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## FOREWORD

Compliment of the season to all our contributors, well-wishers and world of Academia in general. I respectfully appreciate and welcome you all to the volume 3 issue 2 of Federal Polytechnic – Journal of Pure and Applied Sciences (FEPI-JOPAS) which is a peer reviewed multi-disciplinary accredited Journal of International repute. It is imperative to re-affirm that FEPI-JOPAS publishes full length research work, short communications, critical reviews and other review articles. In this issue, readers will find a series of manuscripts of top-rated significance in pure and applied sciences, engineering and built environment. This issue is the last of its kind for 2021 calendar year which features findings from basic and applied researches of high societal impacts from the seasoned authors. These articles have been reviewed and packaged for wider readership through the collective efforts of our managing editor, publishing editors, our valuable reviewers and editorial board members.

In this particular issue, you will find that Ilelaboye and Jesusina evaluated the quality of biscuits and chin-chin made from okara enriched plantain-sorghum flour blends. Ojo and Ebisin utilized convolutional neural network for gender classification through facial analysis. Omotayo and Fafioye investigated antimalarial potential of ethyl acetate fraction of *Phyllanthus niruri* while Olubodun and Adetona examined landscaping as a strategy for combating air pollution in Lagos megacity. Buoye and Ojuawo provided imperative dataset on Covid-19 crisis management in Nigeria and Brazil. Obun-Andy and Banjo investigated effective communication as a tool for good governance in Nigeria. Yusuff and co-workers conducted a field survey on fish hatcheries in Yewa South and Yewa North Local Government of Ogun State. Akinlade and co-workers meticulously expatiated on the effect of aqueous blend of three herbs on haemato-biochemical indices of broiler chicken at starter phase. Ajeigbe, Sangosina, Ogunseitan, Lawal, & Yusuff analysed the Effects of Neem Leaves (*Azadirachta Indica*) and Cassava Peels on the Performance of West African Dwarf Goat. Abdussalam & Adewole in their paper carefully explained the Formulation of Natural Products Repellents for the Control of Cockroaches (*Periplaneta americana*). Elesin & Obafunmiso gave as Assessment of Public Toilets Facilities Provision and Management in Tertiary Institutions in Nigeria- An Overview of The Federal Polytechnic, Ilaro, Ogun State. Ajayi and Adegbola Removal of  $Pb^{2+}$  And  $Zn^{2+}$  from Aqueous Solution using Eggshell Powder as Adsorbent: Kinetics and Equilibrium Studies

I would like to deeply appreciate and extend my profound gratitude to my co-editors, editorial board members, reviewers, members of FEPI-JOPAS, especially the Managing Editor, as well as all the contributing authors for making the production and publishing of this volume 3 issue 2 a reality. I will like to appreciate the authors in this issue for allowing their works to be subjected to our thorough and rigorous peer-review processes and for taking all the constructive criticism in good fate. The authors are solely responsible for the information, date and authenticity of data provided in their articles submitted for publication in the Federal Polytechnic Ilaro – Journal of Pure and Applied Sciences (FEPI-JOPAS). I am looking forward to receiving your manuscripts for the subsequent publications.

You can visit our website (<https://fepi-jopas.federalpolyilaro.edu.ng>) for more information, or contact us via e-mail us at [fepi.jopas@federalpolyilaro.edu.ng](mailto:fepi.jopas@federalpolyilaro.edu.ng).

Thank you and best regards.

Prof. Olayinka O. AJANI

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Article

## Managing Air Pollution Through Sustainable Landscaping in the Emerging Lagos Megacity

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### Abstract

Worldwide, air pollution is a major source of mortality, sickness, and social distress. It is similarly a troubling truth in Lagos, Nigeria's commercial centre and one of the world's fastest-growing megacities. Despite mounting worries about the lethal consequences of air pollution, Lagos lacks both a policy and a comprehensive management plan. This study examined landscaping as a strategy for combating air pollution and environmental degradation in Lagos megacity with a particular focus on Ikeja Local Government Area. The methodology adopted by this study comprised field survey and review of related literature for purpose of collecting primary and secondary data respectively. A structured questionnaire was used to collect primary data from 475 households which were sampled from 95,426 estimated household population using the Taro Yamane sampling model. These findings necessitate an immediate plan of action to enhance the air quality in the city, with a particular focus on the major pollution sources: road transportation, industrial emissions, and power generation.

