



NEED FOR SUSTAINABLE LANDSCAPE OF PORT HARCOURT METROPOLIS

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Abstract

Over the years it has been proven that a good and proper landscaping will assist in creating a comfortable and conducive environment for housing development. Important information to decision makers regarding sustainable land management, space and time of climate variables, land surface pollution and land use changes for Port Harcourt metropolis are limited. This work highlighted the importance of landscaping as a vital key to urban development and how it can improve the outlook of Port Harcourt metropolis and meeting the desires of those living and intending to move to into the state. Landscape practices and business engagement have great potentials to uplift a city's status to either that of developed, under-developed or developing. Among the accruing benefits, are the value added to style of living, improved health status by way of alleviation of stress and development of a buoyant economy through financial in flow from provision of job opportunities and payment to garden owners for relaxation services rendered. This paper reviewed and made case for house owners and property developers to consider landscaping as an integral part of their buildings and elucidated the importance of landscaping in relation to environmental remediation.

Keywords: *landscape, value-added, land use, house*

Introduction

The standard of the urban area and the quality of life in Port Harcourt metropolis sometimes does not grow with the ever growing process of the economic development of the city while some cities grow base on increase in population as a result of more people leaving the rural area to the urban city for greener pastures. For us to have a sustainable and living environment we must focus on providing a good and quality housing. Densely populated areas are changing, and more complicated landscapes in which green or open spaces are considered to be of incalculable value for the well-being of people and wildlife are being developed (Pickett *et al.*, 2011). Throughout history, societies have struggled with environmental constraints. The sharp increase in human population triggered by the industrial revolution also increased the scale of human impact on Earth and created a negative by-product: large-scale landscape degradation, caused by an economy that does not properly restock its key assets: the ecosystem functions it depends upon (Barmelgy, 2013). The need for landscaping of Port Harcourt metropolis cannot be overemphasized as an appealing landscape contributes to people's health (Abraham *et al.*, 2010). Studies have proved that the environment surrounding a person is of great importance to his or her stress level and health (Millennium Ecosystem Assessment, 2005). Various human activities produce pressures that alter the environment, leading to negative impacts on the human health and the environmental eco-system (Barmelgy, 2013). Studies confirmed that inhabitants could benefit from nature, greening and landscape through direct contact with such an environment. Barmelgy, (2013) observed that greenery has the potential of inducing an active living and increasing public health. This finding is in line with Roger Ulrich's Psycho-Evolutionary Theory and Stephen and Rachel Kaplan's Attention Restoration Theory who argued that contact with nature aids recovery from all forms of stress, not just attention fatigue. Characteristics of the environment provide an early-warning signal for safety and survival that triggers positive emotional reactions. Key elements are a level ground surface, considerable spatial openness, the presence of a pattern or structure, curving sightlines and the presence of water (Health Council of The Netherlands, 2004). The Kaplan's consider natural settings which are aesthetically pleasing and are restorative environments which hold one's attention effortlessly (Health Council of The Netherlands, 2004). As noted by Barmelgy, (2013) landscape can be seen as the mitigation process in which health and well-being can be achieved through the sustainability process. Landscaping with ornamental trees with attractive geometric forms provides emotional soothing and healing to man is categorized in secondary consumptive value of the forests.

Among many factors, landscaping; an aspect of city development and environmental beautification has gradually gained acceptance and transformed into a culture, although through uncoordinated awareness efforts which with the immense contribution is gradually influencing the national economy at an increasing steady rate. It is not uncommon to see structures either private or public, of different magnitudes developing not without the inclusion of aesthetic plants for purposes of beautification and value addition to such properties. Cities are dynamic organisms. There is not a single 'historic' city in the world that has retained its 'original' character: the concept is a moving target, destined to change with society itself. To preserve the urban historic landscape, strategic and dynamic alliances need to be built between various actors in the urban scene, foremost between public authorities that manage the city, developers, and entrepreneurs that operate in the city (UNESCO, 2013).

