



## Sustainable Urban Forestry in Nigerian Built Environments

A. C. C. Ezeabasili<sup>1\*</sup>, I. E. Iloghalu<sup>2</sup>, B. U. Okoro<sup>3</sup> and I. F. Manafa<sup>4</sup>

<sup>1</sup>School of the Built Environment, Herriot Watt University, England, United Kingdom.

<sup>2</sup>Department of Agriculture & Natural Resources, Nnamdi Azikiwe University Awka, Nigeria.

<sup>3</sup>Department of Civil Engineering, Nnamdi Azikiwe University, Awka, Nigeria.

<sup>4</sup>Department of Education Foundations, University of Nigeria, Nsukka, Nigeria.

### Authors' contributions

*This work was carried out in collaboration between all authors. Author ACCE designed the study and drafted the research frame work. Author IEL conducted field studies and surveys, identified plant species; author IFM contributed immensely to the literature searches and compilation. Author BUO managed analysis of results and participated in literature restructuring. All authors read and approved the final manuscript.*

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### ABSTRACT

Vegetation in cities and suburbs are important in making built environments more livable, economically and ecologically more sustainable. Urban forestry benefits include erosion control, flood control, fruits and some fuel wood supply. Urban forests play several roles such as relaxation, recreation, physical and psychological comfort for the public. Very importantly the type of trees planted varies with ecological zones and cultural values. Urban forest development in Nigeria is presently been threatened due to rapid urban population growth, human activities, limited land area and poor implementation of government policies. This research work was carried out to evaluate the spatial distribution of urban trees in Awka, Anambra state, Nigeria. Documented observations will aid in creating awareness of the importance of urban forest to the general public. A sustainable urban forest development and forest management techniques that accommodate human, social, political, cultural and economic factors remains imperative.

\*Corresponding author: Email: [accezeabasili@yahoo.com](mailto:accezeabasili@yahoo.com);

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## 1. INTRODUCTION

Urban forestry involves planting and maintaining group of trees within a built environment. The trees commonly found within Urban forestry in Anambra State, Nigeria include, *Treculia africana* (Moraceae), *Bambusa* spp, *Mangifera indica*, *Khaya ivorensis*, *Acacia* sp, *Gmelina arborea*, *Tectona grandis*, *Citrus* spp, *Asimina triloba*, *Elaeis guineensis*, *Cocos nucifera*, *Psidium guajava*, *Delonix regia* to mention a few. Forestry have played an important role in social, cultural, economic and environmental development of urban centers in Nigeria, such as landscape enhancement, provision of recreational and cultural facilities, erosion control, provision of shade during meetings, ceremonies, education activities, water-shade protection and supply of fruits and vegetables and fuel-wood [1]. Increasing urbanization and development have placed urban forest under extreme pressure and extinction in Anambra State, notably among others are Akpaka forest reserve at Onitsha, Nkisi forest reserve (Onitsha) and Agu Aba forest reserve at Awka.

Urban forestry is one of the promising strategies to address millions of problems associated with urbanization. Green area have the ability to afford citizens the opportunity to get direct economic and employment benefits through Urban agriculture or forestry. Urban greening is seen as a strategy for simultaneously making our cities more enjoyable, livable and sustainable [2]. Other benefits include; provision of basic sanitation, potable water and controlling of floodwaters, treatment of sewage, reduction of air pollution, disposing of solid wastes, moderating both macro and microclimates, increasing biodiversity and reducing poverty [3].

## 2. STATE OF URBAN FOREST IN BUILT ENVIRONMENT IN ANAMBRA, NIGERIA

The basic challenge for urban forestry is to develop and maintain a sustainable urban forest resource, which meets multiple societal and personal needs. The immediate challenge at rapid urbanization is the demand for land by rural-urban immigrant for housing projects thus leading to destruction of trees gardens, recreational parks, peri-urban plantations for establishment of housing units, common in

Nigeria especially the southeastern Nigeria. There is also destruction of urban and peri-urban forest to create land for infrastructural development. Intensive pressure by government and land speculators has resulted in the destruction of public institutions. Some rural urban migrants illegally cut down trees along the streets and botanical gardens and bush for fuel wood [4]. Some recreation parks and gardens have been converted into refuse dumps due to poor waste management. There is little or no fund for urban forestry management as most of the fund available is prioritized towards provision of education and health care, e.t.c. In sustaining urban forestry in Anambra State Nigeria, the three arms of sustainability must be considered which include, the environmental, societal and economic advantages of urban forestry.