**Keywords:** Air Pollution, Environmental Degradation, Combating, Megacity

### INTRODUCTION

Air pollution has become an increasingly international challenge due to the release of air pollution from human activities (Motesaddi *et al.*, 2017; Von Schneidemesser *et al.*, 2019). Urban air pollution has risen as a result of human activity and weak environmental legislation (Komolafe *et al.*, 2014). Quality air is of great importance to people, plants, animals, and materials. (Garg *et al.*, 2006). Turbulence or pollution of air components caused by human activities, on the other hand, can cause significant harm or risk the lives of all living creatures on land (Wang *et al.*, 2014). In 2005, the World Health Organization (WHO) stated that air pollution was responsible for more fatalities than illnesses including AIDS, TB, breast cancer, and malaria. Lagos air pollution is a major problem in Nigeria, owing to overpopulation caused by heavy industrial and commercial activity (Odekanle *et al.*, 2016). Previous research in Lagos has shown that local air quality had a substantial influence on individuals when compared to WHO guidelines (Efe, 2008; Odekanle *et al.*, 2017). Rail transit is one of the sources of air pollution in Lagos. The significance of rail transportation as a source of certain persons at any given moment depends on the intensity of traffic and the closeness of other sources of specific things and weather conditions (Odekanle *et al.*, 2016, 2017; Onat & Stakeeva, 2013). According to a study on air quality done by the Lagos Metropolitan Transport Management Authority, Lagos Metropolitan Area Transport Authority [LAMATA] (2002), vehicle service contributes about 43 per cent to Lagos' poor air

quality. Municipal solid waste combustion is another important cause of air pollution in Lagos. It is normal practice in Lagos to burn solid garbage, even in landfills. Although the burning of solid waste informs of waste disposal is beneficial in terms of its low cost in the overall waste management, it, therefore, leads to the release of harmful compounds into the environment. The aim of this study is using landscaping materials in a sustainable way to manage air pollution, from other studies it has been shown how plant can be used to reduce air pollution. One of the biggest problems in public institutions such as Lagos is increasing the amount of waste produced (Adeniran *et al.*, 2017; Ayantoyinbo & Adepoju, 2018). Similarly, it is of importance to note that poor and uncontrolled management of public waste by the government is of great concern. Another method of solid waste originating in sawdust and wood workshop waste which are burning openly without proper environmental control (Igben, 2019; Owoyemi *et al.*, 2016). Sawmills of all sizes may be seen along Lagos's coastline. As a result, one of the most pressing environmental issues confronting the city today is determining how to dispose of the pollutants produced daily by these operators' ever-increasing operations (Igben, 2019; Owoyemi *et al.*, 2016). Without adequate disposal measures, this trash is dumped and burned along the Lagos lagoon's bank (Okedere *et al.*, 2017). As demand for wood and its products grows, the waste volume produced by these sawmills in Lagos is predicted to grow, resulting in increased emissions from waste burning. There are reports on both the



environment and the health effects of these emissions on ventilation from combustion processes. Frederica believes that the products of the burning of crude and crude oil by-product are the most serious threats in the world to the health and future of children, and make the greatest contributions to both international and environmental inequality. Similarly, the burning of fossil fuels in developed countries and the burning of biomass in developing countries have been calculated to alleviate much of the global air pollution problem, which releases up to 85% of the possible particles in the air, SO<sub>2</sub> and NO<sub>x</sub>, to the environment (International Energy Agency (IEA, 2016). Numerous health-related instances have been found as direct causes of these diseases as a result of emissions from various combustion systems (Agarwal & Yamamoto, 2015; World Health Organization (WHO, 2016). Despite all of these environmental and health concerns, distinct combustion processes happening from various sources, ranging from manufacturing operations to household cooking, continue to increase in Lagos, necessitating the need to compute emissions of combustion systems.

#### LITERATURE REVIEW

Landscaping otherwise known as landscape architecture, “is the professional skill of composing man-made structures, including buildings and paving, with the natural landscape and with designs for landform, water and planting” (Gardenvisit, 2009) The underlying notion of landscape design is problem solving via the application of horticultural science, aesthetic composition, and spatial organization to create appealing and efficient outdoor spaces for a variety of purposes. (Parsons, 2011) The benefits of a landscape. Environmental benefits: - Trees, shrubs, fences and flowers offer great environmental benefits, as plants protect the water supply, provide food (in the form of vegetable gardens) and reduce air pollution by absorbing carbon dioxide and planting oxygen dropped. Having your garden set up can also reduce noise pollution in your home by preventing ambient noise. Other reasons for landslides include reduced flood flow and therefore flooding. Also, to control the maximum temperature, it is kept cool in summer and warm in winter. Landscaping is also beneficial for erosion management, which reduces the loss of soils in waterways. Also important is the use of the garden to reduce evaporation and soil damage (Marc-Frank, 2003). b. Improving biodiversity: - Landscaping provides food and shelter for insects, birds and animals developed with them. The development has led to the dramatic depletion of indigenous communities and the division of wildlife.