Landscapes and features are important because they contribute significantly to our well-being and quality of life. They provide the broader context within which we live our lives. Living within aesthetically pleasing and culturally meaningful landscapes enhances

our sense of wellbeing. Visiting largely undeveloped landscapes enables people to re-connect with nature, to refresh their minds and bodies and to gain a greater appreciation of natural heritage. Accessible natural landscapes within close proximity of urban areas, plays an important role in increasing the quality of life within those cities. Iconic features if present, also contribute to the visual identities of the cities and settled areas (Millennium Ecosystem Assessment, 2005).

One of the prevailing environmental pollution in the city of Port Harcourt is the high presence of Black Carbon particles commonly known as “soot”. Residents of the city started experiencing particle (soot) pollution since the last quarter of 2016 (Yakubu, 2018; Chris, 2018). The state recorded a high reading of 270 micrograms per cubic meter for air pollution in the city from a 2016 sampling. According to the U.S. Environmental Protection Agency's (EPA) Air Quality Index (AQI), a reading of 0 - 50 is good, readings between 200 - 300 which Port Harcourt falls under is considered unhealthy for everyone and E.P.A advises residents of such areas to avoid heavy and prolonged exertion, and move activities indoors, (US EPA, 2014) for a 15-month period ending in June (2018). Air quality was in the unhealthy range on 240 days, with 85 days ranking very unhealthy, and 13 days as hazardous. (Cunningham, 2018). The City has also experienced increased rate of flooding, which is partly as a result of improper drainage system, ineffective town planning and landscaping and a weak waste management system. Governmental policies advocating the planting one tree per person has aided as catalyst in the observed transformations. Soot (particulates) are not only detrimental to humans in Port Harcourt and its environs but alters the photoperiods of trees and other woody species and interferes with natural biogeochemical cycles which results in early or late fruiting season of tree-fruit-bearers. Soot pollution in Port Harcourt interferes and disrupts photosynthesis and respirations of the leaves and vegetation

Important ornamental plant production and commercial centres are located in the cosmopolitan city of Lagos in South West Nigeria, alongside other cities in the humid rain forest which include Calabar in South-East and Port-Harcourt in South-South, while other centres characterized by the drier savannah vegetation include Abuja Federal Capital Territory (FCT) and Jos Plateau both located in the Middle Belt zone (Olubode *et al.*, 2015). The cultural diversity and creativity are considered as key assets for human, social and economic development accompanied by the integration of environmental, social and cultural concerns which are woven into the planning, design and implementation of urban development contributing to very positive and encouraging results (UNESCO, 2013).

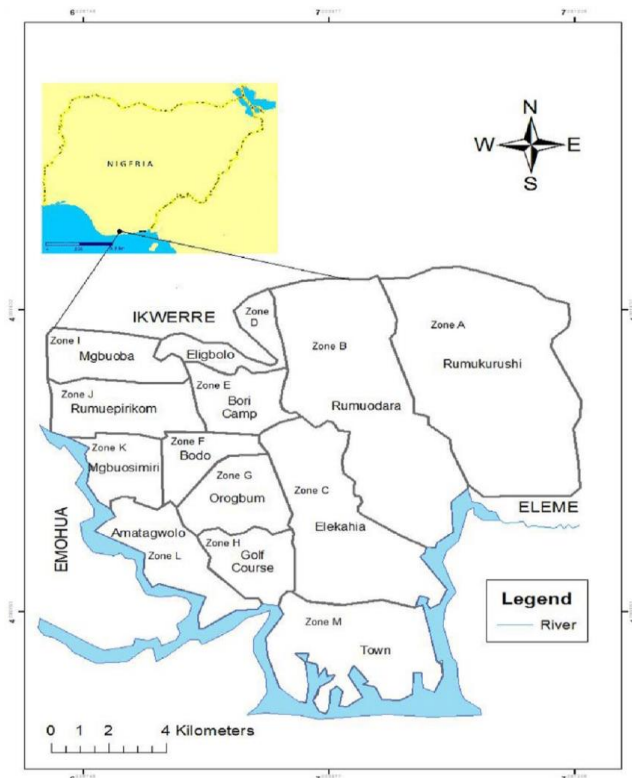


Figure 1: Port Harcourt Metropolis Map
 Source: Ministry of Environment, Rivers State (2022)

Description of Port Harcourt

Port Harcourt is the capital and largest city in Rivers State, Nigeria. It is the fifth most populous city in Nigeria after Lagos, Kano, Ibadan and Kaduna. It lies along the Bonny River and is located in the Niger Delta. As of 2016, the Port Harcourt urban area has an estimated population of 1,865,000 inhabitants, up from 1,382,592 as of 2006. (Arizona *et al.*, 2011; Demographia, 2016). The population of the metropolitan area of Port Harcourt is almost twice its urban area population estimate of 3,171,076 (United Nations, 2021). In 1950, the population of Port Harcourt was 59,752. Port Harcourt has grown by 150,844 since 2015, which represents a 4.99% annual change.

