

Original Research Article

Impact of construction activities on agricultural land use for sustainable food production in Ile-Ife

*Oluwadamilola A. Ayangbenro¹, Akintayo O. Ojo², & Alwadood J. Ali³

Affiliation

¹Department of Building, Obafemi Awolowo University, Ile-Ife.

²Department of Urban and Regional Planning, Obafemi Awolowo University, Ile-Ife.

³Advanced Space Technology Applications Laboratory (COPINE), Ile-Ife.

*For correspondence: email: oafadele@oauife.edu.ng, tel: +234 (0) 813 530 8057

Abstract

The construction industry is a key player in global economic development and assumes a critical position in multifaceted demand for land resources through urbanisation process such as housing and infrastructure development. This pressure plays significant role in decimating available land resources for agricultural activities and has great implication for sustainable food production. This study examined land use change process in Ile-Ife using Landsat Image at 32m resolution over a period of 2002 to 2023. The features were classified into Baresurface, Built-up, Cultivation, Vegetation, and Waterbody with respective area of coverage of 0.9%, 21.0%, 30.3%, 47.4% and 0.3% at the baseline Year 2002. Findings showed that there was significant percentage increase from 2002 to 2023 of 166.7% for Baresurface (2.4%) and 106.2% for Built-up (43.3%). On the contrary, Cultivation area reduced to 22.2%, with a percentage decimation of 26.7%, Vegetation was reduced to 31.9% with a percentage reduction of 32.7% and Waterbody to 0.2% with a percentage reduction of 33.3%. Notably, majority of the percentage differences occurred between 2002 and 2014, which is largely attributable to increase in minimum wage. By implication, substantial arable land areas for cultivation and vegetation towards food production have been overtaken by built-up area and construction activities without any visible effort at exploring alternatives for agricultural practices towards food production. A concerted effort is required to stem the tide in ensuring sustainable food production.

Keywords: *Construction materials, land sat image, food security, urbanisation, sustainability.*

INTRODUCTION

Construction activities within urbanisation process has remained a major driver of multidimensional competition for land and major influence on land use (Smith et al., 2010). Demand for land within urbanisation process is precipitated upon construction activities for housing supply, commercial centres, industrialisation, provision of facilities and critical infrastructure. Consequently, construction activities continue to compete and encroach into agricultural land, thereby threatening food production and food security for the increasing urban population, particularly in developing countries where extensive agriculture is mostly practiced. Land resources are mined for construction materials such as sand (both sharp and soft), coarse aggregate and water. Construction depends heavily on these materials and the intensified efforts

aimed at reducing housing deficit and bridging infrastructure gaps in Nigeria has seen an increase in demand for these materials and land for construction purposes. Demand for land for construction activities and construction materials will mean an increase in land-use change with farmlands and forests at the periphery of urban centres overtaken by development.

Studies that have examined urban growth within the context of land use change and land cover abound (Ajala & Olayiwola, 2013; Balogun et al, 2011; (Enaruvbe & Atedhor, 2015). However, specific study that assesses the impact of land use change within the context of construction activities precipitated by sand mining and its impact on arable agricultural land for sustainable food production has not been given serious attention. Farmlands and forest being overtaken by development has an implication on the food security as a result of the reduction in the land available for farming and food production. Food production is crucial not only to the economic growth of a nation, but also to the healthy living, the sustenance and survival of its populace, hence, there is a need for proper planning and policy formulation to ensure sustainable land use development.

