concept 2	3.492	6.931
Odeda L.G	Ilagbe	DLK	3.553	6.931
Obafemi/Owode	Baaki ake	Blaco	3.625	7.119
Obafemi/Owode	Adelokun	Zanex	4.070	6.965

Sampling techniques

Purposive sampling method was used to select eight (8) quarry locations in the study area. Sampling was carried out in eight (8) selected locations communities due to their closeness (500-1,000 m) to the quarry sites in all six Local Government Areas. Two (2) locations were selected from each of Odeda and Obafemi/Owode Local Government Areas due to higher number of quarry sites present in them. One location was sampled from each of the remaining four (4) Local Government Areas. Sample locations in each Local Government Area are presented in Table 1. The following activities were carried out on the above listed quarry sites e.g vegetation composition and chlorophyll determination.

Vegetation sampling and analysis

Line transect method was used for the vegetation study in November, 2015 and July, 2016. The length of transect used was 100 m. A line transect of 100 m was cut, any plant with ≥5 cm dbh (diameter breast height) found along transect was identified and recorded. Coordinates of the each plot where the Line transect stretched were also taken. The followings were carried out on the plot (along the line transect) plants with ≥5 cm dbh were identified and classified into trees or shrubs based on their height, using forester pistol (Haga ultimeter) to measure the height.

The scale of 15 m was chosen to take measurement of the height of the plant on the Haga ultimeter; the observer stood at 15 m distance from the base of the tree accordingly as chosen in the scale on the instrument. The release button was pressed to move the needle freely. Through peep hole and object hole the base of the tree was seen and after a little while, when the needle had stopped moving, the stop button was pressed to arrest the needle permanently. The reading was seen on the 15 m scale, (on right side of zero) and recorded. Similarly, tip of the tree was seen and needle was brought to a rest. Also, reading is noted on the left side of zero. Thus the total height of tree was calculated by the addition of the value of the base and the tip of the tree recorded from Haga ultimeter. However; the following classifications were carried out on the plants with ≥5 cm dbh found along the transect line;

The plants below 18 m were classified as shrubs and those above 18 m were classified as trees.

Economic species and non-economic species

Species and families

A total of thirty (30) plants were identified and named in the herbarium laboratory of Forestry and Wildlife Management Department of Federal University of Agriculture, Abeokuta, Ogun State. With reference number: uaha: 016/001, 002.

Chlorophyll sampling

Three leaves of the plant with highest frequency of vegetative composition around each quarry site were plucked from three different plant so as to determine the chlorophyll content of the plants. The means and standard deviation of each three samples per location were calculated

Determination of chlorophyll

One gram of finely cut fresh leaves were taken and grounded with 20-40 mL of 80% acetone. It was then centrifuged at 5,000-10,000 rpm for 5 mins. The supernatant was transferred and the procedure was repeated till the residue become colourless. The absorbance of the solution was recorded at 645 nm and 663 nm against the solvent blank (Rajalakshmi and Banu 2015).

The concentrations of chlorophyll *a*, chlorophyll *b* and total chlorophyll were calculated using the following equation:

Total Chlorophyll: 20.2 (A645)+8.02 (A663) (i)

Chlorophyll a: 12.7 (A663)-4.68 (A645) (ii)

Chlorophyll b: 22.9 (A645)-4.68 (A663) (iii)

The Chlorophyll content was measured using the Non-destructive method involving the Red edge Chlorophyll Index based on the reflectance, R, in the edge 720-730 nm and near infrared 770-800 nm (Rajalakshmi and Banu 2015).

Data analysis

The inventory data were subjected to descriptive analysis (mode and percentage). Vegetation data were subjected to descriptive (mode and percentage) analysis and chlorophyll data were also subjected to descriptive (mean and standard deviation) and inferential analysis (T-test).