Factors such as urbanization, poor farming practices, exploitation for firewood, uncontrolled logging, bush fire which is caused by farmers, smokers and hunters who look for game. Through these avoidable practices, thousands of hectares of our forest are lost every year especially during the dry seasons. Furthermore, the natural and manmade features that combined to make Anambra state one of the most environmentally stressed regions include deforestation, soil erosion, air pollution, solid waste.

Deforestation, the continuous removal or destruction of significant areas of forest cover for constructions and other use has resulted in a highly degraded environment with attendant reduction in biodiversity. It also causes soil erosion and in marginal can lead to desertification [5]. Soil Erosion, in Anambra state due to flood and erosion, some small rills which were crossed with single footstep some 30 or 40 years ago are now so large enough to expose the foundation of houses and causing gullies in neighborhoods. These situations affect more than 70% of the state land in form of sheet and gully erosion. Indeed over 550 gullies have been mapped in Anambra state with enormous soil loss and several threats to agricultural production, homes and other civil structure. Urban greenery has been proven by scientists that it ameliorate environmental variable by preventing solar radiation from heating the surrounding building and surfaces, cooling the air by evapo-transpiration and reducing wind speed [6].

Pollution, municipal and industrial pollution is a major environmental problem in Anambra state as we lack proper solid waste management scheme and monitoring and control of industrial waste rarely practiced. Solid Waste, one of the major negative impacts of high urbanization is massive waste generation (liquid, gaseous, industrial and domestic) and attendant disposal problems resulting in a threat to the quality of air and water we consume. There is a clear vicious circle linking high population growth, poverty and ecological degradation [7].

Nigeria cities and towns are mostly horrible examples of unplanned population growth, poor town planning methods, squalor and environmental degradation. Population growth has put a lot of pressure on our forest because farming population seeks for more land for survival and social housing programmers' for estates are increasing.

Source of Home Pest, Urban forest have been seen by most people as a home for insects, rodents and reptiles which inhabit trees close to the buildings, from where they easily made their ways into the roofs and crevices of buildings and most often become dangerous to the inhabitants and properties. The roots of the trees if not well guided pierce the walls and fences of the buildings.

The importance of forest in urban forestry can't be overemphasized. Benefits derived from urban forestry are innumerable, economic benefit, environmental and benefits of aesthetic/ improve scenery. Cities with designated areas for urban forests, landscaped roads and residential outlets surrounded by urban trees will experience a more stable environment and of course a reduced surface runoff during very high flood incidences. These will result to control of environmental problems of diverse kinds.

## 2.1 Objectives of the Survey

The objective of survey includes;

- To take inventory of urban trees in study location,
- To create awareness of the importance of urban forest to the general public.

## 2.2 Description of Study Location

Awka, Anambra state, Nigeria, an urban city is located between 6.20°N and 6.28°N, and longitudes 7.00°E and 7.06°E on the south

eastern part of Nigeria; study area covers 144.5 hectares with a 2006 population of 116,206 persons [9]. The vegetation of Awka, ranges from light rainforest to savannah. Dense vegetal cover with high trees is prominent around stream, river courses and the shaley lowlands while savannah vegetation and isolated trees are prominent on sandy highland; extensive man-made vegetation exist within the city and environs. The climate of Awka is the tropical wet and dry type according to the Koppen's classification system with a clear cycle of season. The mean daily maximum temperature is usually 27°C all over the year although it could reach 34°C in March and lowest during the hamattan months of December and January. The mean annual rainfall according to the local meteorological station which has maintained climatological records since 1978, reveal a mean rainfall of about 1,600mm with a relative humidity of 80% at dawn [10]. Map of Awka is depicted in Fig. 1.

## 3. METHODOLOGY

During course of research work, participants survey was employed and questionnaires to obtain base line information on the values of Urban forest were prepared and used to ferret out and collect the required information/data from Agu-Awka GRA, Anambra state, Nigeria which is an abode for different category of people.