Construction materials, urban growth and agricultural land use

Construction materials are significant part of construction activities and the growing quest for housing and infrastructure development in response to dynamics of urban growth has put issues relating to materials in focus. Construction materials are estimated to accounts for about 65% of the total construction cost and perceived to have a significant impact on project delivery, performance, growth and development of the construction industry (Windapo & Cattell, 2013). According to Krausmann et al. (2017), construction materials such as cement, wood, steel, cement, and aggregate are second most consumed after water in construction activities. As observed in most developing nations, Nigeria construction industry relies heavily on non-renewable sources for construction materials (most especially for fine and coarse aggregates) in an unregulated manner, which in most cases encroach the virgin agricultural land and forest. Construction activities in these developing countries are hardly deconstruct except in emergency cases, thus, recycling aggregates remains unexplored option for sustainable aggregate use and mining. For instance, the global demand for sand and gravel alone for construction is said to be about 41 billion tonnes with an estimated increase to 60 billion tonnes per annum by 2030 due to increase in industrialization and urbanisation (UNEP, 2019). A substantial portion of this increase is expected to occur in developing countries grappling with housing and infrastructure deficit.

Dynamics of urban growth is characterized with construction of housing to provide shelter and accommodation for increasing urban population. The global urban population has been reported to have increased by 1990 from 13% to 29% in 1950, then to 49% in 2005, which is further projected to be 60% by the year 2060 (UN, 2015). This projectile is undoubtedly indicative of an increasing need for housing and eventual rise in construction activities and sand mining particularly. Madhavarao et al. (2018) reported that for a six-storey building containing four houses per floor, 2175 tonnes of sand and 2782 tonnes of aggregate were required, a breakdown of this to truck load implies that on the average, 218 and 278 loads of 10 tons trucks of sand and aggregates respectively were utilized. Expectedly, there is the dimension of corresponding need for supporting infrastructure development such as transportation in the likes of roads, railways and airports (Bhatta, 2010). Importantly, expansion in transportation infrastructure has been described as both centripetal and centrifugal forces within the dynamics of urban growth process. As city expands in land area, provision of transportation networks becomes inevitable to provide accessibility to

various parts of the city and in turns further attract more activities within urban space. Moreover, provision of facilities like schools, hospitals, power plants, water supply, among others are other essentials components of multidimensional life-supporting systems for urban life.

The increase in built-up land area as a result of increasing urban population implies an increase in food demand by the growing urban population. Importantly, the peri-urban areas are noted as the host to spatial expansion of the urban growth process, characterised with growing competition between agriculture and construction activities. The consequential impacts of this include high cost of food complicated by the increase in transportation cost with an attendant impoverishment of urban poor, low quality of available farm produce due to longer distance travel to which perishable foods may have been subjected before getting to the city.

It is therefore essential to evaluate the impact of sourcing construction materials on competitiveness of land for agricultural purposes in order to enhance sustainability with respect to food production and provision of shelter. African countries with shortfall in housing and infrastructure development is likely to contribute significantly to the increase in demand for sand and gravel globally expected by 2030. An outlook on sustainable competitive land use implies a need to ensure environmental sustainability with respect to exploitation, processing, production and utilization of non-renewable natural resources (the main material source) especially those having direct bearing on food production.

Demand for construction materials and impact on agricultural land use

In urban and peri-urban areas, the growing competitiveness between agriculture and construction activities have been on the increase in recent times. For instance, the study by Awoyelu and Mebo (2023) reported an increase of 121% and 153% between 2015 and 2019 (i.e. within four years) in the land area that are already sand mined in Ile-funfun and Agogo area of Ife Central and Ife East Local Government Areas of Osun State respectively, (Figure 1). The implication of this drastic increase is a reduction in the land area available for farming activities of 47% and 56% with a corresponding increase in the built-up area of 11% and 13% respectively. This also indicates the decimation of available arable land for sustainable food production for growing population. Multidimensional impacts of this include high cost of food products and impoverishment of urban poor, low quality of available foods due to longer distance travel for which perishable food may have been subjected before getting to the city.

