PERI

Urban forestry practices and its challenges in Makurdi metropolis, Benue state, Nigeria

J.I. Alfa[1]* and P.U. Ancha[2]

[1]Department of Forestry and Wildlife, Kogi State University, Anyigba, Kogi State, Nigeria
[2]Department of Social and Environmental Forestry, University of Agriculture, P.M.B.2373, Makurdi, Benue State, Nigeria

*Corresponding Author: lucia.sipauba@unesp.br

Abstract: The study assessed urban forestry practices in Makurdi metropolis, Benue State with a view to ascertain its current status. The study examined the urban forestry practices, the tree species mostly utilized in urban forestry practices and the challenges of urban forestry in the study area. Five council wards were randomly selected out of the eleven council wards, and four hundred respondents were selected through systematic random sampling. Data for the study was obtained with the aid of semi-structured questionnaire. Data was analyzed using descriptive statistics (frequency distribution, percentage and mean). The result revealed that planting of shade trees in residential areas is the most common type of urban forestry practice in Makurdi metropolis and this constituted 46.67% of the types of urban forestry practices in the study area. The most predominant urban tree species according to the study was mango and it constitutes 22.00% of the urban trees in the study area while the least predominant tree species was Mahogany with 0.21%. However, urban forestry is not without challenges in Makurdi metropolis. Insufficient information on the need for urban forestry represented by 31.14% is the major challenge. Other challenges include poor management by the government (29.00%), lack of access to the right tree species (12.82%), poor management by the individuals (7.88%) and legal framework (5.86%). Thus, awareness on the importance of urban forest practices should be created and proper management approach should be developed to preserve urban forest in Makurdi metropolis with the enforcement tree planting by the government.

Keywords: Urban forestry, Trees, Environment, Sociology, Economics.

INTRODUCTION

The branch of forestry, dealing with the cultivation and management of trees for their present and potential contribution to the physiological, sociological, and economic wellbeing of urban society is known as urban forestry. These contributions include the over-all ameliorating effect of trees on their environment, as well as their recreational and general amenity value (Jorgensen, 1993). Carter (1994) defined urban forestry as the management of trees for their contribution to the physiological, sociological and economic wellbeing of the urban society. He further stressed that urban forestry also includes the management of individual and groups of trees planted or naturally grown within urban areas. Lewis (1991) however, observes that urban forestry encompasses principally, but not exclusively the management of trees in urban areas, but those in peri-urban centers as well.

Urban forests are ecosystems characterized by the presence of trees and other vegetation in association with human developments (Nowak *et al*., 2002). Urban forests have a positive impact on air quality through deposition of pollutants to the vegetation canopy, sequestration of atmospheric CO_2 in woody biomass, and reduction of temperature. Furthermore, urban forests are one of the most cost-effective means of mitigating urban heat islands and associated expenditure for air conditioning (FAO, 2000). Trees also intercept and store rainfall on leaves and branch surfaces, thereby reducing run-off volumes and delaying the onsets of peak flows. Root growth and decomposition increase the capacity and rate of soil infiltration by rainfall and reduce overland flow. Urban canopy reduces soil erosion by diminishing the impact of raindrops on barren surfaces. By virtue of their proximity to people, urban forests can provide a substantial environment and recreational benefits to urban dwellers. Trees as a solar-powered technology can help restore balance to dysfunctional urban ecosystems. Besides, urban forests are strands in the urban fabric that connect people to nature and to each other (FAO, 2000).

Due to rapid and unplanned urbanization, commercial development, along with population pressure, the overall urban forest environment is being worsened seriously day by day (Mohammed, 2008). Urbanization is occurring most rapidly especially in developing countries causing major social and economic changes (Faleyimu, 2014). This rapid increase in urbanization and development has resulted in increasing demand for basic needs as fuel-wood, low-cost construction materials, drinking water and water for household use. The urban environment presents arboricultural challenges of

limited root and canopy space, poor soil quality, deficiency or excess water and light, heat, pollution, mechanical and chemical damages to trees and mitigation of tree-related hazards (McPherson & Simpson, 2002).