Table 2. Categorization of quarry

S/N.	Quarry name	Long (E)°	Lat (N)°	Quarry location	LGA	Funtionality	Size
1	A.G.I Ltd	3.25727	7.10122	Igbo Ora road	Odeda	Active	Small
2	ABL Granite Comp Ltd	3.26660	7.14436	Boruboru	Obafemi Owode	Active	Big
3	Akile Resources Ltd	3.64091	7.12627	Aberu- agba	Obafemi Owode	Closed down	Small
4	Blaco Nigeria Ltd	3.62519	7.11907	Baaki ake	Obafemi Owode	Active	Big
5	Blue Bridge Mineral	3.53384	7.13519	Okudu (Ago-iwoye)	Ijebu North	Active	Big
6	C.C.E.C.C.Nig. Ltd	3.42959	7.15479	Isara-Remo	Remo North	Active	Big
7	C.C.E.C.C.Nig. Ltd	3.46266	7.13813	Idode (Ago-iwoye)	Ijebu North	Active	Big
8	C.N.C	3.56635	7.09551	Itesi,Orile Ilugun	Odeda	Active	Small
9	C.S.A	3.68757	7.08926	Omo Ologede	Odeda	Active	Small
10	Capital	3.60643	7.06390	Olodo	Odeda	Active	Big
11	Casagrande Nig. Ltd	3.65545	7.06813	Ayoyo	Odeda	Closed down	Big
12	Caxtban Nigeria Ltd	3.70954	7.13996	Erunwon-Odamo	Obafemi Owode	Closed down	Big
13	Chesy fen ltd	3.63348	7.08926	Ijako Oya	Obafemi Owode	Active	Big
14	China Harbour Engineering company (Nig.) Ltd	3.42051	7.09855	Agbede,Ogbere	Ijebu East	Closed down	Big
15	Crown	3.60474	6.98108	Eye	Odeda	Active	Small
16	Crushed dragon 1	3.52868	7.02841	Ogbere	Ijebu East	Inactive	Small
17	Crushed dragon 2	3.57896	7.34257	Ago Iwoye	Ijebu North	Active	Big
18	D.L.K	3.55319	6.93122	Ilagbe	Odeda	Active	Small
19	Desroto Trust &Investment Company Ltd	3.50164	6.96840	Idi-Osan	Odeda	Inactive	Small
20	Enptech Nigeria Ltd	3.40867	6.74614	Omosanya	Odeda	Inactive	Small
21	F.W.S.A.N.H.Concept	3.44079	6.79938	Ilawo	Odeda	Closed down	Big
22	F.W.S.A.N.H.Concept2	3.49150	6.88896	Jagun (Igodo)	Odeda	Active	Big
23	Fam Construction Ltd	3.57178	7.02418	Banja	Odeda	Closed down	Small
24	Glo World	3.45516	7.04447	Mile 12	Obafemi Owode	Inactive	Big
25	Green Palm	3.65567	7.35346	Igbo Ora	Odeda	Active	Small
26	Higher Ground Quarries Ltd	3.29881	7.29124	Solomo	Obafemi Owode	Active	Big
27	H.H.L Nigeria Ltd	3.32020	7.30289	Apesin Eruwon	Obafemi Owode	Active	Big
28	Lab Integrated Services Ltd	3.65703	7.38982	Ijeun	Obafemi Owode	Active	Big
29	Jia Bio 1	3.62714	7.32455	Ijeun	Obafemi Owode	Active	Big
30	Jia Bio 2	3.64127	7.26068	Obele	Odeda	Close down	Small
31	Julius Berger Nig.	3.55681	7.31186	Oko -Eko, Ogbere	Ijebu East	Active	Big
32	Julius Berger Nig.	3.52498	7.25491	Ago Iwoye	Ijebu North	Active	Big
33	Kepxing	3.59896	7.39148	Ilawo Kaho Onigbogbo	Odeda	Active	Small
34	Krisjam Investment	3.72299	7.23508	Sokan	Odeda	Active	Small
35	Milatex Geneworks	3.56876	7.24661	Tigbori, Ogbere	Ijebu East	Closed down	Small
36	Mofals Constructions	3.67299	7.28722	Ipara-Oke (Ijebu ode)	Ijebu north east	Inactive	Small
37	More & S.A More Ltd	3.69753	7.17460	Idi-Osan	Obafemi Owode	Inactive	Small
38	Multiverse Resource2	3.53181	7.16744	Alagutan	Obafemi Owode	Active	Big
39	Multiverse Resources1	3.52667	7.22667	Oloparun	Obafemi Owode	Closed down	Big
40	New Technics Construction co. Ltd	3.76039	7.17890	Ayoyo	Odeda	Inactive	Small
41	Navy	3.49285	7.24768	Adigbe-abeokuta	Abeokuta South	Closed down	Small
42	Obasanjo Holdings	3.51211	7.35397	Odeda	Odeda	Inactive	Big
43	Prestige Chen Jun Quarry Ltd	3.59885	7.29588	Idi-Osan	Obafemi Owode	Active	Small
44	P.W Nigeria Ltd	3.42617	7.41843	Foke	Obafemi Owode	New	Big