The sharp increase in the proportion of land sand mined points to the heavy reliance of construction activities within the study area on the extraction of sand and gravel which is encroaching into agricultural land. These are peri-urban areas witnessing increasing land-use change due to urbanization and an increase in competition for land between agriculture and construction sector of the economy as the construction sector is land and material intensive. Unfortunately, sand mined areas cannot be effectively reclaimed for agricultural purposes due to the extent of degradation of the land structure and profile. However, the increase in the built-up land area as a result of increasing urban population implies an increase in food demand by the growing urban population. Hence, there is a need for deliberate action to intensify urban agriculture to reduce the impact of urbanisation on food security.

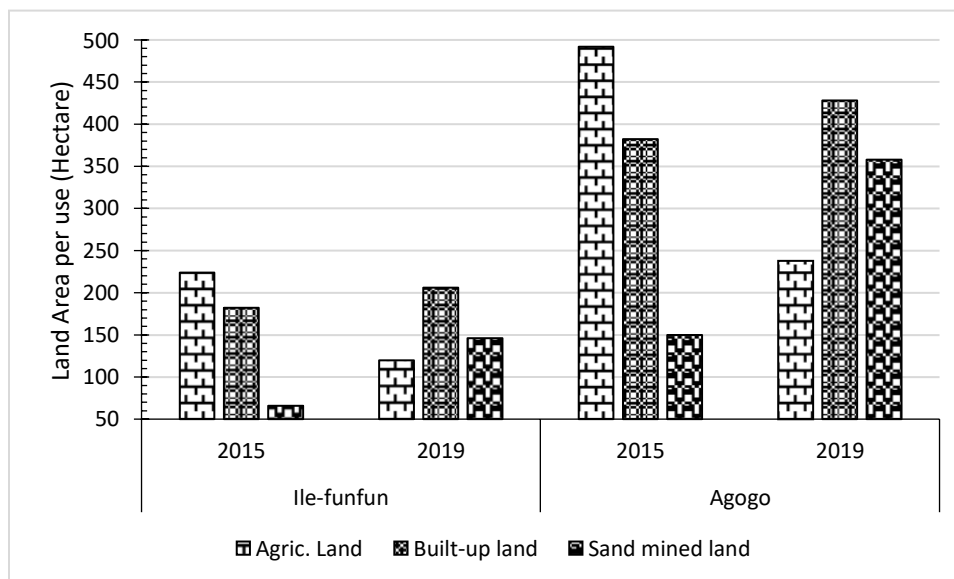


Figure 1: Changes in land-use pattern

(source: Awoyelu and Mebo (2023))

The study area

Ile-Ife is a typical traditional urban settlement in Osun State of Nigeria (see Figure 2). The city is predominantly a Yoruba speaking community located in the south-western geopolitical zone of the country. It lies between Latitude 7°15'N, 7°31'N of the equator and Longitude 4°43'E, 4°45'E as shown in Figure 2 at distance of 208 and 571 kilometres from Lagos and Abuja respectively. Politically, Ile-Ife is a major town in Osun State, as it is the seat or administrative headquarters for Ife East and Ife Central Local Governments of Osun State, and in addition serves as a centripetal force of attraction for people and development from adjoining villages, towns and cities in the state. A feat that is partly due to the presence of a federal higher institution of learning, Obafemi Awolowo University and several other higher institutions such as The Polytechnic, Ile-Ife.

Ile-Ife, just like many other traditional cities in Nigeria, is known to have existed prior to colonialism. Ile-Ife up till date still retains characteristics of typical traditional Yoruba settlements such as communal land tenure, homogeneity, small and nucleated social group relationships. However, growth in population in the town of Ile-Ife from about 92,862 people in 1963 Population Census and 178,410 in 1991 Population Census and to about 500,000 people in 2006 coupled with an increase in developmental activities brought about growth beyond the walls of the city, which produced two cities in one - the traditional city and the modern city (Afon, 2005; Badiora, 2012). This population upsurge no doubt has implication on the need for housing and infrastructure development in the town.