In the management of our private and public landed spaces, we can provide food, shelter, water and connectivity to reduce loss, which is the result of activities such as deforestation (Novak, 2003). c. Health reasons: - Create a healthy environment by

filtering polluting agents and producing clean air. It helps to adapt to the local population by cultivating an active lifestyle. It also creates a beautiful environment that is not vulnerable to factors that promote stress and all other health challenges and provides privacy for individuals (Novak, 2003). d. Economic reasons: - Landscaping increases the economic value of assets. It also increases investment in the area in question because some aspects of land surveying contribute to physical development (Novak, 2003). e. Societal Objectives: By creating green areas, increases the quality of life of our communities. Incidentally, it is also believed that local noise reduction and heat reduction are also possible. The attraction site also serves as an agent for sports and recreation. It also increases the probability of high-density growths (Novak, 2003). Landscape Architecture in Lagos is like in any other city in the country; there is little or no deliberate landscaping within the city, both at the macro and the micro-level of the city. The general idea is that landscaping is an unnecessary component of property development and people are not aware of the function of landscaping within the built area. Roads and buildings were built with little or no plans for landscape development. The negative impact of this indifference to landscape design is often seen on the environment, especially in areas where development and urbanization are rapidly taking place. It is important to say that the use of plants to combat pollution is the main reason for this. Plants have essential ecological roles in cities by eliminating various types of organic debris (Leung *et al.*, 2011). Some research aimed at determining the material (quality and quantity) of the particles accumulated on the leaves has revealed that activating green matter to the particles may be useful because when the particles created on the turbulent path flow fall on a leaf, they are guided by a dream layer to the surface of the leaf, on which they are exposed (dry precipitation) (Beckett, 2000; McDonald *et al.*, 2007 & Rai, 2016). According to research, 1 m<sup>2</sup> of leaf area may absorb between 70 mg and 2.8 g of particles every year (Nowak, 2006 & Beckett, 2000). Some simulations produced in the United States for a large-scale project in Chicago revealed that 1 hectare of trees (11 per cent area) eliminated 9.7 kg of garbage each year (part for which the effect the most important is that the particles are less than 10m, e.g., 3.5 kg) (Nowak, 1994) and the removal for the entire urban area (e.g., 600 km<sup>2</sup>) is 591 tons. The results of Yang *et al.* (Yang *et al.*, 2005) showed that trees in central Beijing removed 1241 tons of particles in 2002 (mostly PM10, 772 tons). A work by Nowak *et al.* (Nowak, 2013) linked the removal of PM 2.5 from trees in 10 U.S. cities linked to health outcomes. The average value of PM2.5 shifts from annual trees ranging from 4.7 tons in Syracuse (NY) to 64.5 tons in Atlanta (GA), with annual values generated by direct and indirect gains from \$ 1.1 for

Syracuse to \$ 60.1 million for New York City. Most of these values are given by the effects of human mortality. The reduction in mortality is estimated at 1 / year per person in different cities, but in New York City with a population of 7.6 per year. Similar models have also been developed in Europe (McDonald *et al.*, 2007) showing the role of trees as “destroyers” of pollutant particles for other plant species and other species. (McDonald *et al.*, 2007) showed that a conscious increase in tree cover, up to a maximum of 54%, would reduce PM<sub>x</sub> concentration by 26% in the West Midlands region in the United Kingdom.

### **Lagos megacity, Air Pollution and Landscape Architecture**

In many cities in Nigeria, pollution is a sanitary practice during development. In the course of what is called physical development, the wind is unknown, trees are cut down, mountains are pushed, and so on. Lagos falls within the category of cities currently seeking development, which attracts urban sprawl but also does not assess its impact on the environment. Concerns arising from corporate activities to transportation activities may reflect the impact it has had on the air (which is the focus of this study). Human and environmental services go hand in hand. This is because any human activity takes place within the community and the result is either positive or negative for the people. According to Uchegbu (1998), negative effects of man arise from these economic and domestic activities. Areas, where air pollution is most prevalent, include transportation, commercial and industrial services, domestic services, coal burning and waste disposal (Uchegbu, 1998). On transportation, Lagos 'megacity is similar to the most developed megacities in the world. Urban travel in Lagos is very important, in transporting goods and people and therefore it stands as an economic backbone. So it is hoped that, if more trips are made on the roads, the city will often be plagued with traffic problems such as high cost of transportation, replacement of traffic and environmental pollution. City traffic faces many challenges, primarily caused by rapid urbanization and an increase in car ownership that affects the speed of traffic use and its impact on the environment. With changes in the economic system, transportation costs increase, increasing traffic capacity at a tremendous rate.