Table 2. Continued

S/N.	Quarry name	Long (E)°	Lat (N)°	Quarry location	LGA	Funtionality	Size
45	Paras Crushing Company Limited	3.63068	7.17492	Iwaye	Ijebu North east	Active	Small
46	Ratcom Nig. Ltd. 1	3.95329	6.96707	Ago Iwoye	Ijebu North	Close down	Small
47	Ratcom Nig. Ltd. 2	3.95806	6.74107	Oko -Eko, Ogbere	Ijebu East	Active	Big
48	S.J.A WestAfrica Ltd	3.99467	6.75539	Efon	Odeda	Active	Big
49	Strong Tower Infastructure & Development Nig. Ltd	3.24839	7.02042	Layanran	Obafemi Owode	Active	Big
50	Sandcrete EngineeringNig. Ltd	3.73153	7.00816	Degbe	Obafemi Owode	Inactive	Small
51	Sanju Sanny Nig Ltd	4.12709	6.77149	Iyanju	Odeda	Inactive	Small
52	Saunders	4.15701	6.76269	Oke-Ata	Abeokuta North	Closed down	Small
53	Shepherd's Value Pack Company Limited	4.16964	6.79054	Arege	Odeda	Closed down	Small
54	Svegao Nig. Ltd	3.59689	7.38752	Sosun	Odeda	Active	Small
55	Unicontinental International Eng. Company Ltd	4.14335	6.79352	Ogbe	Obafemi Owode	Active	Big
56	Veritas	4.11795	6.79749	Omo Ologede	Obafemi Owode	Active	Big
57	Western Quarry Ltd	4.15174	6.81605	Kenta Logemo	Odeda	Active	Big
58	Zanex International Ltd	4.07007	6.96505	Adelokun	Obafemi Owode	Active	Big
59	Zhong Tai	3.46262	7.13813	Ago Iwoye	Ijebu North	Active	Big
60	Zouchling Chang	3.32516	7.12927	Abaru	Obafemi Owode	Active	Big

Field survey (2017).

Result and Discussion

Table 2 illustrates the number of quarry sites and their locations. This shows that the locations were relatively close, since they were all located in Ogun State, Nigeria.

The Table 2 also showed that 38.3% of the quarry sites were located in Odeda Local Government Area (LGA), 35.0% were located in Obafemi Owode LGA, 10.0% were located in Ijebu North LGA, 8.3% were located in Ijebu East LGA, while 1.7% each were located in Abeokuta North LGA, Remo North LGA and Abeokuta South LGA. However, Odeda LGA has the highest number of quarry sites among the LGAs sampled in Ogun State, Nigeria. Table 2 also indicates the functionality of quarry sites; about 61.6% of the quarry site in Ogun state were active, 21.7% were closed while 16.7% were inactive. However, the closed sites are the quarry sites that are no longer operational, because the granite there had been exhausted. Inactive sites simply mean that they were temporarily non-operational for one reason or the other; among these were government policy; management crises; economic situation of the country; such as fuel scarcity and lack of patronage. In case of government policy, Ogun state government was demanding royalty in 2014 from the quarry operators. The backlash of this move was a protest that led to the stoppage of operations in some quarry sites until the matter was resolved.

