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Christian Arinze Iguocha *

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Christian Arinze Iguocha and Ebele Josephine Emengini

Department of Surveying and Geoinformatics, Nnamdi Azikwe University Awka Anambra State.

Abstract

Stone quarrying is a vital economic activity in Anambra Eat local government area, Anambra state providing employment and income for numerous individuals. However, the environmental impacts of stone quarrying have raised concerns among local communities, environmentalists, and policymakers. The extraction process involves blasting, drilling, and crushing of stone, leading to potential environmental degradation. Anambra East local government are rich in limestone, granite and sandstone deposits, making it a hub for stone quarrying activities, coupled with the increasing demand for construction materials, have led to an expansion of stone quarrying operations. Nevertheless, the environmental consequences of these activities have not been adequately assessed, particularly in terms of their spatial and temporal patterns. Problems such as deforestation, air pollution, and increased land surface temperature as a result of stone quarrying activities in Anambra East L.G.A. Hence, this study aims at carrying out the spatiotemporal analysis of the effects of stone quarrying activity on the environment in Anambra East L.G.A, Anambra State. Its specific objectives are; to ascertain the spatial extent of landuse/landcover (LULC) with emphasis on the stone quarrying activities in Anambra East L.G.A for over 15 years (2013-2023); to investigate the trends and rate of stone quarrying in Anambra East L.G.A between the same period; to determine if the stone quarrying has also had an impact on the land surface temperature in Anambra East L.G.A from 2013 to 2023.The methodology involved the acquisition of landsat 8 OLI and coordinates of the stone quarrying sites dataset. Image preprocessing was applied to the set of image acquired to correct the effects of the sun angle between 2013, 2018 and 2023. Quarrying area coordinates was used to identify the quarrying areas and then signature samples was collected to classify the landsat. The post-classification comparison technique in ERDAS images was used for change detection. This was used to determine the trends and change dynamics as a result of stone quarrying activities in 2013, 2018 and 2023. Finally, a correlation coefficient was used in this study to measure the statistical relationship between LULC and land surface temperature (LST) in Anambra east LGA in 2013, 2018 and 2023. The result showed that quarry is 0.54% in 2013 and 1.45% in 2018 and increases to 3.12% in 2023. The built-up area increased by 10.74%, 13.89% and 16.40% in 2013, 2018 and 2023 respectively. The analysis revealed that GIS, Remote Sensing and well processed satellite images can be effectively applied as a tool to carry out landuse/land cover and the land surface temperature in detecting and locating of the stone quarry areas. Significantly to enhance proper decision making, and improve the identification of both the abandon quarry areas.

Keywords: Spatiotemporal, analysis, stone, quarrying, environment

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1. Introduction

It is becoming increasingly clear around the globe that quarrying operations have developed into a mining industry, which has the ability to offer management, in their attempts to lessen the effects of quarrying risks to people and the environment, services that are unmatched. Construction resources including dimension stone, decorative stones, and industrial raw materials for architecture and construction are often extracted from quarries (Yari et al., 2024). An open-pit surface mine where rock or minerals are mined is called a quarry. Nonetheless, mining and quarrying are damaging industries that result in the total devastation of the environment. The biggest danger to biodiversity and the main factor leading to the extinction of species is habitat degradation and fragmentation (Shaneeet al., 2023).

Quarrying is poorly managed for environmental sustainability in the majority of African countries as well as other countries. The exploitation of resources is done in an unorganized manner and using extremely subpar procedures. Since most quarries are kept open, the majority of them do collapse, and no steps are done to restore such quarries (Ajibadeet al., 2022). The necessity for a thorough investigation of the impact of quarrying management on the mining industry has therefore emerged. One of the primary adverse effects of quarrying on the environment is the harm done to biodiversity. Quarrying may result in the destruction of ecosystems and the species they sustain. Environmental influences, such as changes to surface or ground water that cause some habitats to flood or dry up, can also indirectly affect and harm habitats, even if they are not immediately eliminated by excavation (Okaforet al., 2023). Certain species can be severely impacted by noise pollution, which can also hinder their ability to reproduce. However, it is feasible to reduce the consequences on biodiversity with good planning and management.

Additionally, quarries might be a great place to develop new habitats or improve already-existing ones. Again, quarrying generates a substantial quantity of trash, much like many other man-made operations. While certain types of quarries, like sand and gravel quarries, may not generate a lot of permanent trash, other types, like clay and silt quarries, do produce a lot of waste material (Ndukaet al., 2022). Nonetheless, there is still a chance of environmental harm, especially from contaminated water, as well as harm to the habitats of plants and animals. A key

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element of the ecosystem, which is a complex interplay between biotic and abiotic environmental entities, are plants. The vegetation aids in the area's rehabilitation.Although quarries can have a negative impact on the environment, many of these effects can be reduced or controlled with proper planning and management. In addition, there are frequently excellent opportunities to protect and improve the environment, such as when existing habitats are relocated or new ones are created (Echeweozoet al., 2024).