Newman and Jeffrey (1997) therefore emphasize the negative effects of urban traffic, as it contributes to accidents, water and air pollution such as road congestion on the roads. In areas with a lot of traffic, the pollution generated is expected to be very high. In a similar situation, carbon monoxide (CO) which is released from vehicles (e.g. cars, buses, trailers, etc.), this problem is more pronounced in that most vehicles are not very efficient, and improper maintain machines, therefore, emit a lot of toxic fumes, of which CO is

commonly found in and CO not being easily detectable upon emission, can result in degenerating climatic conditions, for example, ozone depletion and global warming. Therefore, whether it is a deliberate attempt of the urban traffic constituents to emit harmful atmospheric pollutants, it is still a means of development. Most cars must be equipped with exhaust fumes that separate harmful chemicals before being released into the air. It is also a possible way of air pollution reduction. The city of Lagos is notorious for its corporate activities. These companies are known for their heavy manufacturing activities that cause air pollution. Therefore, the increase in the smoke generation is not noticeable whereby unwanted toxins are released into the air. The reasons for industrial pollution range from lack of policy to pollution. The lack of effective policies and poor implementation has led many companies to avoid the rules laid down by the Environmental Protection Agency, leading to huge pollution affecting the lives of many people. Another reason is the unplanned industry development. This is noticeable in many industrial cities where unplanned growth occurs, in which companies do not read the rules and regulations and pollute the environment with both air and water. The use of old technologies is also a strong factor. Many companies still rely on old technologies to produce products and these processes produces large amounts of waste. To avoid high costs, many companies continue to use traditional custom technologies to produce high-end products. These large volumes of wastes are then released into the air and water polluting the environment. The presence of a large number of small-scale companies is also a contributing factor. Where many small and medium-sized enterprises do not have a capital base but rely on government grants to conduct their business daily, and environmental regulations are often avoided and they release large amounts of toxic fumes into the air. Ignorance is also a factor, people are not sure about the damage they do when they let out toxins into the air. In domestic works and the burning of fossil fuels, studies have shown that illegal burning around the world pumps more pollution into the air. Indoor services are also one of the most important sources of air pollution. Families in Lagos are known for using energy for many, most productive jobs. Waste disposal in Lagos is also a cause of air pollution. The more waste is created, the more we have to throw away. Some waste disposal systems release greenhouse gases and greenhouse gases into the atmosphere. Waste disposal in Lagos is most commonly manifested by traditional methods of waste disposal, i.e. burning of waste, this occurs at collection centres or even in households. The best-case scenario for waste recycling is to use other methods that do not emit large amounts of pollutants but are environmentally friendly, including burning fossil fuels - petroleum, coal, greenhouse gases and others, when they have repeated the updates. and combustion (use)

of these fuels. These activities are dangerous to the environment. After all, they release more people into the atmosphere because they facilitate the multiplication of two major environmental pollutants, acid rain and global warming. In terms of land architecture, the landscape in Lagos is no different from other cities. There is no big deal of pure landscape design, not macro or micro.

People consider landscape design as an unnecessary component during development. Individuals rarely know the extent of the activity of the landscaping, so Lagos cannot be different from other cities in its disposition to landscaping. Roads are being built, buildings raised and infrastructure have been developed, but little emphasis has been placed on the importance of landscaping. Development in Lagos has shown a negative impact on the environment for the lack of attention to the landscaping of the city. Note that the focus on the landscape as a remedy for the increasing impact of pollution is the primary aim of this study limiting the boundaries of vegetation (forest cover). The benefits of plants as a remedy to the contrary are enormous. For example, plants reduce greenhouse gas emissions (CO<sup>2</sup>) caused by many factors that contribute to climate change. The trees absorb CO<sup>2</sup>, remove it and store it while releasing oxygen into the air. Trees and plants release more oxygen into the atmosphere due to photosynthesis; they also take in a lot of greenhouse gases that contribute to air pollution. The world vegetation is responsible for the removal of two-thirds of pollution known as volatile organic compounds (VOCs) released internationally. Research has shown that one hectare of trees growing a year absorbs the amount of CO<sup>2</sup> produced when a car is driving 26,000 miles. Trees absorb harmful sunlight and greenhouse gases (nitrogen oxides, ammonia, sulfur dioxide and ozone) and filter particles from the air by trapping them on their leaves and bark. Trees, shrubs and grass remove smoke, dust and other debris from the air. A tree can remove 26 kilograms of carbon dioxide annually from the surface, which is equivalent to 11,000 kilometres of car exhaust. One study showed that an acre tree can remove 13 tons of particles and gases annually, while nearly 2,500 square feet of peat draws carbon dioxide from the air and releases enough oxygen for a family of four at the same time. Trees also save energy. It has been discovered that no less than three trees in a process placed around a single-family home can reduce air conditioning needs by up to 50 per cent. By reducing energy needs to cool our homes, carbon dioxide emissions and other pollution from power stations can be reduced. Trees can also protect a person from ultraviolet rays. Cancer is the most common form of cancer. The trees reduce ultraviolet exposure by about 50, thus providing people with protection during their outdoor activities.