The status and size of quarry sites (Table 2) shows that 55.0% of the quarry sites studied were big, while 45.0% are small. This means that most of the quarry sites among the sampled ones were big. The activities of the big quarry sites on the locations where they were sited will most likely have impact on the overall result.

Fig. 2 shows that most quarry sites were clustered in Odeda and Obafemi-Owode LGAs of Ogun state. This signifies that the presence of geological material (granite) of commercial quantity and quality are present in these two LGAs. In terms of impact (either positive or negative), the two LGAs will benefit or suffer more than others in Ogun state.

Tables 3-10 show the total distance covered by the trees or shrubs species sampled on each plot or layout and were calculated as follow; the addition of the distance of each tree or shrub to the reference point give the total distance in meter covered by the trees or shrubs species sampled on each strip, plot or lay out. For instance, Ogbere; the total number of tree/shrub documented was 3, namely; black plum, West African rubber and silk plant. Hence their distances from reference point were=5+15+30=60 m on a 100 m line transect. However, they have the following diameter breast height (dbh) of 50, 28 and 34 m, and height of 8.5, 4.0 and 80.5 m respectively. Lameed and Ayodele (2010) asserted

Table 3. Trees found in Ogbere quarry site

S/N	Species name	Common name	Family name	Distance from reference point (m)	Dbh (cm)	Height (m)	Importance	Type
i.	*Vitex doniana*	Black plum	Lamiaceae	5	50	8.5	Economic	Shrub
ii.	*Funtumia elastic*	West African rubber	Apocynaceae	15	28	4	Economic	Shrub
iii.	*Albizia zygia*	Silk plant	Fabaceae	30	34	80.2	Economic	Tree

Dbh, diameter breast height.

Table 4. Trees found in Iwaye quarry site

S/N	Species name	Common name	Family name	Distance from reference point (m)	Dbh (cm)	Height (m)	Importance	Type
i.	*Funtumia elastica* (*Odan*)	West African rubber	Apocynaceae	2	8	2	Economic	Shrub
ii.	*Azadirachta indica* (*Dongoyaro*)	Neem plant	Meliaceae	3	26	6	Non-economic	Shrub
iii.	*Azadirachta indica*	Neem plant	Meliaceae	60	76	8	Non-economic	Shrub

Dbh, diameter breast height.

Table 5. Trees found in Idode quarry site

S/N	Species name	Common name	Family name	Distance from reference point (m)	Dbh (cm)	Height (m)	Importance	Type
i.	*Elaeis guineensis* (*Ope*)	African oil Palm	Arecaceae	2	56	10.5	Economic	Shrub
ii.	*Elaeis guineensis*	African oil Palm	Arecaceae	4	55	11.0	Economic	Shrub
iii.	*Elaeis guineensis*	African oil Palm	Arecaceae	20	60	11.0	Economic	Shrub
iv.	*Albizia zygia* (*Ayinre*)	Silk plant	Fabaceae	60	20	6.0	Economic	Shrub

Dbh, diameter breast height.

Table 6. Trees found in Isara quarry site

S/N	Species name	Common name	Family name	Distance from reference point (m)	Dbh (cm)	Height (m)	Importance	Type
i.	*Funtumia elastic*	West Africa rubber	Apocynaceae	3	58	6.0	Economic	Shrub
ii.	*Albizia zygia*	Silk plant	Fabaceae	5	24	7.5	Economic	Shrub
iii.	*Maranthes robusta* (*Awewe*)	Mahogany nut	Chysobalanceae	15	30	8.0	Economic	Shrub

Dbh, diameter breast height.