Therefore, project planning, formulation, and execution are required to prevent the influence of stone quarrying on the environment and living community in order to establish the balance between natural ecosystems. Therefore, the goal of this study is to evaluate the environmental repercussions of Anambra East's sandstone quarrying and its effects on the ecosystem. The government and large corporations profit greatly from quarrying operations, but the village people bear the brunt of these negative effects, including harm to their health, safety concerns, community dislocation, environmental damage, and the creation of a quarrying village that shifts the livelihood of the locals.The fact that different study sites had different access to water resources demonstrates the wide range of health effects that have been linked to sandstone quarrying, including eye infections, body aches, headaches, insomnia, coughing, and chest pain. These effects have also been reported following the consumption of water near the quarry sites. Waste rock dumping disrupts the natural drainage system, diverts streams and rivers to other areas, and floods agriculture fields, endangering locals even more.

2. Materials and Methods

2.1. Study Area

The research was done in Anambra East. Nigeria's Anambra State has the Local Government Area known as Anambra East. Aguleri, EnugwuAguleri, EziaguluOtuAguleri, EnugwuOtuAguleri, Mkpunando-otuAguleri, IkemIvite, Igbariam, Umuoba Anam, Nando, Umueri, and Nsugbe are the towns that comprise the local government. 6.275766 (6°16'32.76"N) is the east latitude and 7.006839 (70 0'24.62" E) is the longitude of Anambra.

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Economy: In Anambra, agriculture is a significant economic sector. Among the crops farmed are oil palms, cassava, yams, maize, and rice. In Anambra East, fishing is also a major source of income, particularly for the areas that are close to rivers.

Geology: Older sedimentary rocks in the eastern part of the study region and foundation complex rock of Precambrian age that extends somewhat eastward beyond the lower Niger valley are the two primary rock types found there (Onwukaet al., 2015). The several sedimentary rock groups stretch southeast across the states of Enugu and Anambra, as well as along the banks of the Niger and Benue rivers.

Drainage: Because Anambra East is partially located on the 3.3 Onitsha highland and Omambala river flood plain, an area of moderate relief, it has a rough relief. Geologically speaking, the research region is covered in Umueri-Agulueri, which is composed primarily of highly sedimentary sandstone. The sand stone which is predominantly dominating the region is subject to erosion, which is illustrated by the neighboring and famed Nkwelle gully site. The area has plenty of surface drainage systems through which the surplus water is evacuated from their property. The drainage system's constituents make up the tributaries of the Omambala and Ezu rivers, which flow into the Niger River.

Climate: The climate is classified as a tropical wet and dry climate. The position of intertropical divergence, which is felt for eight months during which the maximum rainfall of around 350 mm occurs, controls the amount of rainfall. The two main winds that drive the south western monsoon across the Atlantic Ocean create two different seasons in the tropical zone of Nigeria, which is home to Anambra East Local Government Area. Between April and October, the Atlantic Ocean monsoon winds provide seven months of intense tropical rains, which are followed by five months of dry weather (November to March). The harmattan, also called ugulu in Igbo, is a very dry and dusty wind that hits Nigeria in late December or early January (Egbucheet al., 2020). It is distinguished by a gray haze that obscures the sun's light and reduces vision.

Vegetation and Soil: The vegetation is found in Nigeria's humid tropical rainfall area. This region has considerable humidity, with vegetation that ranges from 80–85% during the rainy

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season to 60% during the dry season. These processes are responsible for the study area's high annual rainfall, which ranges from 1,400 to 2,500 mm and is concentrated in one season with about four dry months, November through February (Okaforet al., 2023). Because of this, the study area's native vegetation is tropical dry or deciduous, having once consisted of large trees with a lot of climbers and dense undergrowth.

Occupation: Due to the area's fertile qualities, the majority of the population in Anambra East is a farmer. The principal food crop farmed in this area is yam. After harvesting, these yams are often kept in a barn to protect them from rotting due to moisture and floods, which typically devastate the area during the rainy season. These yams are often taken to the markets by different modes of transportation after being hauled from the farms and communities in wooden-powered boats. Additional varieties of crops include potatoes, corn, melon, fluted pumpkin, cassava, and others. The natives are also skilled fishermen, using a variety of techniques to catch fish. The annual Ijiflood, which causes the River Niger to overflow its banks and reach its tributaries, is caused by the rainy season. Although it temporarily uproots people, the flood also fertilizes the ground and supplies fish for the numerous lakes and ponds where fish are collected.