A two stage primary data collection procedure was adopted similar to one used by [11]; firstly a cluster group was identified and interviewed. Secondly the specific groups were selected by simple random sampling technique. Two hundred respondents were randomly selected and questionnaires were administered to them. The information and data collected were analyzed both quantitatively and qualitatively. Simple descriptive statistics and parameters were utilized in the analysis.

## 4. RESULTS AND DISCUSSIONS

Data collected from the general public interest on urban forestry were subjected to simple descriptive statistics. The rate of deforestation of Nigeria's forest reserve is presently at its peak and also the world's highest according to figures from the Food and Agriculture Organization of the United Nations [12]. [13] in his research noted that, Nigeria is witnessing an unprecedented rate of deforestation, thereby undermining economic growth, exacerbating poverty and contributing to environmental

degradation. Notably the following plants are mostly affected by this deforestation and their replacement are not in view; *Milicia excelsa*, *Nauclea diderrichii*, *Tectona grandis*, *Triplochiton scleroxylon*, *Hevea brasiliensis* and *Juglans nigra* to mention a few. The results from survey reflects and agrees with assertions above, the percentage of active respondents (>76.4%) were involved during survey (Fig. 2). Migration of the rural poor and teeming population to the city also accounts for the high percentage of active respondents. This upsurge in population amongst other factors may impact on the forest reserves. According to [12], Nigeria has lost over 6 million ha or 36%, of its forest cover; between 1990 and 2005, 79% of these forests were lost and since 2000, Nigeria has been losing an average 11% of its primary forests each year.

According to [14], local people are very committed to the management and conservation of the forests by their efforts in establishing

traditional laws, forest reserved areas for deities, veneration of trees and other physical features. These laws frown against tree felling, cultivation on specific areas, bush burning, illegal hunting and fishing and restrictions to certain seasons. These traditional laws, folklores and institutions regulate detrimental activities in forest reserves. Local people have a very strong relationship with the forest lands and try their best to conserve and protect the forest (Forestry Association of Nigeria, 2003). Fig. 3 below reflects the respondents' opinion on management of forest reserves. Respondents believe that in order to attain a more stable and sustainable forest environs, partnering must be adopted with a greater percentage of involvement from the community. Results from respondents shows that 45.1% agrees that forest reserves will be more sustainable if maintained by the local government as compared to 24.4% that believed state government will maintain reserves better.