Table 7. Trees found in Igodo quarry site

S/N	Species name	Common name	Family name	Distance from reference point (m)	Dbh (cm)	Height (m)	Importance	Type
i.	*Spondia mombin*	Monbin plum or Hog plum	Anacardiaceae	13	55	12.0	Non-economic	Shrub
ii.	*Bridelia ferruginea*	Fula-pulaar (Guinea)	Euphorbiaceae	16	89	10.5	Non-economic	Shrub
iii.	*Albizia zygia*	Silk plant	Fabaceae	30	60	12.0	Economic	Shrub

Dbh, diameter breast height.

Table 8. Trees found in Ilagbe quarry site

S/N	Species name	Common name	Family name	Distance from reference point (m)	Dbh (cm)	Height (m)	Importance	Type
i.	*Albizia zygia*	Silk plant	Fabaceae	3	26	10.6	Economic	Shrub
ii.	*Elaeis guineensis*	African oil plam	Aracaceae	8	40	10.5	Economic	Shrub
iii.	*Azadiracta indica*	Neem plant	Meliaceae	60	125	8.0	Non-economic	Shrub

Dbh, diameter breast height.

Table 9. Trees found in Baaki Ake quarry site

S/N	Species name	Common name	Family Name	Distance from reference point (m)	Dbh (cm)	Height (m)	Importance	Type
i.	*Ceiba pentandra*	Kapok or cotton- like fluff	Bombacaceae	3	45	10	Economic	Shrub
ii.	*Newboldia laevis*	Plant of life	Bignonaceae	6	40	11	Non-economic	Shrub
iii.	*Newboldia laevis*	Plant of life	Bignonaceae	27	32	8	Non-economic	Shrub
iv .	*Cola acuminate*	Kola nut	Sterculiaceae	31	72	11	Economic	Shrub
v.	*Cola acuminata* (*Ewe obi*)	Kola nut	Sterculiaceae	41	26	11	Economic	Shrub
vi.	*Harrisonnia abyssinica*	Dragon blood plant	Rutaceae	51	44	12	Non-economic	Shrub
vii.	*Lonchocarpus cyanescens*	Dye plant	Leguminosae	64	13	6	Economic	Shrub
viii.	*Ficus sur* (*opoto*)	Broom cluster fig	Moraceae	83	15	12	Non-economic	Shrub

Dbh, diameter breast height.

Table 10. Trees found in Adelokun quarry site

S/N	Species name	Common name	Family name	Distance from reference point (m)	Dbh (cm)	Height (m)	Importance	Type
i.	*Bligha sapida* (*Ishin*)	Akee apple	Sapindaceae	10	13	6	Non-economic	Shrub
ii.	*Albizia zygia*	Silk plant	Fabaceae	62	17	8	Economic	Shrub
iii.	*Albizia zygia*	Silk plant	Fabaceae	70	35	6	Economic	Shrub

Dbh, diameter breast height.

that the upper canopy formed by *Hildegardia barteri* reaches about 40 m high in Ogbere quarry site. All the three plants were economically important; with only black plum and West African rubber were shrubs, while silk plant was tree (Ogbonaya and Phi-Eze 2020).

At Iwaye; West African rubber, two neem plants were

found on the line transect; 2, 3, 60 m respectively covering a total distance of 65 m; with dbh of 8, 26 and 76 cm respectively; they had the following heights 2, 6 and 8 m respectively. However, with the exception of West African rubber, the two neem plants were non-economic; but all the three plants are shrubs. Lameed and Ayodele (2010) noted that herbs were restricted in distribution while weeds were quite common in their study quarry site.