2.2. Methodology

Acquisition of Primary Datasets: Handheld GPS was used to get the coordinates of the stone quarrying sites and ground control points for accuracy evaluation. Non-spatial (attribute) data that describe the properties of ground features will also be gathered.

Obtaining Secondary Datasets: Pre-existing media was the source of the secondary datasets. Among these is a map of Anambra East L.G.A.'s administrative boundaries, which was provided by Nnamdi Azikiwe University's Awka Department of Surveying and Geoinformatics.And landsat imagery was obtained from (www.earthexplorer.usgs.gov).

2.3 Hardware and Software Requirements

The study utilized both hardware and software tools. For hardware, a Garmin10 handheld GPS was employed to collect coordinates of quarry sites and ground control points, while a computer system facilitated data processing and analysis. A printer was used to produce hardcopy results.

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Regarding software, ArcGIS version 10.7 was essential for displaying, processing, and enhancing images, as well as applying spectral indices. Erdas Imagine was employed to develop land cover/land use classes, conduct trend analysis, and perform accuracy assessments. Microsoft Excel and Word were used for statistical analysis, report editing, and document production.

2.4 Remote Sensing

Information on a phenomena or thing may be gathered remotely, without having to come into direct touch with it. Earth's Resources Large amounts of data are now available from satellites for GIS applications. Digital data acquired from satellites may be incorporated straight into a geographic information system. Many satellite data sources are available, including LANDSAT, SPOT, IKONOS, and others. The construction of GIS databases will have more possibilities and opportunities with the availability of a new generation of high-resolution satellite data from national and private sources. Panchromatic (black and white) data from these satellite systems will be accessible in the 1 to 3 meter range, as opposed to the 10 to 30 meter range that conventional remote sensing satellites can deliver.

Electromagnetic radiation is used in remote sensing to measure and identify features of objects. This procedure entails recording the observations on an appropriate medium (pictures on photographic films and video tapes or digital data on magnetic tapes) and making observations using sensors (cameras, scanners, radiometers, radar, etc.) installed on platforms (aircraft and satellite), which are at a significant height from the earth's surface. Remote sensing sequence involves an electromagnetic energy radiation source of known uniform intensity at all wavelength, a transmission path usually the atmosphere and a source which detects and records the returned (reflected) signals hence data are obtained. Hence, remote sensing system involves the radiation sources, transmission path, sensor and object of interest.

Remote sensing offers several key features. It captures spatial data at specific points in time, enabling the analysis of changes across multiple scenes over time. Remote sensing allows the description, classification, and measurement of physical properties that cannot be obtained directly on-site. Additionally, it facilitates regional or global comparisons of measurements.The remote sensing imaging system, also known as a sensor, gathers data and can be classified into

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passive or active systems. Passive systems rely on external sources of illumination or the target's thermal radiation, whereas active systems generate their own energy for data collection.Sensors can also be classified based on bandwidth. Broad waveband sensing collects data from various wavelengths to form composite images, while narrow waveband sensing focuses on a single selected wavelength. Bi-spectral sensing records radiation in two distinct wavebands, often improving environmental analysis. Multispectral sensing involves using several sensors to gather data across multiple narrow bands of the radiation spectrum, enhancing the detection of specific features.

2.5 Image Interpretation

Image interpretation, or photo interpretation, is the systematic process of extracting meaningful information from remote sensing images. It involves closely examining and recognizing features in the images to draw logical conclusions. There are two primary approaches to image interpretation. The manual or visual method requires human interpreters to visually analyze and enhance images to extract data. The computer-assisted or digital method uses computer algorithms to identify, recognize, and classify features in digital images.

Manual photo interpretation involves three key phases. First, during examination and detection, the analyst reviews images to identify general characteristics of the area, aided by knowledge of the environment and specific image elements like spatial, spectral, temporal, and radiometric resolutions. Spatial resolution measures a sensor's ability to distinguish closely spaced objects, while spectral resolution refers to the sensor's sensitivity to different wavelengths. Temporal resolution relates to how frequently a sensor captures images of an area, and radiometric resolution determines a sensor’s ability to differentiate between subtle differences in reflected or emitted light.In the recognition, identification, and classification phase, interpreters use their knowledge to categorize objects based on image features like tone, pattern, shape, size, texture, shadow, and location. Finally, ground truthing involves field verification to ensure that the interpretations made from the images are accurate.