Increasing urbanization and development in Makurdi metropolis have placed urban forests under extreme pressure, threatening their ability to maintain the basic ecological functions, including water and air purification, upon which human existence depends. As a result of this increased urbanization and development, urban trees in the study area which provide ecological and economical functions are being fallen without replacement, giving room for increase in urban heat island. Basic information on urban forestry practices such as the various types of urban forestry practices, tree species mostly utilized, and the perceived problems of urban forestry practices in Makurdi metropolis are also not well documented. It is, therefore, imperative to ascertain the current status of urban forestry practices and identify tree species mostly utilized in urban forestry practices as well as the challenges of urban forestry practices in Makurdi metropolis, Benue State, Nigeria. This will aid informed decision making and proper management approach will be developed to preserve urban forest in Makurdi metropolis.

MATERIALS AND METHODS

The study area is Makurdi which lies between latitude 70º 20' to 80º North and longitude 80º 20' to 90º East (Fig. 1). It covers a total landmass of 80.4 km^2 and the Local Government Area (LGA) has a population of 3,00,377 people. The municipality comprises eleven council wards, but five council wards including North-Bank, Central South Mission, Ankpa/Wadata, Fiidi, and Walomayo were randomly selected for the study as shown in figure 1. Being a state capital, the inhabitants are predominantly career civil servants and traders. There are also artisans (in carpentry services, artwork, and plants or ornamental nursery operators to mention but few) in the town operating on full time basis.
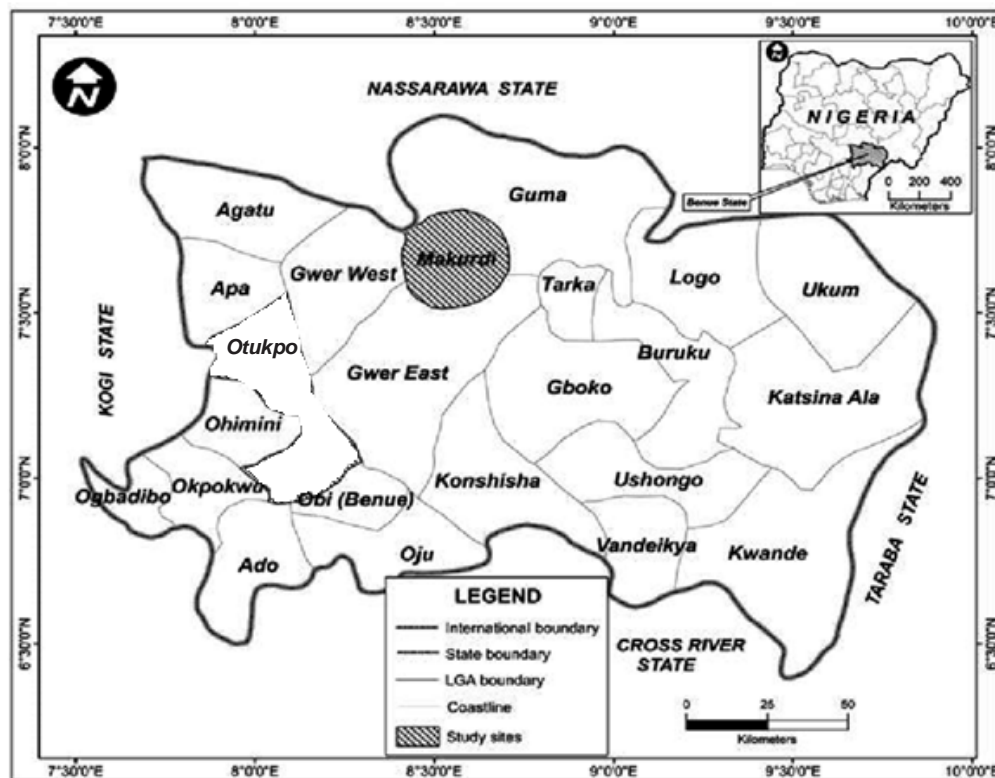

Figure 1. Map of Benue State, Showing Makurdi Local Government Area.