Idode had three African oil palms and a silk plant on the line transect of 100 m with the following distances 2, 4, 20 and 60 m from reference point; having total distance of 86 m. The dbh of each plant was as follows 56, 55, 60 and 20 cm; with the height of 10.5, 11, 11 and 6 m respectively. All the four plants are shrubs and were found to be economically important (Ndace and Danladi 2012).

West African rubber, silk plant and mahogany nut were the plant found at Isara on the line transect; with the following distances from reference point 3, 5 and 15 m; total 23 m and the dbh of 58, 24 and 30cm and the height of 6, 7.5 and 8 m respectively. All the three plants are shrub and were found to be economically important. In some parts of study area (Ogbere), vegetation is usually dense with young trees and shrubs such as *Alchornea cordifolia* and *A. laxiflora* and covered with scramblers and climbers such as *Combretum* spp, *Adenia lobata* and *Smilax kraussiana* (Lameed and Ayodele 2010).

Monbin plum or hog plum, fula-pulaar and silk plant were 13, 16 and 30 m from reference point on the line transect laid at Igodo; making total of 59 m and with the following dbh of 55, 89 and 60 cm respectively; the heights were 12 m (monbin plum), 10.5 m (Fula-pulaar) and 12 m (silk plant). Except silk plant, that is economic and shrub, monbin plum and fula-pulaar are non-economic and shrubs (Ogbonaya and Phi-Eze 2020).

Ilagbe had three plants namely silk plant, African oil palm and neem plant with 3, 8 and 60 m from the reference point on line transect; total together as 71 m; they had dbh as follows: 26, 40 and 125 m and height of 10.6, 10.5 and 8 m respectively. Silk plant and African oil palm are economic and shrubs; while neem is non-economic and shrub (Ndace and Danladi 2012).

In the location like Baaaki Ake, eight plants were identified on the line transect; namely kapok or cotton- like fluff, two plants of life; two kola nut plants, dragon blood plant, dye plant and broom cluster fig and found at 3, 6, 27, 31, 41, 51, 64 and 83 m distance respectively from reference point and having a total distance of 306 m; their dbh as follow: 45, 40, 32, 72, 26, 44, 13 and 15 cm; while their correspondent heights as stated: 10, 11, 8, 11, 11, 12, 6 and 12 m respectively. All mentioned plants in this location are non-economic important and shrubs; with the exception of cotton- like fluff, that is economic but shrub. Lameed and

Table 11. Plant species distribution

Common name	Scientific name	Frequency	Percent	Cumulative percent
Silk plant	*Albizia zygia*	7	23.3	23.3
Neem plant	*Azadirachta indica*	3	10.0	33.3
Akee apple	*Bligha sapida* (*Ishin*)	1	3.3	36.7
Fula-pulaar (guinea)	*Bridelia ferruginea*	1	3.3	40.0
Kapok or cotton-like fluff	*Ceiba pentandra*	1	3.3	43.3
Kolanut	*Cola acuminate*	2	6.7	50.0
African oil palm tree	*Elaeis guineensis* (*Ope*)	4	13.3	63.3
Broom cluster fig	*Ficus sur* (*opoto*)	1	3.3	66.7
West African rubber tree	*Funtumia elastic*	3	10.0	76.7
Dragon blood tree	*Harrisonnia abyssinica* (*Arunje*)	1	3.3	80.0
Dye plant	*Loncocapus cienensis*	1	3.3	83.3
Mahogany nut	*Maranthes robusta* (*Awewe*)	1	3.3	86.7
Tree of life or fertility tree	*Neubodia levis*	2	6.7	93.3
Monbin plum or Hog plum	*Spondia mombin*	1	3.3	96.7
Black plum	*Vitex doniana*	1	3.3	100.0
	Total	30	100.0	

Ayodele (2010) asserted that the most diverse of the four transects is S 1 with an index of 2.2. were the non-timber forest resources (NTFR) include *Xanthosoma sagittifolia (cocoyam)*, *Ananas comosus* (pineapple), *M. esculenta* (cassava), *Musa sapientum* (banana), *Musa paradisiaca* (plantain), *Elaeis guineensis* (palm oil and palm wine), *Thaumatococcus daniellii* and *Cola* spp (cola nuts) among others while the timber forest resources (TFR) include *Hallea ledermanii*, *Terminalia superba* and *Nauclea diderrichii* among others.