**METHODOLOGY**

The data used for this study is collected from both primary and secondary sources, the use of a well-structured questionnaire and the review of related works of literature.

The Yaro Yamanne formula was applied to the population of the city to determine the sample size for the study,

The formula is given as  $n = N / 1 + N(e)^2$

Where, n = sample size desired N = population for the study e = level of significance (5%). In the end, a sample size of 475 households was arrived at and used for the study. Spearman’s Rank Correlation analysis was employed to examine the significant relationship between Lagos megacity grade of landscaped architecture and the prevalence of air pollution-related ailments and Analysis of Variance (ANOVA) was used to examine the significant differences in the occurrence of air pollution-related ailments around the megacity.

1. Spearman’s Rank Correlation

Analysis is given by:

$$Rs = 1 - 6\sum d^2 / N(n^2 - 1)$$

2. Analysis of Variance (ANOVA)

model is given by:

$$SST = \sum x^2 - (\sum x)^2 \dots\dots\dots (1)$$

$$SSB = (\sum x_1)^2 \times (\sum x_2)^2 \times (\sum x_3)^2 \times (\sum x_n)^2 \dots\dots\dots (2)$$

$$SSW = SST - SSB \dots\dots\dots (3)$$

Where, SST = Total variation (Total sum of squares) SSB = Variation between groups (sum of squares between) SSW = Variation within groups (sum of within)

**RESULT AND DISCUSSION**

Summary and Findings This paper made some findings. Prominent among such are:

1. Burning of fossil fuels, improper agricultural practices, exhaust fumes of automobiles, vehicular traffic, factories and industries, mining operations, and indoor activities are the major factors that cause air pollution and environmental degradation in cities and elsewhere.
2. The major adverse consequences of air pollution include acidification, eutrophication, ozone layer depletion, skin cancer, the release of particulate matter into the ambient surroundings, diseases etc.
3. The major causes of environmental degradation include land disturbance, pollution (air, water, soil), overpopulation, landfills, deforestation, and natural disasters.
4. The prominent consequences of environmental degradation are ill-health to man, loss of biodiversity, ozone layer depletion, depletion of national income, and loss of tourist sites.

5. Landscaping comes with many environmental, biodiversity, health, economic, and social benefits, which highly recommends it as a potent strategy for curbing the adverse effects from air pollution and environmental degradation in the Lagos metropolis.

### DISCUSSION

Air pollution is a product of man's yearning need for a better livelihood, ignorant of the after-effects, hence sustained development at all sectors of the society with its devastating effect on the inhabitants and the natural environment. To squarely address the consequences associated with air pollution and environmental degradation in cities in Nigeria, efforts should, first and foremost, be made to strengthen the official mechanisms for control of pollution such as emission from traffic, industries, and automobiles by the relevant authorities of government. Secondly and most crucially, there should be increased use of landscaping as a tool for curbing air pollution. Landscaping has a role to play in our urban environment, Enugu, in this period of rapid urbanization. It is not only of lesser cost because it deals with the natural environment which is almost complete and free, but without the conscious activity of man, wouldn't materialize. This is why landscaping should be encouraged, since it has been shown that areas with high vegetative belts of high quality experience the least occurrences of diseases, unlike the lowly vegetative areas.

### CONCLUSION

Development is viewed as a very costly enterprise but its after-effects largely go unnoticed. One of them, being air pollution, the introduction of harmful particles into the atmosphere, is the reason for health and environmental mishaps in our society today. Generally, solutions have been forthcoming and one of them is landscaping. Landscaping, which aims at shaping the environment for the comfort of man, with careful application in the urban environment, would go a long way to securing the expected livelihood of the inhabitants of the society, particularly in Enugu urban.

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