The population of the study consisted of male and female residents of Makurdi metropolis. Simple random sampling and systematic random sampling techniques were adopted for the study. The population figures for each of the five council wards are stated in table 1. The population was projected to 2015 using the formula:

$$Pn = Po\left(\frac{1 + r}{100}\right)^n$$

Where; Pn= Population projection; Po=Existing population; r = Population growth rate; and n = Number of years population is to be projected.

The sample size for each of the council wards was generated from the projected 2015 figures using Yamane formula:

$$n = \frac{N}{1 + N(e)^2}$$

Where, n = Sample size, N = population size and e = the level of precision (0.05).

Table 1 shows the sample size for each of the selected council wards. The total sample size for the study was 400. In each of the council wards, the systematic random sampling technique was used to select respondents in every seventh house visited. The head of each household was selected.

Table 1. Sample size for each council ward.

Council ward	Pt	Po	X
Ankpa/Wadata	22,877	25,055	67
Fiidi	35,369	38,736	103
Walomayo	34,212	37,469	100
North Bank 1	18,226	19,961	53
Central Mission	26,367	28,877	77
Total	**137,051**	**150,098**	**400**

Note: Pt= Population of the base year (2011); Po= Projected population (2015); X= Sample size of each ward.

Primary data was collected using semi-structured questionnaire which was validated by research supervisors as well as experts in Research and statistics. The questionnaire was administered to respondents in five council wards within the study area. Personal on-the-spot observations were also made. The data collection for the study lasted for a period of two (2) months in the selected council wards of Makurdi metropolis in Benue State.

The primary data collected were collated and analyzed using descriptive statistics such as frequency distribution, percentage and mean.

RESULTS

The results presented in table 2 revealed the types of urban forestry practices in the study area. Planting of shade trees in residential areas was the most predominant type of urban forestry practice in the study area, constituting 46.6% of the urban forestry practices, others were ornamentals (30.79%), Avenue planting/street trees (14.29%), Parks and Gardens (7.04%), and amenity planting (1.21%). Similarly, in the order of predominance, the other types of urban forestry practices are stated as follows; ornamentals (30.39%), Avenue planting/street trees (14.29%), Parks and Gardens (7.04%), and amenity planting which constituted 1.21% of the types of urban forestry practices in the study area. Most of the trees were sighted around houses and along roads with Flames of the forest being the tree species used as avenue planting along all the road networks in Makurdi metropolis. Thus, the most predominant type of urban forestry practice in Makurdi metropolis was planting of shade trees in residential areas while few of the respondents pay attention to amenity planting.

Table 2. Types of urban forestry practices in Makurdi metropolis.

Variables	F	%
Planting of shade trees in residential areas	388	46.67
Ornamentals	256	30.79
Avenue planting/Street trees	119	14.29
Parks and Gardens	59	7.04
Amenity planting	10	1.21

Source: Field Survey, 2015.

Table 3. Identified tree species and their percentages of occurrence in the study area.

Common name	Scientific name	Cumulative F	Cumulative %
Mango	*Mangifera indica* L.	207	22.00
Palm tree	*Elaeis guineensis* Jacq.	150	15.94
Ficus	*Ficus sycomorus* L.	89	9.46
Orange	*Citrus sinensis* (L.) Osbeck	77	8.18
Masquerade Tree	*Polyalthia longifolia* (Sonn.) Thwaites	74	7.86
Cocoa nut	*Cocos nucifera* L.	68	7.23
Umbrella tree	*Terminalia mantaly* H.Perrier	55	5.85
Neem	*Azadirachta indica* A.Juss.	53	5.63
Cashew	*Anacardium occidentale* L.	36	3.83
Flame of the forest	*Delonix regia* (Hook.) Raf.	26	2.76
Moringa	*Moringa oleifera* Lam.	21	2.23
Alexandra palm	*Archontophoenix alexandrae* (F.Muell.) H.Wendl. & Drude	18	1.91
Guava	*Psidium guajava* L.	18	1.91
Paw-paw	*Carica papaya* L.	16	1.7
Royal palm	*Roystonea regia* (Kunth) O.F.Cook	11	1.17
Eucalyptus tree	*Eucalyptus globulus* Labill.	6	0.64
Kapok tree	*Ceiba pentandra* (L.) Gaertn.	6	0.64
Gmelina	*Gmelina arborea* Roxb.	5	0.53