Adelokun was with three plants namely; Akee and two silk plants on the line transect with 10, 62 and 70 m distance respectively from reference point and occupied total distance of 142 m with dbh of ; 13, 17 and 35 cm and height of 6, 8 and 6 m respectively. Except Akee apple, the silk plants are economic but all the plants are shrubs (Bamgbose et al. 2014).

Among the vegetation identified in the study area (Table 11); *Albizia zygia* was predominant with 23.3% frequency; which implies that it is very resistant to the quarry activities; hence its choice for chlorophyll analysis; followed by *Elaeis guineensis* (13.3%), *Azadirachta indica* and *Funtumnia elastic* (10%) each, *Cola acuminate* and *Neubodia levis* (6.7%) apiece; while the rest plant species had 3.3% frequency each, as shown in Table 11, whereas Lameed and Ayodele (2010) noted that *Hildegardia barteri* formed about 60% of the trees in the study site at Ogbere.

Shrubs were many with 96.7% distribution and tree was 3.3% as shown in Table 12. Table 12 also shows economic importance: economic plants had 66.7% and non-economic plants, 33.3% (Akanwa et al. 2017).

Table 13 shows the t-test during dry season. There was significant difference between chlorophyll *a* and chlorophyll *b* and the values of chlorophyll *a* were significantly greater than that of chlorophyll *b* at 5% level of significance across the locations. There is no significant difference in the values of chlorophyll *a* and *b* across the locations. Table 13 also shows that Baaki Ake has the highest value of chlorophyll *a* and *b* (396±1.34 and 124±0.43 mg Chl/m^2) during the dry season. Except Isara (344±4.02 and 108±1.04 Chl/m^2), Idode (320±0.03 and 100±1.23 Chl/m^2) and Ogbere (303±0.01 and 95±2.12 Chl/m^2) were lower in chlorophyll *a* and *b* content, while other locations were higher than the control value (353±0.00 and 110±0.00 Chl/m^2). The low concentration at Isara, Idode and Ogbere may be attributed to heavy quarrying going on there and the three locations were being operated by multinational construction companies. Others quarries were affected by problems; such as fuel scarcity and low patronage

Table 12. Vegetation types and economic importance at the sites

Vegetation type	Frequency	Percent
Shrub	29	96.7
Tree	1	3.3
Total	30	100.0
Economic importance		
Economic	20	66.7
Non-economic	10	33.3
Total	30	100.0

Table 13. Chlorophyll index of *Albizia zygia* in dry season (N=3)

Location	Chlorophyll (mg Chl/m^2)			
	A	B	t-test	p-value
Isara	344±4.02	108±1.04	4.02	0.00
Iwaye	368±0.02	113±1.02	3.12	0.002
Idode	320±0.03	98±1.23	2.11	0.001
Ogbere	303±0.01	95±2.12	1.22	0.02
Baaki Ake	396±1.34	124±0.43	4.44	0.0023
Adelokun	357±2.12	112±0.23	2.32	0.032
Ilagbe	353±0.14	111±3.012	4.99	0.023
Igodo	356±0.24	116±0.21	3.22	0.0189
Control	353±0.00	110±0.00	4.22	0.0119

(economic situation of the country); hence quarrying affects the chlorophyll of the plant. Dust from quarrying has been reported to stall the growth and flowering of crops, because it settles on surfaces of leaves thereby interfering with the normal photosynthetic and other exchanges that take place at the leaf and atmosphere interface (Madhaven and Sanjay 2005).