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2.6 Digital Image Processing

Computer-assisted photo interpretation, also known as digital image processing, was used to identify, recognize, and classify features in digital images. The process began with image pre-processing, which involved image restoration and rectification to remove systematic errors and noise introduced during scanning and transmission. Key operations included correcting radiometric and geometric distortions, removing noise, and performing image re-sampling and registration. Image re-sampling assigned appropriate brightness values to output pixels, while image registration superimposed the image onto a map or another image to align it with a coordinate system.

Next, image enhancement was applied to improve the pictorial quality of the image, focusing on enhancing its radiometric and geometric properties. Image classification followed, in which image features were categorized into land cover types based on their reflectance characteristics, effectively converting the image into a thematic map. Two classification methods were considered: supervised and unsupervised classification.In the study, the supervised classification method was employed for land use and land cover (LULC) analysis using Landsat 8 OLI imagery. Training samples were created based on prior knowledge of the area by drawing polygons in the area of interest (AoI). The maximum likelihood algorithm (MLC), widely used for medium-resolution satellite imagery, was applied as the classifier. The algorithm used a statistical approach, assuming a normal distribution for each class in each image band. Spatial reclassification was then implemented to minimize classification errors through image interpretation, knowledge-based approaches, and GIS functions.

2.7 Accuracy Assessment

To determine the reliability and accuracy of the land use and land cover, this study will perform the accuracy assessment using the confusion/ error matrix.Accuracy assessment of image classification is an important step in determining the reliability of the results obtained from the classification process. At least a minimum of 85% interpretation accuracy should be attained in the identification of land cover classes from remotely sensed data. In this study, four (4) different accuracy metrics namely user's accuracy, producer's accuracy, overall accuracy, and kappa coefficient will be determined for the overall assessment of the classification. Acharya

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et al., (2016) stated that the user's accuracy and the producer's accuracy are based on the matrix column and row allocation and do not take into account the agreements between datasets that are due to chance alone. Therefore, the kappa coefficient of agreement is often used. The kappa coefficient is a measure of agreement based on the difference between the actual agreement in the error matrix and the chance agreement.

Producer's accuracy measures how well a certain area has been classified. It includes the error of omission which refers to the proportion of observed features on the ground that is not classified in the map. User's accuracy is computed by dividing the number of correctly classified pixels in each category by the total number of pixels that were classified in that category. The user's accuracy measures the commission error and indicates the probability that a pixel classified into a given category actually represents that category on ground.

3.Results

Land use/ Land cover Analysis

The supervised classification method was used in classifying the land use and land cover in the study area. The training sets for each class were 30 training samples and the maximum likelihood algorithm was used for the classification process. In the study area, four distinct land use and land cover were identified and they include: quarry, water, vegetation/farm lands and built-up.

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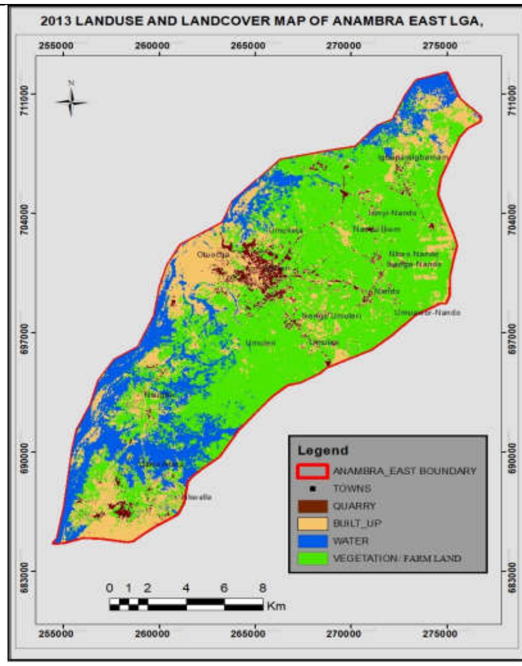

Figure 1: 2013 Land use/ Land cover of study Area

From the results the land use and land cover map in Fig. 1, it was observed that in 2013, the land use at the study site were as follows: built-up areas occupy a total area of 401407.18 hectares, vegetation/farm lands is at 2205123.23hectares, water is1110904.83 hectares and quarry 20313.18 hectares.