Landscape otherwise described as landscape planning has been described as a process concerned with activities geared towards the articulation of existing open spaces for the purpose of enhancing the quality of the environment (Essaghah, 1997). This includes the process of rehabilitation of open spaces as well as the coordination of the existing relationship between them. This is usually carried out in the cities with the main aim of protecting property values to revive civic pride, promote circulation and increase environmental wellbeing, in some cases to create leisure areas.



Plates 1 and 2: Use of Hard and Soft scape in construction of a walkway.

Source: Field Work, 2022

Elements of Landscape Design

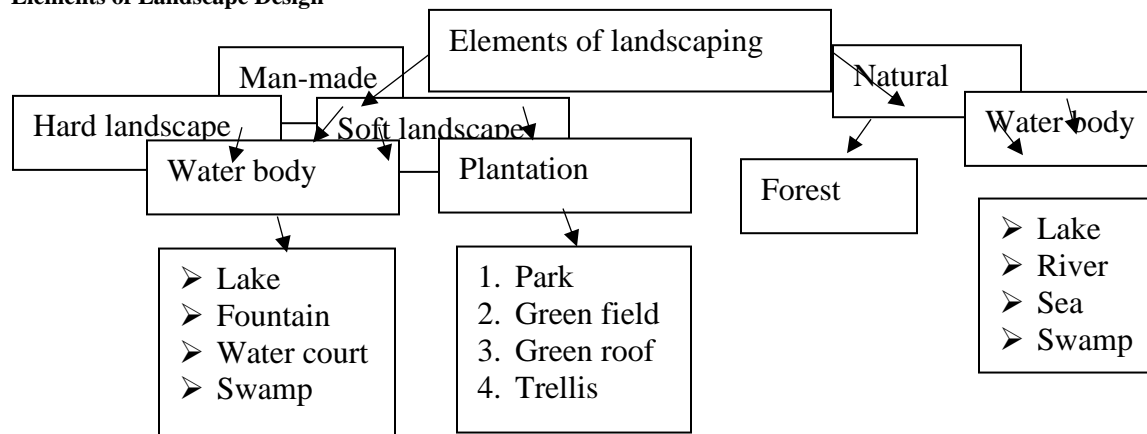


Figure 2: Landscape Design Elements

Source: Ale *et al.*, 2019

Reasons for Landscaping Adoption in Port Harcourt Metropolis

Landscaping is when trees and other plants are brought in to create an area of beauty, whether it's in a quiet neighborhood or a bustling city thus increasing the scenic value of trees and plants. Today, population estimate of 3,171,076 of Port Harcourt (United Nations, 2021) put ecological pressure on landscaped plants including trees as infrastructural development of the State Government and individuals which either alter the scenic architecture of Port Harcourt or remove avenue-planted-trees. In Port Harcourt one can find impressive landscaping projects in the form of rooftop gardens, urban pocket parks, and backyard oases. However, urban landscapes can significantly and positively impact the environment. Planting trees in cities helps reduce the levels of fossil fuels, distribute energy, and improve air and rain quality as well as surface temperature and also reduce the motility of polluted air particularly soot thereby converting soot into droplets through oxygenation. These benefits prove just how important it is to take the small step of developing urban landscapes to counteract the disastrous consequences of climate change on our planet. This simple step will promote a huge positive step for our planet's future.