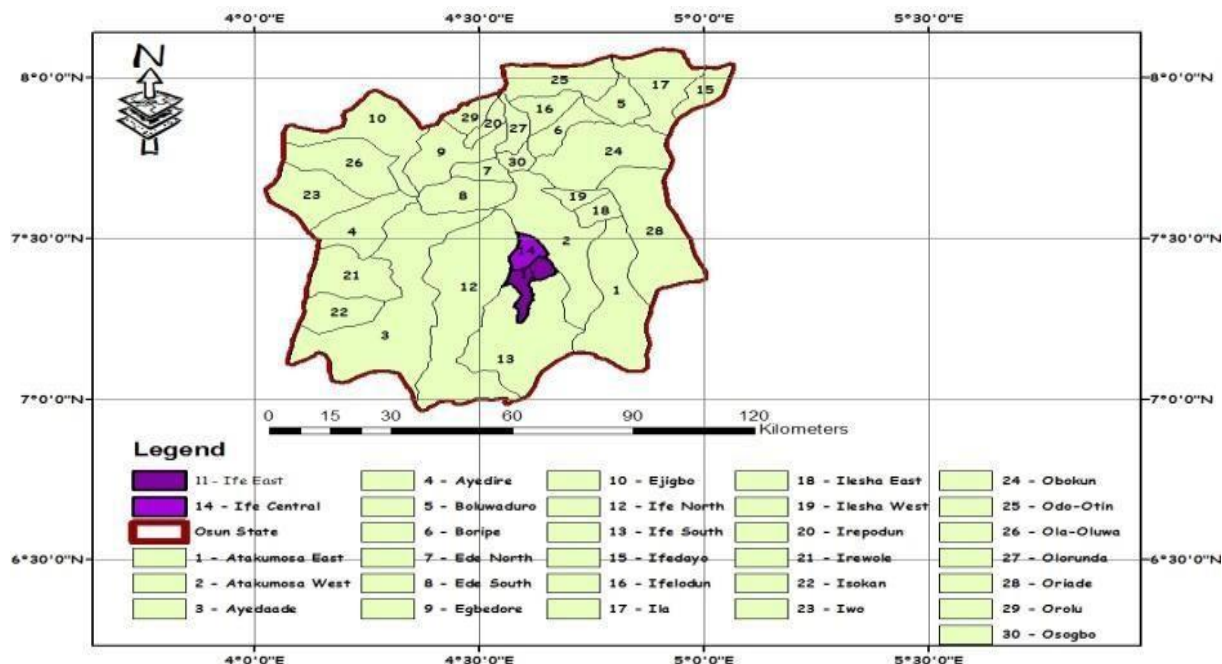


Figure 2: Map of Osun State showing Ile-Ife

Source: National Space Research and Development Agency (NARSDA), 2023

MATERIALS AND METHODOLOGY

This study employed Satellite imagery of the study area, which was obtained from Landsat. The Landsat image covering the years 2002, 2014 and 2023 was obtained with the resolution of 32m and the selected years was premised on the availability of clear data. Classification of the imagery was based on maximum likelihood using Erdas Image 2024 (QGIS). The classifications are Baresurface, Waterbody, Cultivation, Vegetation and Built-up (See Figure 3).

Typically, Bare surfaces are areas characterised with little or low vegetation density made open either by natural or human activities, which comprise bare soil, rock outcrops, sand dunes, bare ground like vacant plots, construction sites and mining sites. Waterbody refers to streams, rivers and dams, and these in Ile-Ife include Opa, Esinmirin, Amuta and Agbogbo. The cultivated areas on the other hand are portions where agricultural activities and practices takes place. Areas classified as vegetation are virgin land such as forest and woodland, while the built-up areas are portions where construction works have taken place, which include road construction, residences and physical development generally.

FINDINGS AND DISCUSSIONS

Based on the available data for the study, as at Year 2002, the Baresurface constitute 0.9% of the entire Ile-Ife among other classified features. Areas classified as Built-up accounted for 21.0% within the same year, compared with the Cultivated land with a total coverage of 30.3%, while Vegetation had that largest share of 47.3%. The remaining 0.3% constitute the portion the Waterbody.