Baobab	*Adansonia digitata* L.	3	0.32
Mahogany	*Khaya senegalensis* (Desr.) A.Juss.	2	0.21

Source: Field Survey Data, 2015.

The most predominant urban tree species according to the study was Mango and it constitutes 22% of the urban trees in the study area while the least predominant tree species was Mahogany with a percentage of 0.21 (Table 3). The urban trees identified are presented in the order of their predominance. All the tree species used in urban forestry in Makurdi metropolis are multi-purpose tree species.

The result presented in table 4 revealed the challenges of Urban Forestry practices in Makurdi metropolis. Insufficient information on the need for urban forestry represented by 31.14% is the major challenge of urban forestry practices in the study area, and this is followed by poor management by the government represented by 29%. Similarly, lack of access to the right tree species represents 12.82% of the challenges of urban forestry practices in the Makurdi metropolis. Also, poor management by the individual represented by 7.88% and legal framework represented by 5.86% are part of the challenges of urban forestry in Makurdi metropolis. However, the result reveals that religion which is represented by 0% is not a challenge to urban forestry in the study area. Urban forestry is not without challenges in Makurdi metropolis with insufficient information on the need for urban forestry as the major challenge.

Table 4. Challenges of urban forestry in Makurdi metropolis.

Challenges	Frequency	%
Insufficient information on the need for urban Forestry	326	31.14
Poor management by the government	307	29.30
Lack of funds	136	13.00
Lack of access to the right tree species	134	12.82
Poor management by individual	83	7.88
Legal framework	61	5.86
Religion	0	0

Source: Field Survey, 2015.

DISCUSSIONS

The most widely practiced urban forestry in Makurdi metropolis is the Planting of shade trees in residential areas. This is contrary to the findings of Olayemi & Oluwafemi (2013) in Lagos Island local government area of Lagos state, where 93% of respondents felt that aesthetic reasons were the main reason for practicing urban forestry. To them, planting of trees adds beauty to the environment and transforms the drab look of slums. The preference for planting of shade trees in residential areas could be as a result of the constantly high temperature of the study area that makes the place hot and uncomfortable. This reason agrees with the study carried out by Adekunle *et al*. (2008) which stated that as a result of the predominance of concrete buildings, asphalt and metal as well as the concentration of transport systems and industrial activities in and around urban areas, the median temperature is higher (the "heat island" effect), the air is drier and often polluted, rainfall is less efficiently absorbed and the environment is generally noisier than in a rural setting. Trees are planted around houses and public institutions to ameliorate high temperature (Fuwakpe & Onyekwelu, 2010).

As a result of the "heat island" effect in Makurdi metropolis, the residents channel their efforts in planting shade trees because shade trees help in mitigating the effects of solar radiation. In modifying temperature extremes, Trees, shrubs and other vegetation help to control temperature extremes in urban environments by modifying solar radiation. The shade of one large tree may reduce the temperature of a given building to the same extent as would 15 air conditioners at 4000 British thermal units (BTU), *i.e.* 4220 kJ, in a similar but un-shaded building. NAA/ISA (1991) suggests that the energy-saving through tree-planting around houses ranges from 10-50% for cooling and from 4-22% for heating. According to Akbari, (2002), urban shade trees offer significant benefits in reducing building air-conditioning demand and improving urban air quality by reducing smog.