Landscaping Preserves the Environment

Sprawling cities hurt the environment. We know the negative consequences of deforestation and shrinking green spaces. Landscaping provides an opportunity to preserve and protect the environment. Planting native flora, avoiding chemicals, and addressing environmental problems keep green spaces healthy and thriving. It also reduces chemical usage, Minimizes environmental impacts on land, water, habitat, and wildlife by reducing forest fires, soil erosion/runoff and pollution, Noise pollution is an often overlooked problem. Excessive or unwanted sound has negative physical and psychological effects. Noise can come from many sources, especially roads and highways. Trees can play an important role in deadening unwanted noise. Sound waves are absorbed by a tree's leaves, branches, and twigs. Studies suggest that belts of trees 100' wide and 45' long can cut highway noise to half (A Handbook of Landscape, 2013).

Landscaping Helps Manage Soil Pollution

Factory pollution is one of the most serious types of pollution. The areas around factories are poisoned by toxic waste, chemical spills, and emissions. Simply getting rid of all the factories isn't feasible at this point. Landscaping can help mitigate some of the issues when Plants purify the soil contaminated by factories. Certain plants like alfalfa and sunflower are so good at this; they are also called "super-plants." The official term however is "phytoremediation."

Landscaping Helps Clean the Air

Plants clean the air as well as the soil. Trees are especially effective at this purification. The world's forests absorb around one third of global emissions each year. Tree leaves (and the leaves of all plants) absorb pollutants like smoke, ozone, and nitrogen oxides, filtering them from the air. Some of these particulates are inhalable and can pass into the lungs and bloodstream, causing a variety of health problems. Port Harcourt metropolis can be purified through urban landscaping..

Particles of air pollutants are absorbed by leaf surfaces or they may be deposited on the leaves as they fall on the soil, they are absorbed. Mbah (2001) indicated that quantified pollution remediation by plants and showed that 85% of lead from vehicles can be removed by a shelter belt of trees. Landscaping plants mask fumes and disagreeable odour by replacing them with more pleasing scents or absorbing them. Air flow modification caused by these plants affects transport and diffusion of water pollutants and energy. Trees particularly and other plants through their growth processes act as a sink for atmospheric carbon dioxide, the predominant greenhouse gas. Mbah (2001), assert increased trees in the landscape will potentially slow the accumulation of atmospheric CO₂. In addition, the production of CO₂ by fossil powered generating plants will be reduced and energy conserved. Some plants such as *Eucalyptus saligna*, *Brunfelsia hopeana*, *Nerium oleander* etc. produce sweet scent capable of neutralizing the polluted air thereby making the air fresh for human consumption.

Landscaping Helps with Water Management

Water may be a sustainable resource, but it is not limitless. It needs to be managed carefully. Landscaping can help by prioritizing water drainage solutions; landscapers protect natural waterways, create rain gardens, and rejuvenate wetlands. Wetland-friendly landscaping is important because wetlands are endangered. These areas encourage biodiversity, purify storm water, and control floods. Humidity is a measure of the amount of water vapor in the air. As long as heat present, the heat energy will be absorbed by moisture and released to the air in exchange for the use of heat energy. Plants in general increase the humidity of the site. They can therefore increase the thermal comfort during hot, dry seasons, although the plants have to be watered regularly. The plants take water from the soil, and when this water evaporates from the leaves it increases the relative humidity while lowering the air temperature. Pools and ponds behave in a similar manner. Water evaporating from the surface increases relative humidity while reducing air temperature (Adedeji *et al.*, 2011).

Landscaping Creates a Cooling Effect

Cities can get very hot, creating what is known as "heat islands". This is when the temperature in the city is much warmer than in nearby rural areas. The presence of concrete, cars, and other human activities are responsible and to stay cool, people run their air conditioners more. Trees are nature's air conditioners. They reduce the temperature in a heat island. On a hot day, a backyard with

trees will be 6-degrees cooler than a yard without trees. The surrounding temperature goes down, meaning that people will use their air conditioners less, significantly reducing emissions.