For Year 2023, the proportion of Baresurface increased to 1.2%, which is similar to that of Built-up area with the share of 39.0%. However, there is a decrease in the proportion of area classified

as Cultivation to 25.4% and that of Vegetation (34.1%), although Waterbody maintained its share of 0.3%. For Year 2023 understudy, increase in the share of Baresurface continued unabated with a total 2.4% already exposed. Similarly, the Built-up accounted for 43.3% of the entire study area, unlike Cultivation area that further reduced to 22.2%, while 31.9% and 0.2% accounted for Vegetation and Waterbody respectively.

By implication, increase in Baresurface between 2002 and 2014 (percentage increase of 33.3%) is not as phenomenal compared with between 2014 and 2023 with an indicative percentage increase of 100.0%, and 166.7% over the period of 2002 to 2023. Invariably, the substantial increase is hinged on the vegetative/cultivated land area, which may be unconnected to sand mining activities for construction works. Similarly, consistent increase in Built-up area among other classifications could be attributed to urban growth as evident in the spatial expansion of the physical development within Ile-Ife for the years under consideration. Specifically, intensive construction activities as reflected in the proportion of the built-up area witnessed unprecedented upsurge with as much as 18.0% between Year 2002 and 2014, an indicative of 85.7% percentage increase within the space of 12 years compared with 4.3% difference between Year 2014 and 2023, and 106.2% for the period of 21 years. Among other factors that could account for this significant increase is spiral effect of the increment in minimum wage for workers in Nigeria. Minimum wage that was ₦3,000 in 1999 later rose to ₦7,500 in 2000, then to ₦18,000 in 2011. Purchasing power of citizen increased significantly and those who never dreamt of owning a property began to venture into construction activities, particularly the civil servants. Invariably, demand and consumption of construction materials such as aggregates must have necessitated increase in the proportion of Baresurface where the aggregates are sourced.

Moreover, reduction in the available arable and cultivated land across the years is indicative of encroachment in agricultural land use for construction activities with significant implications on sustainable food production for the increasing urban population. The decimation of agricultural land is further evident in percentage decrease of 28.1% in the vegetative proportion between 2002 and 2014, and 32.7% for the entire period of consideration. Waterbody only experienced a change in proportion between Year 2014 and 2023. The substantial differences in the proportions across various classification occurred majorly between Year 2002 and 2014, except for Waterbody until between Year 2014 and 2023.