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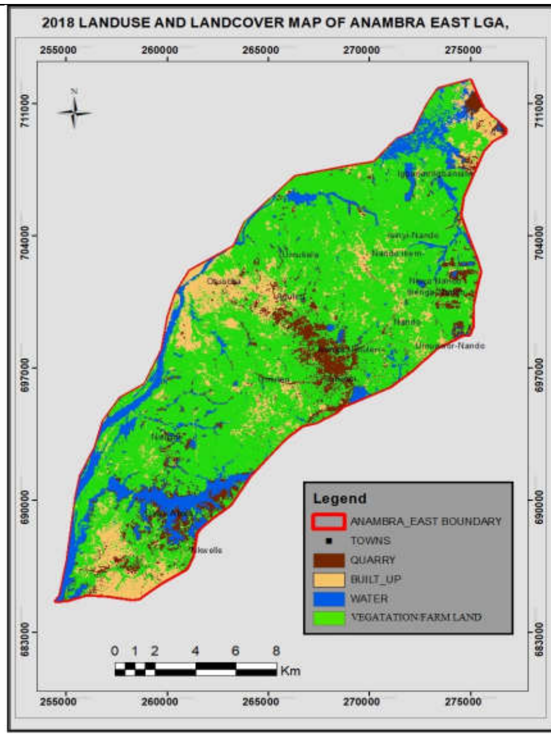

Figure 2: 2018 Land use/ Land cover of Study Area

From the results the land use and land cover map in Fig. 2, it was observed that in 2018, the land use of the study area was as follows: built-up areasoccupy a total area of 519138.38 hectares, vegetation/farm lands are at1931538.61 hectares, water is 1232703.18 hectares and quarry is 54193.71 hectares.

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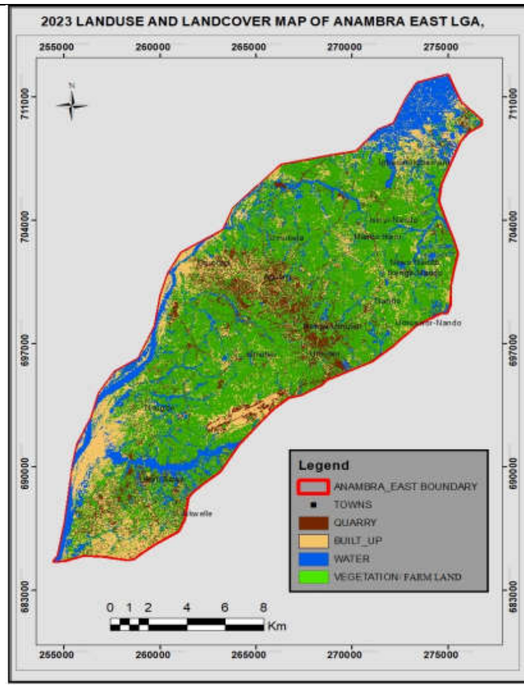

Figure 3: 2023 Land use/ Land cover of Study Area

From the results the land use and land cover map in Fig. 3, it was observed that in 2023, the land use of the study site are as follows: built-up areas occupy a total area of 612949.56 hectares, vegetation/farm lands is at 1774189.98 hectares, water is 1233747.87 hectare and quarry is 116609.916 hectare.

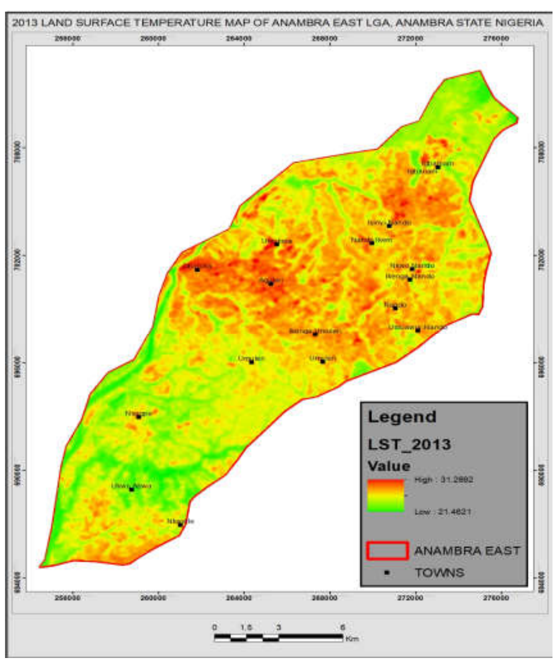

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Figure 4: 2013 Land Surface Temperature Map of Anambra East Local Government Area, Anambra State, Nigeria.

The 2013 Land Surface Temperature map of Anambra East LGA, Anambra State in Figure 4 shows temperature variations from 21.46°C to 31.27°C. Hotter areas (30-31°C), marked in red and orange, are concentrated around towns like Aguleri, Otuocha, and Umueri, likely due to urbanization and deforestation. Cooler areas (21-23°C), shown in green and yellow, correspond to less developed or vegetated regions. This map is vital for urban planning, highlighting the urban heat island effect and its implications for local ecosystems and agriculture.