Plate Trees, shrubs planted to beautify and provide shade.
Source: Field work, 2022

Landscaping Stops Erosion

Erosion is a serious issue, it leads to increased pollution and sedimentation in rivers and streams. Waterways get clogged, which kills fish and other species. Erosion also destroys fertile land and leads to more flooding. Landscaping, especially grass and shrubs, hold the soil together with their roots. Trees and shrubs could serve as shield to cover the bare soil while holding the soil together and their roots serving as barriers against run-offs. The characteristic features of plants in land reclamation and erosion control is that their strong spreading roots help to hold the soil particles together (Adams, *et al.*, 2002). Most of the incidences of soil erosion in urban centres can be minimized if appropriate and well planned tree planting is combined with other developmental activities. Trees such as *Terminalia catappa* has strong spreading roots that can hold the soil together. Planting of drought resistant trees such as *Azadirachta indica* and *Acacia spp* in the Northern part of the country could be effectively used to checkmate the deleterious effects of wind storm common in Kano, Borno and Sokoto States. Adams *et al.*, (2002), found that the wind breaking effect of trees has caused the reduction of wind speed by as much as 30% -50%. Trees and shrubs should be systematically arranged in the direction of the prevailing wind in order to form strong obstruction and resistance against the speed of turbulent windstorm and consequently check its devastating effects.

Landscaping Plays a Big Role in Sustainability

Sustainability is so crucial that the United Nations has a blueprint of 17 Sustainable Development Goals. They address things like climate change and environmental degradation. Good landscapers prioritize the health of the environment. They are at the forefront of techniques and innovations dealing with energy efficiency, clean water, clean air, and more.

Landscaping Improves People’s Mental and Physical Health

Studies consistently show that being in nature is good for a person’s mental health. It can improve their memory, reduce stress, and boost feeling of happiness. Nature is so powerful that something as small as one tree or a single houseplant can improve mental health. Plants such as *Araucaria spp*, *Grevillea robusta* and *Agava sisalana* (A Handbook of Landscape, 2013) are very useful for this purpose. Having access to quality urban green spaces and spending time outside exercising, playing, socializing, enjoying nature, relaxing is healthy for the body and mind. Green spaces encourage and increase physical activity, leading to numerous health benefits relevant to cardiovascular disease, diabetes, hypercholesterolemia, osteoporosis, mood disorders, psychological issues and overall health. Researches have confirmed that urban landscapes enhance the health and quality of life of city dwellers. One of the first studies on plants and psychology confirmed that hospital patients recover more quickly when they have a view of nature. Some newer hospitals around the country are incorporating this into their design and landscaping, as are some Japanese

hospitals with “ecology gardens”. Restorative gardens are used in many hospices for treating patients. A more recent study showed that office workers with a view of nature are more productive, report fewer illnesses, and have higher job satisfaction. Interior plants also can be beneficial to workers, increasing productivity and reducing stress. Studies in public housing neighborhoods show that having trees can lower levels of fear, reduce violent and aggressive behavior, and encourage better neighbor interactions. Weeding for one hour is equivalent to walking or cycling at a moderate pace, burning 300 calories. Pushing a mower for an hour is the same as playing tennis, burning 500 calories. One study specifically on women showed that those between the age of 50 years and above who gardened at least once weekly had higher bone density than those who did common exercises such as aerobics, walking, or jogging. The Sloan Kettering Institute in New York found that if women spend time in a garden they recover more quickly from breast cancer.

Landscaping Adds Value to an Area

Landscaping is not only good for the environment and peoples’ mental health but adds value to an area. It is no secret that when someone intends selling their homes, their landscaping affects the asking price. Urban landscapes create dynamic and inviting public spaces that attract people and encourage them to engage in meaningful social interaction. Good landscaping also encourages surrounding houses and areas to step up their game. Plants provide a variety of aesthetic values and accentuate the architectural design of buildings. Avenue plants such as *Thuja plicata*, *Lagaestromia indica*, *Caryota mitis*, *Juniperus chinensis*, *Hura crepitans* on our roads and pedestrian walkways create a safer restful and scenic view and provide shade to the pedestrians and other road users. Trees in a single or double row have strong visual impact. This arrangement is suitable for the urban or built environment (Adams *et al.*, 2002; Orewere *et al.*, 2019). On Rivers State University Campus trees such as *Terminalia mantaly*, *Casuarina equisetifolia*, *Polyathia longifera*, royal palm and others are planted along avenues, roads and pathways, though most of these trees are old, partly rotten and wolfed which requires replacing.