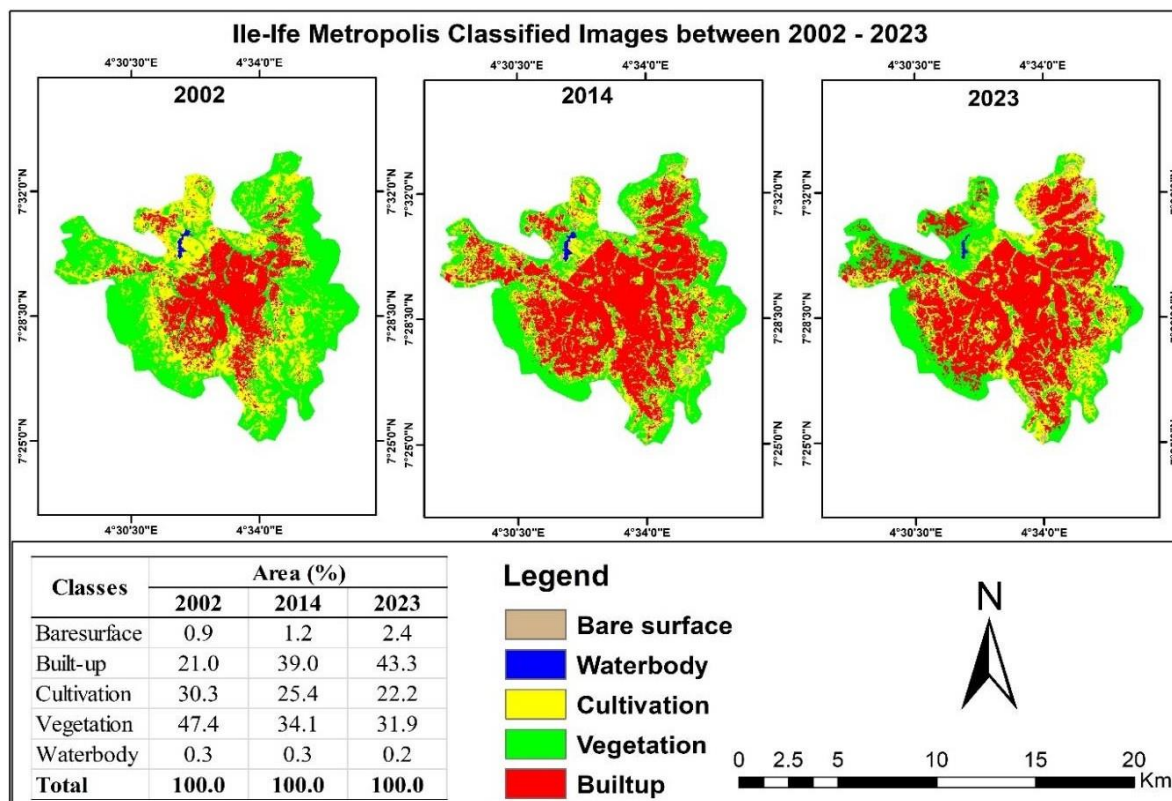


Figure 3: Classification of Ile-Ife metropolis between 2002 and 2023

Paradigm shift in competitive land use change towards achieving zero hunger

The United Nations sustainable development goal (SDG) 2 is targeted at ending hunger and malnutrition and achieving food security by 2030. However, a review by Atukunda et al. (2021) shows that Africa may not be able to meet the timeline nor achieve the goal given the current efforts and progress. No doubt, the reduction in cultivated land area and increase in the built-up area and sand mined area as a result of competitive land use is among the contributors to the shortfall in achieving SDG 2. To attain food security, there is the need to regulate and control development and construction activities which has direct bearing on food production towards ensuring availability and improving access to food in the urban and peri-urban areas.

CONCLUSION

Dynamism of urbanisation process and urban growth in Ile-Ife is evident with varying implications. Increasing economic activities and consequential job opportunities will continue to attract population to Ile-Ife with the need for housing and infrastructure development, thus, construction activities and demand for construction materials such as sand and other aggregate is unstoppable.

RECOMMENDATIONS

Based on the findings, the following are recommended to addressing sustainable food production:

- Alternative and contemporary agricultural practices in the city needs to be explored and promoted. This includes urban agriculture variants such as rooftop gardening, community

gardens, urban livestock indoor gardening, among others. This could be achieved through intensified effort such as aggressive campaign and government support for urban farmers.

- There is visibly no known physical development plan for the town to protect arable lands and guide against uncontrolled encroachment on cultivated land. It is therefore suggested that there should be concerted effort to ensure conscious planning that guides physical development and expansions within the city of Ile-Ife.
- Exploration and sand mining within Ile-Ife is highly unregulated and constitute a great threat to available land for agricultural practices towards sustainable food production. Some of the arable lands have been degraded by these unwholesome practices.
- Policy makers, particularly relating to the environment should adopt holistic view by properly tracking implications and potentials of economic improvement on physical development in order to guide against unwholesome practices.
- Construction industry can explore the use of crushed sand as partial or whole substitute to natural sand as aggregate source to reduce overdependence on natural sand and reduce environmental degradation in peri-urban areas. This will require government intervention to reduce the associated high cost of crushed aggregates.
- Also, there is the need to regulate the activities of local sand miners within the peri-urban areas as this sector is largely informal and unregulated at present.

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