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Climate Change: Mitigating Effects of Landscaping on Carbon Dioxide Emissions in Nigerian Built Environment

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Abstract: A great concern for environmentalist globally is the increasing concentration of carbon dioxide in the atmosphere and consequently the resultant effect on climate. The Nigerian built environment has a stake in this reality if it is to survive the adverse effects of climate change. This paper focuses on Climate change and mitigating effects of landscaping on carbon dioxide emissions in Nigerian built environment. The objective of this study is to review factors responsible for carbon dioxide emissions in Nigeria, and how this can be curtailed to reduce the impact of climate change. The study was analytical in nature and relied on secondary sources of reliable data, critical review of literature and synthetic presentation of facts. It was found that burning of municipal wastes, soil erosion, wood and bush burning, deforestation and fossil fuel combustion are major sources of CO₂ emission in the atmosphere. Likewise, the review identified establishment of large scale agro-forestry programmes, providing cost effective alternatives to charcoal and firewood, soil conservation measure in agriculture, recycling non-biodegradable wastes and banning the exportation of logs as effective mitigation strategies. It was concluded that sustaining the environment in which we live is very crucial to the survival of man on earth. Hence, promulgating relevant laws and environmental friendly policies, by government would mitigate emission levels.

Keywords: Built environment, Carbon dioxide, Climate change, Landscaping, Mitigation.

1.0 Introduction

A major source of concern globally is the adverse effect of climate change on the socio-economic wellbeing (IPCC, 2012; Amba, 2016; Saliu et al., 2016; Mobolade et al., 2020). The changes that have occurred since the 1900s in global climate and the associated increase in greenhouse emissions is referred to as climate change (Allu, 2014). Anthropogenic activities resulting in increasing atmospheric concentration of greenhouse gasses especially carbon dioxide is largely responsible for climate change (Allu, 2014; Amba, 2016; Adebisi-Adelani et al., 2018).

A steady rise in sea levels by an annual average of 3.1mm have been noted by many researchers (CTA, 2008 cited in Owonubi et al., 2018). Furthermore, it has been projected that Nigeria could lose a minimum of 18, 000km² of coastal land, thereby putting about 3.6 million people at risk should the sea level rise by one meter (Owonubi et al., 2018). For instance, more than 20 million people in Nigeria live along the coastal zone (Saliu et al., 2016). Consequently, it is imperative to plan cities in such a way as to make them sustainable and environmentally friendly. Landscape architecture can be harnessed by taking into cognizance the essential elements of the environment such as vegetation, soil, topography and associated water bodies to improve and sustain the quality of life in urban environments. This has been noted by some authors (Bello, 2016; Igwe et al., 2018) who observed that this principle would help reconnect urban residents to their natural environment by developing

attractive green cities that promote environmental sustainability.

As posited by Owonubi et al., (2018) it is clear that Nigeria's long term plan for poverty reduction, food security, and the Millennium Development Goals now (Sustainable Development Goals, 2015) will be severely constrained if insufficient attention is paid to the current and future impacts of climate change on the nation. Furthermore, successful implementation of mitigation and or adaptation strategies of any kind has strong bearing on the change in behavior of the people whose individual choices may have huge collective impacts at global scale. It is against this backdrop that the study sought to assess mitigating effects of landscaping on carbon dioxide emission in response to climate change in Nigerian built environment.

2.0 Methodology

This is a literature review study with the main sources of data and information from documented sources such as books, journals, bulletins, official documents, reports, conference proceedings/workshop papers, available statistics etc. The data from these sources are then logically organized, analyzed and interpreted to bring out a clear picture of the issue in focus. The opinions and conclusions formed from this systematic process in accordance with academic research are accepted as accurate, valid and reliable.

3.0 Discussions

3.1 Sources of Carbon Dioxide Emissions in Nigerian Built Environment

Specific evidence of anthropogenic emissions of Carbon dioxide (CO₂), together with other gases have terribly caused global warming, which obviously have resulted in climate change as we know it today. The human induced activities include:

i. Burning of Municipal Wastes:

The Nigerian Environmental Society (Undated) defines waste as “any material that lacks utility or an object or substance that the owner or generator voluntarily or involuntarily relinquishes ownership”. Municipal solid waste includes but is not limited to all non-air and sewage emissions created from domestic, commercial and industrial (non-hazardous) sources (Gwom, 2016). Twenty five million tons of waste is generated annually in Nigeria with most of it burnt in open air (Owonubi et al., 2018), thus, serving as a source of CO₂ emission to the environment.

ii. Soil Erosion: Soil organic matter is the fraction of the soil that consists of plant or animal tissue in various stages 'of breakdown (decomposition), (Tessier, 2008), and is a major store house for carbon (Brady and Weil, 1999). Soil erosion has been identified as one of the factors resulting in CO₂ emissions most especially in tropical environments (Owonubi et al., 2018). Soils under natural condition and not disturbed by anthropogenic activities contains more organic carbon. (Owonubi et al., 2018).