Plate Landscaping with different plant and tree species of Rivers State University, Port Harcourt, Rivers State
Source: Field work, 2022

Well-Maintained Landscaping Protects Homes and Buildings

The presence of plants (trees) is worthwhile, but there is a balance required. If left to her own devices, Mother Nature will take over. For homeowners, this can be a serious problem. The roots of trees and plants can damage the foundation of a house and get into the plumbing. Overgrowth from branches can also cause issues, though these are usually easier to spot quickly. For nature and humans to live in harmony, healthy maintenance is necessary.

Modification of Temperature

Landscape planting especially trees and shrubs modify solar radiation, for example through provision of shade. The amount of radiant energy absorbed, stored or radiated by buildings and concrete surfacing in the living environment is significantly reduced by shading. Evapotranspiration in planted landscapes helps reduce sensible heat which warms air and the result is reduced temperature. It is estimated that tree planting around houses reduces energy for cooling by 10 to 50% and in temperate climate where heating may be needed, it is reduced by 4 to 22% (NNA/ISSA, 1991; Mbah, 2001).

Improves Water Quality

Plants help anchor soil and reduce storm water runoff, saving the high costs of drainage ditches, storm sewers, and other “engineered solutions” to storm water management. A Street lined with 32’ tall trees can reduce runoff by almost 327 gallons, allowing cities to install smaller and less expensive water management systems. Reducing runoff also decreases topsoil erosion and the amount of silt and other pollutants washed into streams, rivers and lakes (A Handbook of Landscape, 2013).

Fences/Boundary Demarcation

Plant species such as *Duranta rupens*, *Dodonea viscosa*, *Hibiscus spp.*, *Thevetia peruviana*, *Rosa sinensi* are used in constructing fences in our surroundings. While popular woody species such as *Lonchocarpus cyanescens*, *P. santalinoides*, *Millefia thonningii*, *Jatropha spp.*, *Dracaena mann* *Thevetia peruviana*, *Moringa oleifera*, *Calotropis procera*, serve for boundary demarcation in both urban and rural landscapes in Nigeria. They demarcate boundaries between church lands, school lands and farm lands (Omokhua *et al.*, 2002). While Trees species such as *Terminalia mantalis* *Caesalpinia pulcherrima*, *Tectona grandis*, *Terminalia catappa* are often used as windbreaks to shelter sensitive crops (A Handbook of Landscape, 2013). Fences around private buildings provide, restrict movement of domestic animals and eliminate trespasss. They are also used in primary, secondary and tertiary institutions in game courts.

Conclusion

This paper has stressed the need for landscaping of Port Harcourt with trees and woody species due to its benefits to the city dwellers and its environs to combat and cleans the soot-pollution. The government should take the issue of landscaping seriously both in terms of design and during building construction in Port Harcourt metropolis. It also give a details importance of landscape design in respect to having a sustainable environment and as we look forward to having a better, finer, healthier and cleaner Port Harcourt city.

Improving the quality of life, human well-being and biodiversity are currently important policy drivers in metropolitan areas and megacities through urban green space. Green spaces are one of the most important wildlife habitats in the urban area. Herbaceous vegetation is an increasingly essential element of the urban landscape. Currently, public and professional urban designers increasingly accept naturalistic planting design, semi-natural grassland and meadow in the urban landscape. Both native and exotic species have an essential role in naturalistic planting design. Understanding the process of climate change adaptation is necessary to designing plant communities for use in public landscapes.

Recommendation

Based on these reviews, the following are recommended:

- Landscape design should be part of buildings and any building that does not have a proper landscape design should not be approved.
- Urban planners should always visit the site during construction to ensure buildings are constructed according to design.
- There is the need to inculcate more studies on the importance of landscaping, landscape planning and other environmental issues into the primary, secondary and tertiary curriculum.
- Professionals in landscape planning and other related disciplines (Horticulturists, landscape planners) should be employed in the Planning and Horticulture unit to handle issues of landscape design and planning in development of housing estates in the city.
- There should be need for adequate funding of landscape projects as well as sensitization to residents on the importance of an aesthetic environment as well as compel residents to show more concern and respect for the environment.
- There should be continuous and a well-structured maintenance schedule of landscape elements of the housing estates to sustain the beautification of the environment.
- Establish new forest zones and Carry out community orientation, workshops and enlightenment campaigns on climate change and reduction of carbon footprint

References

- A Handbook of Landscape–A Guide. 2013. Central Public Works Department New Delhi
- Abraham, A., Sommerhalder, K. and Abel, T. (2010). Landscape and well-being: a scoping study on the health-promoting impact of outdoor environments. *International Journal of Public Health*, 55(1): 59-69.