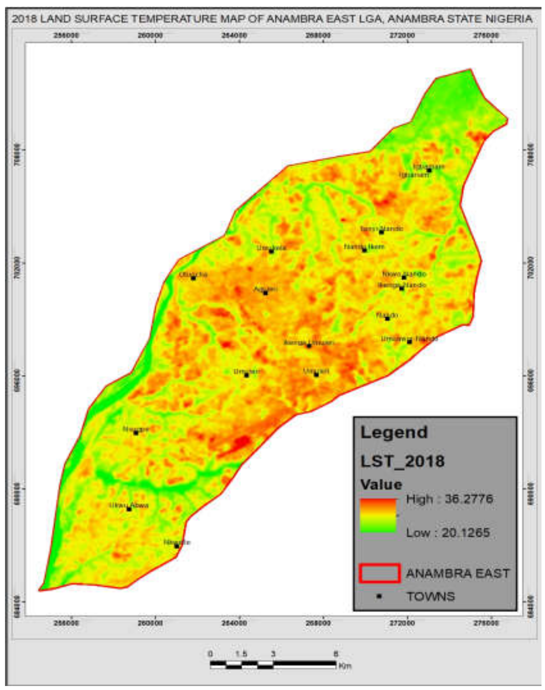

Figure 5: 2018 Land Surface Temperature Map of Anambra East Local Government Area, Anambra State, Nigeria.

The 2018 Land Surface Temperature map of Anambra East LGA, Anambra State in Figure 5, shows temperature variations ranging from 20.13°C to 36.28°C. Hotter areas (35-36°C) are concentrated around towns like Aguleri, Otuocha, and Umuleri, reflecting urbanization and reduced vegetation. Cooler regions (20-22°C), shown in green, are found in rural or vegetated zones such as UkwuAbwa and Nsugbe. This map illustrates significant temperature increases compared to 2013, highlighting environmental changes possibly due to deforestation or expanding urban areas.

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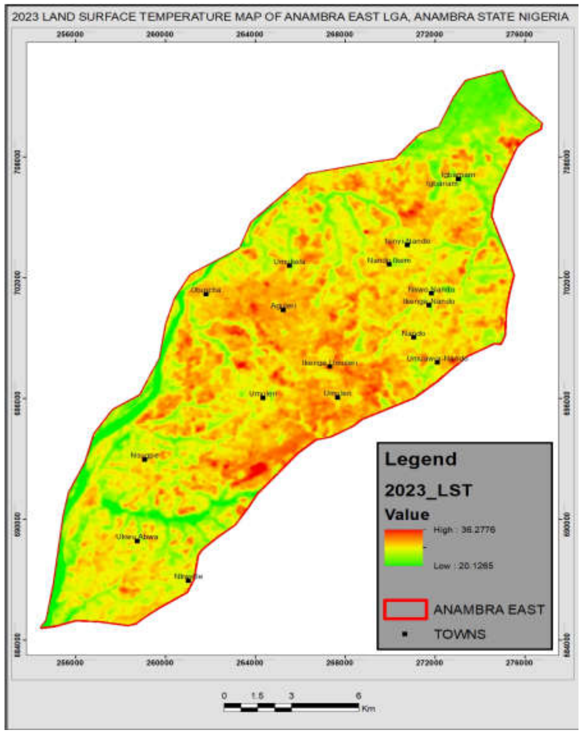

Figure 6: 2023 Land Surface Temperature Map of Anambra East Local Government Area, Anambra State, Nigeria.

The 2023 Land Surface Temperature (LST) map of Anambra East LGA, Anambra State, Nigeria (Figure 6) shows temperature variations across the region. The color gradient from red to green represents temperatures ranging from a high of 36.28°C (in red) to a low of 20.13°C (in green). Towns such as Aguleri, Umuleri, Otuocha, and Nando are identified within the map. The map highlights areas with higher temperatures concentrated in central and northern parts, while cooler areas are found mostly in the south and along the edges.

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Table 4: showing the classification accuracy assessment for 2023

CLASSES	Quarry	Vegetation	Built-up	Water bodies	Total	User's Acc.
Quarry	11	79	0	8	98	80.61
Vegetation	96	4	0	10	110	87.27
Built- up	11	0	0	87	98	88.78
Water bodies	0	0	45	3	48	93.75
Total	118	83	45	108	354	
Producer's Acc. (%)	95.18	81.36	80.56	100		
Overall Acc. (%)	86.72					
Kappa Coe.	0.82					

Table 4 presents the classification accuracy assessment for 2023 across four land cover classes: Quarry, Vegetation, Built-up areas, and Water bodies. The total accuracy (overall accuracy) achieved is 86.72%, with a Kappa coefficient of 0.82, indicating substantial agreement between predicted and actual classes. Producer's accuracy is highest for Water bodies (100%) and lowest for Built-up areas (80.56%). User's accuracy ranges from 80.61% for Quarry to 93.75% for Water bodies. Vegetation and Built-up areas show moderate accuracy levels, with User's accuracy at 87.27% and 88.78%, respectively. The total sample size used for the assessment is 354.