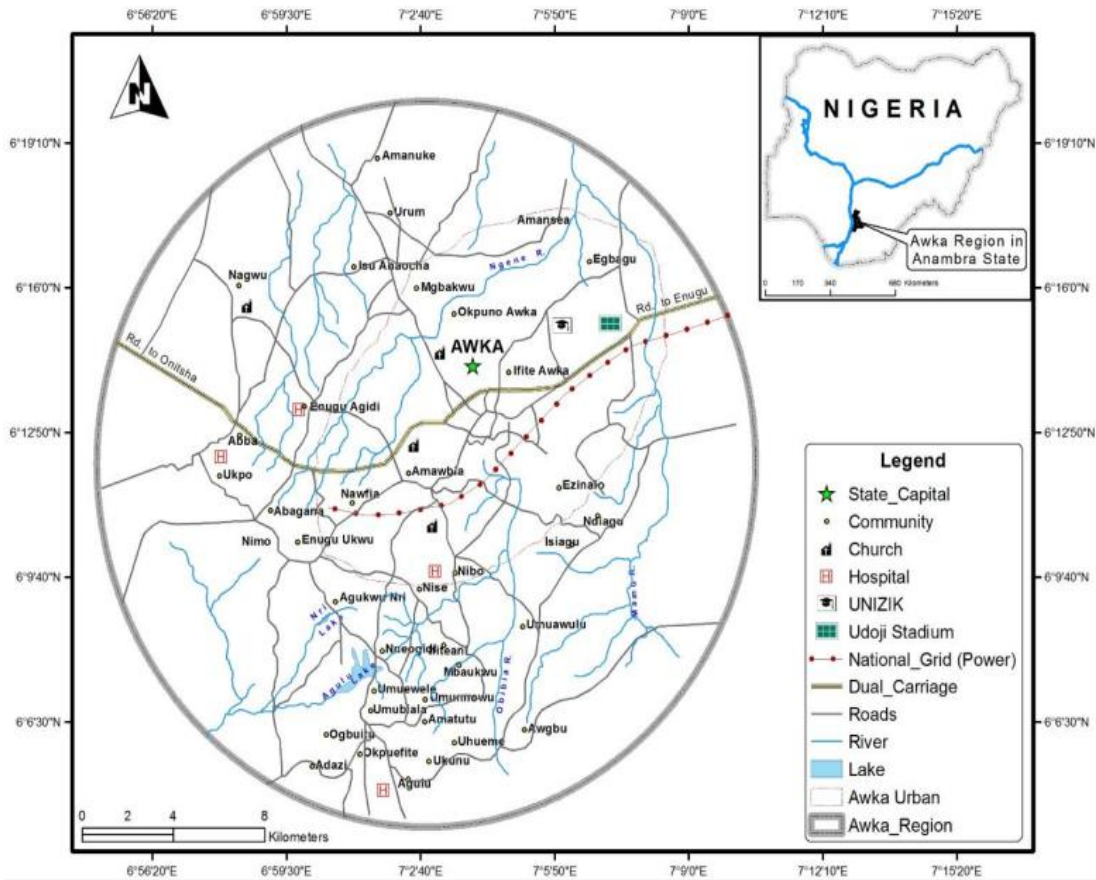
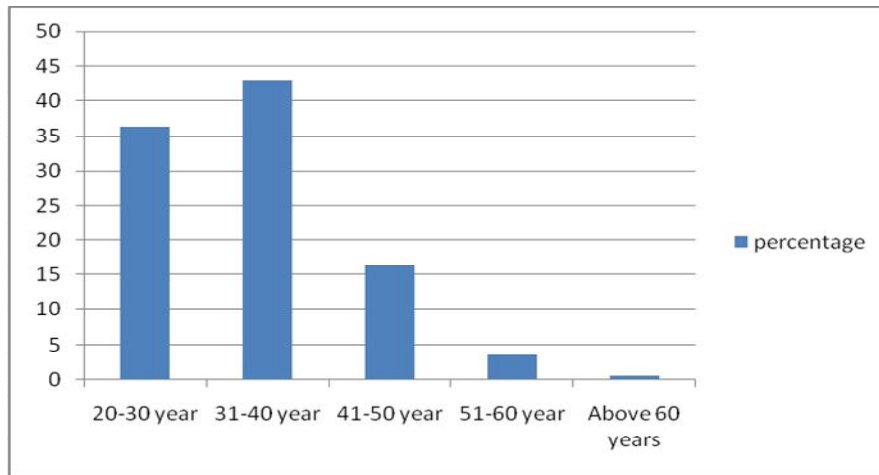
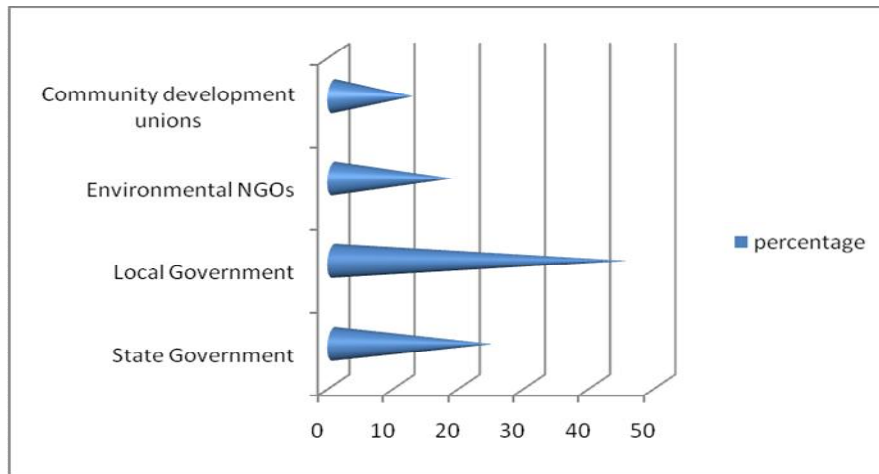