- Adams, B.A., Osikabor, B. and Akoun, J. (2002). The Place of plants in landscaping as a strategy for effective environment management and beautification of Urban Centres. In: Umeh, V.C. and Fagbayide, J.A. Proceedings of the Annual Conference of Horticultural Society of Nigeria (HORTSON) 14th-17th May, 2002, 202-204 pp.
- Adedeji, J.A. and Fadamiro, J.A. (2011). The “Duo”, Building Setback and Landscape Quality: Lautech (Nigeria) Neighbourhood Examined. *Journal of Architecture and Built Environment* 38 (1): 73-79
- Need for sustainable landscape of Port Harcourt metropolis.....David-Sarogoro
- Barmelgy, H.M. (2013). Sustainable landscape and healing gardens: Introducing healing gardens as a deep form of sustainable landscape. *International Journal of Development and Sustainability*, 2(3): 2051-2065
- Cunningham, Anna (22 October 2018). "Amid Staggering Pollution, Nigerians Struggle to Catch Their Breath". Undark. Retrieved 27 September 2019
- Demographia, (2016). "Demographia World Urban Areas" (PDF) (11th ed.). Archived (PDF) from the original on 5 August 2011. Retrieved 7 September 2016.
- Essaghah, A. (1997). *Urban Planning Concepts, Standards and Symbols* (pp. 59-62). Lagos, Nigeria: Amfitop Books Nig. Ltd.
- Mbah, N.B. (2001). Horticultural initiatives to current environmental concerns. In: *Proceedings of the 19th Annual Conference of Horticultural Society of Nigeria (HORTSON) held at University of Nigeria Nnsuka. 28th May-1st June, 2001, 1-5 p.*
- Millennium Ecosystem Assessment. (2005). *Ecosystems and Human Well-Being: Synthesis*. Island Press, Washington, DC. 137 pp.
- Olubode, O.O., Adekola, S.U., Idowu, S.M. (2015). Evaluation of flowering pattern, yield and yield determinants of hybrid tea rose in response to seasonal variations and applied organic manure rates. *American Journal of Plant Sciences*, v.6, n.464-482.
- Pickett, S.T., Cadenasso, M.L., Grove, J.M., Boone, C.G., Groffman, P.M., Irwin, E., Kaushal, S.S., Marshall, V., McGrath, B.P., Nilon, C.H. and Pouyat, R.V. (2011), “Urban ecological systems: Scientific foundations and a decade of progress”, *Journal of Environmental Management*, Vol. 92 No. 3, pp. 331-362.
- Population of Cities in Nigeria (2021)". Worldpopulationreview.com. Retrieved 19 November 2021.
- Port Harcourt Location, Facts, & Population Britannica". www.britannica.com. Retrieved 4 March 2022.
- Port Harcourt Population (2021) (Demographics, Maps, Graphs)". Worldpopulationreview.com. Retrieved 19 November 2021
- Port Harcourt, Nigeria Metro Area Population 1950-2021". www.macrotrends.net. Retrieved 19 November 2021
- Port Harcourt, Nigeria Metro Area Population 1950-2021". www.macrotrends.net. Retrieved 19 November 2021
- UNESCO. Landscape planning: The basis of sustainable landscape development. (2013). Available at: <whc.unesco.org/document/123570>. Accessed on: November, 2013.
- United Nations, Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. 2007. *World Urbanization Prospects: The 2007 Revision Population Database*. <http://esa.un.org/unup> (accessed 2/17/2009).
- US EPA, OAR (15 September 2014). "Patient Exposure and the Air Quality Index". www.epa.gov. Retrieved 6 August 2021.
- Yakubu, Okhumode H. (2018). "Particle (Soot) Pollution in Port Harcourt Rivers State, Nigeria—Double Air Pollution Burden? Understanding and Tackling Potential Environmental Public Health Impacts". *Environments*. 5 (1): 2. doi:10.3390/environments5010002. Text was copied from this source, which is available under a Creative Commons Attribution 4.0 International License.