Ornamental planting is the next type of urban forestry practice to planting of shade trees in Makurdi metropolis. It is important to understand the public's shared believes and attitudes towards trees that promote their care, management, and protection before encouraging and ensuring community involvement (Faleyimu, 2014). Contrary to the reports that indicated that some recreational parks and gardens have been converted into refuse dump in Ibadan, Lagos, Kano and Kaduna in Nigeria; Accra and Kumasi in Ghana and Freetown in Sierra Leone (Fuwakpe & Onyekwelu, 2010), the parks and gardens in Makurdi metropolis have not been converted into refuse dump, the parks and gardens in Makurdi metropolis have not been converted into refuse dump, in other words, parks and gardens are part of the types of urban forestry practices in Makurdi metropolis. The parks and gardens in Makurdi metropolis are still in use, and this could be either as a result of the fact that Makurdi residents especially those within the young and agile group have value for recreation or because there is no scarcity of refuse dump in Makurdi that would necessitate such conversion.

Makurdi metropolis is endowed with different tree species and many of these trees are located in residential areas. Most of the urban trees in Makurdi metropolis are multipurpose tree species and this corroborates with the findings of Fuwakpe & Onyekwelu (2010) that multipurpose tree species are widely preferred for urban forestry in West Africa. This is because multipurpose urban trees are especially important for the urban poor (Jabessa, 2003). The study showed that, multipurpose trees planted in Makurdi metropolis serve more purposes than the findings of Olayemi & Oluwafemi (2013), ''Arguments put forward by the residents of Lagos Island included the fact that the trees were not fruit-bearing therefore not edible neither were they large enough to provide shade from the hot sun''.

People around the world are of one mind when it comes to the durability, availability and use of the goods and services provided by these multi-purpose tree resources, whether inside or outside the forest (Jabessa, 2003). Multi-purpose tree resources outside forests are more intimately linked to the society around them than forest trees (Jabessa, 2003). Community involvement is critical for the continued vitality of the urban forest (Dwyer *et al.*, 2002). Therefore, it is important to understand the public's shared beliefs and attitudes toward trees that promote their care, management, and protection before encouraging and ensuring community involvement (Faleyimu, 2014). To create, maintain, and preserve urban forests, it is important that urban foresters, arborists, planners, and land managers who deal with trees understand what residents, community leaders and decision-makers think about trees in the environment (NKUCFC, 2008).

According to Fuwakpe & Onyekwelu (2010), the basic challenge for urban forestry is to develop and maintain sustainable urban forest resources that meet multiple societal and personal needs. Findings from this study also revealed that urban forestry in Makurdi is not well developed and there is poor management by the state government in the study area. The project of tree planting and maintenance especially urban beautification by the state government in Makurdi metropolis has not been successful over the years. This could be as a result of less interest in tree planting by the government or non-professionals handling tree planting. It seems clear that trees outside forests have not yet succeeded in arousing real interest at the top (FAO, 2002). According to this study, individuals and communities take responsibility for the maintenance of urban trees and this they do without the influence or support of the government. This finding is not at consonance with the submission quoted thus; Considering the advantages of green space the government in most capital cities, in Nigeria have begun to inculcate a good attitude toward green space in their citizens (Ward, 1992). Poor management of urban forestry by the government which is one of the challenges of urban forestry in Makurdi metropolis could also be expressed in the diversion of fund allocated for urban forestry development to other projects. The rapid urban development has also affected allocation of fund by municipal government, where most of the fund are diverted to provision of education and healthcare, little fund is available for urban forests establishment and management (Fuwakpe & Onyekwelu, 2010).

Although, a greater proportion of the urban dwellers in Makurdi metropolis are young, agile and educated, yet insufficient information/awareness on the value and benefits of urban forestry remains immediate, pressing and leading challenges of urban forestry in the study area. This challenge reveals that there is great need for orientation on the benefits of urban forestry in the study area. This weakness reveals the level of effort the government and non-governmental organizations particularly those involved in climate change adaptation/mitigation are doing in the study area. According to NKUCFC (2008), the overall challenge of urban forestry is to increase awareness and understanding about the value and benefits of urban forests to be considered essential infrastructure when planning and managing communities.