Fig. 1. Map of Awka, Anambra State, Nigeria [8]



**Fig. 2. Age distribution of respondents**



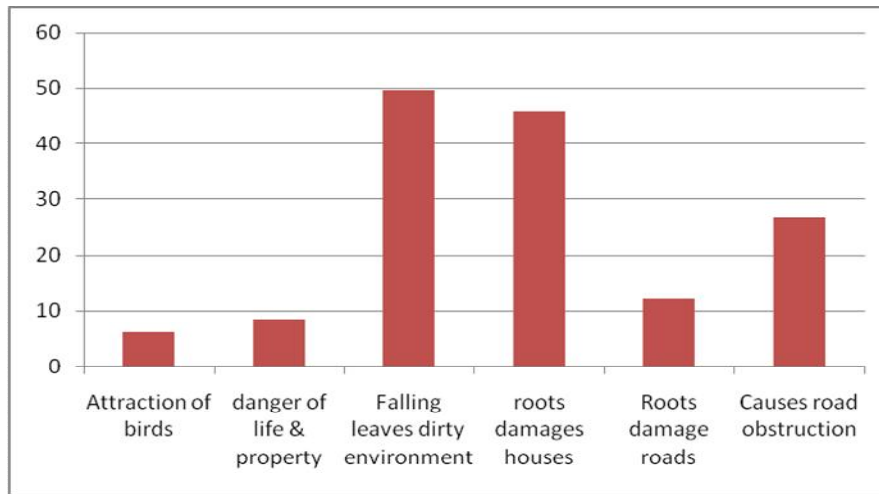
**Fig. 3. Respondents perception on forestry management**

Policies formulated by governments have significantly contributed to deforestation over the past years. Insensitivity of part of government to enforcement of prohibitory laws has contributed to illegal encroachment and incessant and unchecked logging activities in the various forest belt within Nigeria. Therefore, in order to achieve a sustainable development of forest urban forest/ reserves, locals/ inhabitants must be engaged in and during decision making processes to ensure that future existence of the forest reserves are not depleted.

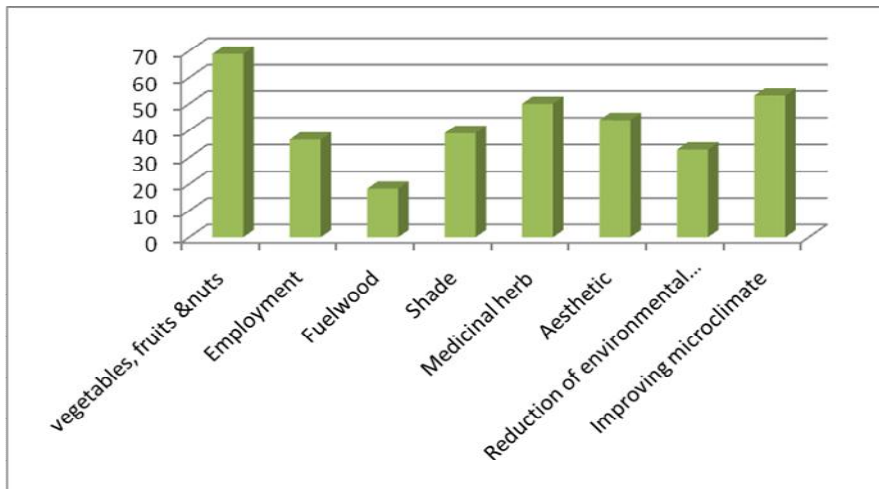
Fig. 4 shows that about 50% of the respondents agree that urban forest impacts negatively on the environment; while 35% believes it's detrimental to houses, roads, and pollution of environment. Respondents strongly agree that urban forestry have a prominent effect on microclimate (Fig. 5).

The magnitude of damage attributed to urban forestry will depend on the proximity of trees to properties/ foundation, land clearing and post-clearing soil management methods employed [16,16].

Undisturbed forest has very low rates of soil loss. Tree roots bind soil together, and if the soil is sufficiently shallow they act to keep the soil in place by also binding with the underlying bedrock. Their roots create macropores, their litter and other organic residues change soil properties that affect the capacity of soil to store water. [17] noted that, human activities like agriculture, construction activities e.t.c., disturb soil properties. This has a negative effect on the stability of soil; consequence is a predisposition and high susceptibility of the soil to erosion.