Discussion

The analysis of the land use and land cover the (LULC) study provides significant information regarding environmental changes as well as the expansion of urban regions. The findings from this study demystify the understanding of the urban development, environmental transformation, and consequent LST implications. It also underscores trends in the management of land when these findings are compared to other research endeavours. In 2013, built-up areas covered 401,407.18 ha, vegetation/farmlands 2,205,123.23 ha, water bodies 1,110,904.83 ha and the quarry areas 20,313.18 ha. The built form has increased to 519,138.38 hectares in the same year in contrast to vegetation/farmlands which has reduced to 1,931,538.61 hectares thereby

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showing rapid urbanization. Water bodies increased to 1,232,703.18 hectares, and quarry areas grew to 54,193.71 hectares. By 2023, built-up areas further expanded to 612,949.56 hectares, with vegetation/farmlands reduced to 1,774,189.98 hectares. The slight increases in water bodies and quarry areas continued.

In contrast to these findings, Ayeniet al., (2016) reported that urbanization in Lagos resulted in a reduction in water bodies due to wetland encroachment. In a related study, Abali and Nkii (2024) found that urban growth in Calabar led to a 30% loss in vegetated areas within five years, similar to the decrease in vegetation/farmlands seen in Anambra East from 2018 to 2023.The 2023 classification accuracy (Table 4) shows an overall accuracy of 86.72% and a Kappa coefficient of 0.82, indicating a strong agreement between the classified land cover and actual ground truth. This finding agreed with Aigbokhanet al., (2022), who reported an accuracy of 85.9% in southeastern Nigeria. In comparison, Akinyemiet al., (2020) achieved a lower classification accuracy of 84.50% in southwestern Nigeria, likely due to differences in training sample size and algorithm refinement.

The LST maps reveal environmental impacts of LULC changes. In 2013, temperatures ranged from 21.46°C to 31.27°C, with hotter areas around towns like Aguleri due to urbanization. By 2018, temperatures had increased, ranging from 20.13°C to 36.28°C, with the hottest areas in urbanized zones. These temperature trends continued into 2023, reflecting the urban heat island effect as urban areas expanded and vegetation decreased. In contrast, Emenike and Okereke (2020) found more gradual temperature increases in Enugu State due to better preservation of green spaces.In a related study, Obiefunaet al., (2021) investigated the impact of urban growth on LST in Ibadan and observed temperature increases of up to 5°C in urban areas, aligning with the findings in Anambra East. This highlights the significant role of urban expansion in contributing to higher local temperatures and the need for sustainable urban planning.

Conclusion

The research work that evidently focused on the spatiotemporal analysis of stone quarrying in Anambra East Local Government Area, Anambra State Nigeria was highly informative to the environmental effects of quarrying over the years. According to the findings it can be concluded, that negative impacts of quarrying are clearly seen in almost every area of the local environment, with a special emphasis towards agriculture, property and road infrastructures. Based on the study, one of the issues that have receiver a fairly negative hit from the quarrying activities is the agricultural land. The expansion of quarry sites has continued to see more vegetation and farmlands taken over which a direct lead to decreased arable land for farming hence food security and incomes of farmers is impacted negatively. This means that the people in these regions lose out on crop yields and at the same time is a seat for environmental degradation due to increased soil erosion.

In addition, another positive correlation to increased quarrying activities is the loss of property and structures as a result of more intense operations. From the effect of blasting, dust and traffic loads mainly from quarry trucks and other vehicles, roads and buildings near the quarries have been affected in terms of cracks and frequent maintenances. Not only do they impose costs on local government and property owners but they also adversely affect daily life and commerce in that area. The study also calls for further action in managing and preventing the negative characteristics of quarry activities in polluting the local environment and urges adequate policies that can preserve the sustainable development and the welfare of people in the community. This strategy can be recommended for other areas confronting the same problems.

REFERENCES

Abali, T. P., &Nkii, L. B. (2024). The Impact of Urban Land Use Changes on the Morphology of the New Calabar River Catchment, Port Harcourt Metropolis, Nigeria. *International Journal of Environment, Engineering and Education*, *6*(1), 47-56.

Acharya, T., Lee, D., Yang, I. and Lee, J. (2016). Identification of water bodies in a Landsat 8 OLI image using a J48 decision tree. *Sensors* 16 (7) 1075..

Aigbokhan, O. J., Ofordu, C. S., Essien, N. E., &MbaEssien, N. C. (2022). Land cover accuracy assessment in Okitipupa, Ondo State, Nigeria; application of atmospheric correction and machine learning algorithms. *Journal of Meteorology and Climate Science*, *21*(1), 29-53.