CONCLUSIONS

Five urban forestry practices were identified in Makurdi metropolis, with ornamental and residential planting dominating the system. Furthermore, multipurpose tree species were identified as the tree species mostly utilized in urban forestry practices in Makurdi metropolis with Mango, oil palm, ficus species and oranges dominating. Species like *Baobab¸ Gmelina*, *Mahogani* and *Eucalyptus* were less predominant. Deciduous tree species like Flames of the forest were mostly utilized for avenue planting in Makurdi metropolis. The main challenges of urban forestry in Makurdi metropolis were insufficient information on the need for urban forestry, poor management by the government, lack of fund and lack of access to the right tree species.

ACKNOWLEDGEMENTS

REFERENCES

Adekunle M., Momoh S. & Agbaje B. (2008). Valuing urban forests: the application of Contingent valuation methods. *Ethiopian Journal on Environmental Studies and Management,* 1: 61-67.

Akbari H. (2002). Shade Trees Reduce Building Energy Use and CO Emissions From Power Plants. *Environmental Pollution,* 116: 119-126.

Carter E.J. (1994). The Potential of Urban Forestry in Development Countries: A Concept. Paper. FAO Forestry Department Rome, 90 p.

Dwyer J.F., Nowak D.J. & Watson G.W. (2002). Future Directions for Urban Forestry Research in the United States. *Journal of Arboriculture,* 28: 231-236.

Faleyimu O.I. (2014). Public Perceptions of Urban Forests in Okitipupa Nigeria: Implication for Environmental Conservation. *Global Journal of Science Frontier Research: D Agriculture and Veterinary,* 14(1): 14-27.

FAO (2000). *Urban Forestry Issues in North America and Their Globa Linkages*. North America Forest Commission; Item 6 (a) of the Provisional Agenda, Food and Agriculture Organisation.

FAO (2002). *Urban and Peri-urban Forestry Sub-programme: Strategic Framework for the Biennium 2002-2003 and Midterm 2002-2007*. Part of Forestry Department Mid term Plan, 2002-2007. Forest Conservation, Research and Education Service, FAO Rome, 44 p.

Fuwakpe A.J. & Onyekwelu C.J. (2010). Urban Forest Development in West Africa: Benefits and Challenges. *Journal of Biodiversity and Ecology Sciences,* 1(1): 77-94.

Jabessa S. (2003). *Urbanization and Multi-Purpose Tree Resources in Ethiopia: A Contingent Valuation Study*. Retrieved from: http://nanopdf.com/download/a-contigent-valuation-study_pdf

Jorgensen J. (1993). Urban Land Growth in the United States. Retrieved from: http://www.treecanada.ca/site/?Pag=programs_urbanforestry_history&lang=en

Lewis D. (1991). Urban Forestry: Management for Local Authorities. *Arboricultural Journal,* 15: 265-277.

McPherson E.G. & Simpson J.R. (2002). Actualising Microclimate and Air Quality Benefits with Parking Lot Sgade Ordinance. *Wetter and Leben,* 4: 98.

Mohammed N.A.A. (2008). *Opportunities and Challenges of Urban and Peri-urban Forestry and Greening in Bangladesh: Dhaka city as a case*. Retrieved from: https:/tud.epsilon.slu.se/13015/

NAA/ISA (1991). *The importance of large tree maintenance in mitigating global climate change*. National Arborist Association, Amberst, USA. Agroforestry Theory and Practices Amazon.com

NKUCFC (2008). *Challenges of Urban Forestry*. Northern Kentucky Urban and Community Forestry Council (NKUCFC). Retrieved from: http://nkyurbanforetry.org

Nowak D.J., Crane D.E. & Dwyer J.F. (2002). Compensatory value of urban trees in the United States. *Journal of Arboriculture,* 28(4): 195-199.

Olayemi S. & Oluwafemi O.O. (2013). Assessment of Tree Planting Efforts in Lagos Island Local Government Area of Lagos State, Nigeria. *Journal of Environment and Natural Resources Research,* 3(4): 12-18.

Ward S.V. (1992). *The Garden City Past, Present and Future*. E and F.N Spon, London, 29 pp.