**Fig. 4. Respondents view on disadvantages of urban forest**



**Fig. 5. Respondents view on advantages of urban forest**

Altering state of soil negatively affects soil thereby altering water storage and retention, reducing erosion and providing the organic matter from which nutrients are released. Conversion of tropical forests to agriculture can result in substantial losses of soil organic matter by as much as 50% within five years [18].

There exists a link between urban forestry and climate change; deforestation aggravates problem of climate change while climate change impinges on urban forestry and the soil negatively. Destruction of urban forest destroys natural habitants of animals and also leads to biodiversity loss. When forests are destroyed, wildlife loses their habitat. [19], cited in [20] reports that forest biotopes are irreplaceable source of new drugs such as taxol, and that

deforestation can destroy genetic variations (such as crop resistance) irretrievably.

Human activities over the years have led to degradation of the environs. Flooding though a natural occurrence can be influenced by human activities also. The response of the research survey (Fig. 4), shows that majority of the respondents believes on the negative impact flooding has on the populace as witnessed during the past flood incidence of 2012 in Anambra State, Nigeria. Amongst the numerous factors responsible for flooding is deforestation, construction activities, overgrazing e.t.c. [21] noted that some prominent causes of land degradation in Nigeria includes bush fires, deforestation, increasing intensity of cultivation, tillage-related practices, low input agriculture,

accelerated erosion and construction works. Soils in Anambra state, Nigeria has been devastated by erosion; erosion, a gravity driven process that moves sediment, soil and other particles from source to an entirely different location is fostered by transportation by wind, water, by down slope creep of soil under the force of gravity is very prominent in areas with a history of deforestation in the state.

Sustainable development of forest resources encompasses enacting and formulation of managerial decisions and laws that will enhance social and economic benefits for the present and the future generation, without impairing the hydrological processes.

## 5. URBAN FOREST MANAGEMENT

A radical review of forest policy by the Nigerian government need be induced to put a check to challenges posed by rapid urbanization. The present government policy secured government control over forest resources without the participation of the people. Consequently this resulted in the indifference of people to urban forest development and occasional destruction of the forest [22]. For urban forest to be sustainable there must be policy review to integrate participatory management by members of the community in planning in designing, establishing and maintaining forests. Also, there's a need for government refocusing on alleviating poverty, providing livelihoods, and environmental services like flood and erosion control, and forest encroachment/desertification combating which are the pressing issues in Anambra State, Nigeria. Improvement of information sharing and dissemination through the establishment of network of knowledge on urban forestry will aid proper management; enlightenment of people on the values of forest in urban centers; involvement of urban community members in the management and maintenance of street trees, botanical gardens and peri-urban plantations to curtail incidences of deforestation and encroachment. There's a need for NGOs in educating the people and mobilizing them to restrain politicians and people in government from diverting designated parks & botanical gardens to other use.

## 6. CONCLUSION

Urban forest is paramount for healthy environment. Upsurge in population growth have negative impact in the city's environment and urban forest. This study has shown that the

potential of urban forests in providing essential products and services could be maintained if appropriate integrated management approach is adopted for sustainability. It becomes very imperative that all stakeholders (the public, private, academics and local community members) should be involved in planning, establishment, maintenance and protection of urban forest. Education campaign about urban forest should be intensified to create more awareness. The urban forestry sector should actively work with community groups, residents and other professional and scientist to keep urban forest in Nigeria cities green and healthy. There's a need for evaluation of the extent to which people are informed about the value of urban forest in checking global warming, soil and land erosion, flooding, noise and temperature rise in big cities of Nigeria.

## 7. RECOMMENDATIONS

Governments and Communities can help in urban forest sustainability by formation of society tree board or commission. This will regulate the rate of forest exploitation and also aid in raising funds for urban forestry management. There should be a comprehensive long range management plan to ensure a healthy urban forest and maximization of its benefits. There should be bottom top approach to the choice of the trees to plant which will enable the community to develop interest and treat as ours instead of theirs.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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