Ajibade, O. M., Olisa, O. G., Oladipupo, S. D., Adegoke, C. B., & Adebayo, O. H. (2022). Health impact assessment of quarrying in some parts of southwestern Nigeria. *Arabian Journal of Geosciences*, *15*(8), 777.

IJO - International Journal of Applied Science
(ISSN: 2992-247X)
https://ijojournals.com/
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Volume 07 || Issue 10 || October, 2024 ||

Akinyemi, D. F., Ayanlade, O. S., Nwaezeigwe, J. O., &Ayanlade, A. (2020). A comparison of the accuracy of multi-satellite precipitation estimation and ground meteorological records over Southwestern Nigeria. *Remote Sensing in Earth Systems Sciences*, *3*, 1-12.

Ayeni, A. O., Omojola, A. S., Fasona, M. J., & Akoka–Yaba, L. (2016, May). Urbanization and water supply in Lagos State, Nigeria: The challenges in a climate change scenario. In *7th International Water Resources Management Conference of ICWRS* (pp. 18-20).

Echeweozo, E. O., Agwu, K. K., Ogada, J. C., & Ike, P. O. (2024). Survey of Natural Radioactivity of Soil and Rock Samples and their Radiological Implications to Human Health in Ugwuele Quarry Mining Site, Uturu, Abia State, Nigeria. *Journal of Applied Sciences and Environmental Management*, *28*(2), 581-587.

Egbuche, C.M., Onyido, A.E., Umeanaeto, P.U., Nwankwo, E.N., Omah, I.F., Ukonze, C.B., Okeke, J.J., Ezihe, C.K., Irikannu, K.C., Aniekwe, M.I. and Ogbodo, J.C., 2020. Anopheles species composition and some climatic factors that influence their survival and population abundance in Anambra East LGA, Anambra State, Nigeria. *Nigerian Journal of Parasitology*, *41*(2).

Emenike, A. I., & Okereke, I. O. (2020). Using sustainable green strategy to upgrade blighted urban spaces in Enugu, Nigeria. *Environmental Review*, *7*(1).

Nduka, J. K., Umeh, T. C., Kelle, H. I., Ozoagu, P. C., & Okafor, P. C. (2022). Health risk assessment of radiation dose of background radionuclides in quarry soil and uptake by plants in Ezillo-Ishiagu in Ebonyi South-Eastern Nigeria. *Case Studies in Chemical and Environmental Engineering*, *6*, 100269.

ObiefuNa, J. N., OkOlie, C. J., NwilO, P. C., Daramola, O. E., &Isiofia, L. C. (2021). Potential influence of urban sprawl and changing land surface temperature on outdoor thermal comfort in Lagos State, Nigeria. *Quaestiones Geographicae*, *40*(1), 5-23.

Okafor, O. C., Njoku, C., Ekwe, A. C., & Onuoha, P. I. (2023). Environmental impact of quarrying on soil quality in Ebonyi State, south-eastern Nigeria. *Arabian Journal of Geosciences*, *16*(11), 632.

Okafor, U.P., Asuoha, G.C., Uzuegbu, C.N., Mba, L.C., Okwor, C.O., Onuorah, C.P., Onah, N.G., Ngele, O.K., Okoli, B.A. and Onyekwelu, C.A., 2023. The Influence of African Traditional Religion on Biodiversity Conservation in Anambra East LGA of Anambra

IJO - International Journal of Applied Science

(ISSN: 2992-247X)

https://ijojournals.com/

Christian Arinze Iguocha *

Volume 07 || Issue 10 || October, 2024 ||

State, Southeastern, Nigeria: A Geospatial Information System Study. *Journal of Asian and African Studies*, p.00219096231200589.

Onwuka, S. U., Ikekpeazu, F. O., & Onuoha, D. C. (2015). Assessment of the causes of 2012 floods in aguleri and umuleri, Anambra East local government area of Anambra state, Nigeria. *British Journal of Environmental Sciences*, *541*, 43-57.

Shanee, S., Fernández-Hidalgo, L., Allgas, N., Vero, V., Bello-Santa Cruz, R., Bowler, M., ErkenswickWatsa, M., García Mendoza, G., García-Olaechea, A., Hurtado, C. and Vega, Z., 2023. Threat analysis of forest fragmentation and degradation for Peruvian primates. *Diversity*, *15*(2), p.276.

Yari, M., Jamali, S., Abdullah, G. M., Ahmad, M., Badshah, M. U., &Najeh, T. (2024). Development a risk assessment method for dimensional stone quarries. *Scientific Reports*, *14*(1), 21582.