Table 14 shows the t- test during wet season. The analysis shows that values of chlorophyll *a* were significantly greater than that of chlorophyll b, at 5% level of significance across the locations during wet season. Also, there is a significant difference between chlorophyll *a* and chlorophyll *b* at 5% level of significance in all locations. Table 14 shows that Baaki Ake has the highest chlorophyll *a* and *b* (416±2.12 and 135±2.99 Chl/m^2) during wet season. Moreover, aside Iwaye (386±0.04 and 124±1.24 Chl/m^2) and Baaki Ake (416±2.12 and 135±2.99 Chl/m^2 Chl/m^2) that were higher than the control (379±0.44 and 122±0.33 Chl/m^2) in wet season, other locations were lower. This implies that the quarry activities affect the chlorophyll of the plants in the wet season. Those that were not yet affected, was as a result of low patronage during wet season; hence the quarry activities were not much as to affect the chlorophyll. Dust fall and rock remains do not only contaminate the soil for agricultural practices but also hinder the plant leaf functions thereby reducing the chlorophyll content, impairing carbon oxide exchange and ultimately, photosynthesis rate.

Table 15 shows that the chlorophyll indices in all the locations (whether dry or wet season) were significantly difference from one another at 5% level of significance. There was significant difference in the values of chlorophyll (a and b) between dry and wet seasons across the locations. That is the chlorophyll indices in the wet season were significantly higher than that of the dry season; because quarry activities were higher in dry season than the wet season. Hence, the

Table 14. Chlorophyll index *Albizia zygia* in wet season (N=3)

Location	Chlorophyll (mg Chl/m^2)			
	A	B	t-test	p-value
Isara	367±0.44	115±0.33	2.41	0.014
Iwaye	386±0.04	124±1.24	5.51	0.022
Idode	339±2.19	112±0.12	2.5	0.045
Ogbere	318±0.99	108±3.11	12.3	0.0050
Baaki Ake	416±2.12	135±2.99	15.1	0.0305
Adelokun	375±1.18	121±0.12	8.12	0.0228
Ilagbe	374±0.23	124±0.29	4.01	0.0050
Igodo	372±3.12	135±1.02	3.5	0.045
Control	379±0.44	112±0.33	2.41	0.014

Table 15. T-test for Chlorophyll index by season (N=3)

Location	Dry	Wet (mg Chl/m^2)	t-test	p-value
Isara	226±0.12	241±0.22	2.98	0.023
Iwaye	241.5±0.34	255±0.31	2.51	0.018
Idode	210±1.04	225.5±0.08	1.25	0.023
Ogbere	199±1.23	213±0.02	4.13	0.008
Baaki Ake	260±2.01	275.5±0.14	2.10	0.021
Adelokun	235±0.43	248±0.19	7.21	0.014
Ilagbe	232.5±0.09	249±0.23	1.21	0.002
Igodo	236±0.07	253.5±0.44	2.25	0.015
Control	232±0.14	250.5±0.24	2.15	0.011

generation of more dust affected the chlorophyll content of the plants in the dry season. Air pollution (in terms of deposition on surfaces of the plant) exerts negative effects on health. More so dust can also have physical effects on the surrounding plants, such as blocking and damaging their internal structures and abrasion of leaves and cuticles, as well as chemical effects which may affect plants long-term survival (Guach 1999).

Conclusion

This study has assessed the impact of quarrying activities on the vegetative composition around the quarry sites. There were sixty quarry sites in Ogun state and spread across eight Local Government areas with Odeda having the highest number of quarry sites. Among the plants common in the quarries was the *Albizia zygia* (Silk plant) with the highest number of frequency. However, the chlorophyll content of *Albizia zygia* in the wet season was significantly higher than dry season in all locations. Furthermore, the chlorophyll content of the *Albizia zygia* at the Baaki Ake was predominant among other locations studied in both seasons probably because of less quarry activities present there. Quarries have impact on the vegetation around them, as dust stains the leaves of the plants cultivated there; hence, unable to photosynthesise very well.

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