iii. Deforestation and Bush Burning: Deforestation is the

indiscriminate removal of trees for several purposes, but without replanting to replace the one felled. Often forests in Nigeria are cleared in favor of farmlands, residential or urban infrastructure. Burning of rangelands by pastoralists, or to clear land for building purposes is a common practice in Nigeria. Bush burning provides intense and localized injections of carbon (stored in trees) into the atmosphere potentially shifting the seasonal or inter-annual distribution of CO₂ emissions (Carbon Cycle, 2017; Owonubi et al., 2018). Bush fires are lit for purposes such as hunting rodents for their meat, for land clearing during farming, for firewood for fuel and to provide fresh fodder for cattle rearing in the dry season when grazing land wither out. It has been estimated that about 20 to 25% of CO₂ emissions is a consequence of forest and bush burning (Owonubi et al., 2018).

iv. Fossil Fuel Combustion: Fossil fuel combustion is a major source of energy in Nigeria, but releases CO₂ into the atmosphere. Firewood for cooking, kerosene and gas stoves, automobiles, thermal electric power stations, household and industrial electric generators etc. are major areas of fossil fuel combustion in Nigeria. It is estimated that the transport sector alone accounts for 20% of CO₂ emissions in Nigeria (Owonubi et al., 2018).

3.2 Mitigating Climate Change through Landscaping

The following options for mitigating carbon dioxide emissions in urban environments is based on principles which through landscape architecture aims to develop attractive green cities that promote environmental sustainability. Options for mitigation include:

- i. Urban forestry:** Forests play an important role in helping to absorb and trap CO₂ from the atmosphere, the main gas responsible for the greenhouse effect and hence climate change. It is therefore imperative that designs of urban environment should deliberately include space devoted to forest establishments. This in addition would be beneficent to urban environments by improving aesthetics, ameliorating microclimates, improve soils conservation, reduce runoff and flash floods and could serve as avenue to establish miniparks.
- ii. Agroforestry:** Agro-forestry is the collective native land use system in which woody perennials are deliberately combined on the management unit with herbaceous plants in the form of spatial arrangement temporal sequence Amba (2016). Through appropriate landscape design techniques mixtures of trees grass or herbaceous vegetation can used to improve the aesthetics of the urban space while mitigating carbon dioxide emissions simultaneously. Some plants such as *Eucalyptus saligna*, *Brunfelsia hopeana*, *Nerium oleander* etc. produce sweet scent capable of neutralizing.

- iii. Green buildings:** The concept of green buildings which among others involves the incorporation of vegetation withing and without building infrastructure holds a great deal of potentials for environmental sustainability especially in urban areas. This concept has the benefit of also mitigating carbon dioxide emissions, ameliorating micro climate within and around buildings just to mention but a few.
- iv. Waste Recycling:** Waste generated in Nigeria can be classified as either biodegradable or non-biodegradable. To reduce CO₂ emissions, non-biodegradable waste should be recycled into useful products. Bio-degradable organic wastes could be recycled into organic fertilizers- details of which have been highlighted by Owonubi et al (2018).
- v. Soil Conservation Measures:** Research has shown that soils cultivated with zero tillage system traps CO₂ rather than release it into the atmosphere .Zero tillage combined with rotation of crops and permanent ground cover limits the oxidation of organic matter in the soil – a major source of CO₂ in tropical environments Owonubi et al (2018).
- vi. Other alternatives:** The enormous gas reserve In Nigeria can be harnessed to meet the energy requirement of rural household at subsidized rates through direct supply of gas to households or indirectly through electricity generation. This measure would make the felling of trees to meet

energy demands unattractive. Solar and wind power; fuel cell and geothermal energy technologies can also serve as alternative to fossil fuel combustion in Nigeria if more research is devoted to adapting them to our environment. Some developed countries have begun assessing some of these technologies to help mitigate carbon dioxide emissions in the environment.

- vii. Funding and Government support:** Government's support such as promulgating relevant laws and policies, and providing financial incentives are critical in curbing climate change. Individuals and corporate organization that are ready to establish forest estates for conservation of the environment should be given incentives.

4.0 Conclusion and Recommendations

This study reviewed the various sources of carbon dioxide emissions in Nigerian built environment and strategies for its mitigation. It was observed that burning of municipal wastes, soil erosion, wood and bush burning, deforestation and fossil fuel combustion are major sources of CO₂ emission in the atmosphere. Some specific mitigation strategies revealed by this study include establishment of large scale agro-forestry programmes, providing cost

iv.

effective alternatives to charcoal and firewood, soil conservation measure in agriculture and banning the exportation of logs. Sustaining the environment in which we live is very crucial to the survival of man on earth. Hence, promulgating relevant laws and environmentally friendly policies, by government would mitigate emission levels.

Based on the findings of this study, the following recommendations are put forward:

- i. Awareness should be created to help the populace (particularly rural dwellers) know the implications of deforestation to their environment. Government needs to re-orientate the rural populace and carry them along through afforestation program in their local community.
- ii. Effective landscape planning and implementation is very vital in achieving goal 13, 11 and 15 in the Sustainable Development Goals. This can be achieved through Land reclamation measure such as construction of a pumping station and building of dykes to channel volumes of water to safe discharge points within communities.
- iii. Design a lifeline resilient system of roads, utilities, infrastructure and other support facilities that functions in the face of extreme climatic conditions, environmental degradation, and other shocks.

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