

# Influence of Urban Environmental Greening on Climate Change Challenges in Nigeria

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## Abstract

It has now become a reality that the climate of the earth is changing, especially due to human activities and these changes has been predicted by many studies to have adverse impacts on both the natural and the built environments. While developed worlds are fast developing strategies from decades to combat these challenges, developing countries like Nigeria and other African nations are not equally proactive. Thus, developing countries will be disproportionately affected by the adverse impacts of climate change more than the developed world due to a combination of so many factors attributed to inadequate preparation and an already fragile environment. This paper examines the concept of climate change and its attendant problems. It assesses the influence of urban environmental greening on climate change challenges in Nigeria situation and investigates into the challenges which climate change poses to the achievement of sustainable city development in Nigeria. The paper identifies the need to widen the campaign for urban environmental greening by the government, professionals and other stakeholders in order to cope with these challenges.

**Keywords:** adaptation, built environment, climate change challenges, mitigation, sustainable city development

## 1. Introduction

Climate change has become an inevitable global problem, affecting almost every part of the world, in which Nigeria is not left out. Various evidences in the scientific literature indicates that in the coming decades the world will witness higher temperatures and changing precipitation levels (Churkina, 2008; Akpodiogaga & Odjugo, 2010; Chang et al., 2014). To this end, these challenges have necessitated various scientific debates at regional, national and international levels. Many research approaches were established to discover the causes of climate change and to finding appropriate solution to the daunting challenges. So far, some studies have observed that human anthropogenic activities are more responsible as the causes of the climate change than climate change been a natural phenomenon (Changnon & Changnon, 2010; Heyward, 2007; Corringham, Westerling, & Morehouse 2008; Easterling, Meehl & Parmesan, 2000). They further suggested that if climate change is actually a natural phenomenon and of various magnitudes, people may assume that they need to adapt to the result. If, however, it is demonstrated and accepted that human activities are largely responsible for the current trend in climate change, then human being should not only deal with the impacts, but also take proactive steps to prevent further interference with the natural environment.

However, the IPCC (Intergovernmental Panel on Climate Change) - a panel jointly established in 1988 by the World Meteorological Organization and the United Nations Environment Programme concludes based on its researches that human activities, including the burning of fossil fuels, land-use change and agriculture, are increasing the atmospheric concentrations of greenhouse gases which are the major constituents of earth warming agents.

According to IPCC 2007, two major activities through which humans have continue to increase the amount of GHG (greenhouse gases) in the atmosphere are; continuous burning of fossil fuel and deforestation. Forest consists of plant community predominantly of trees and other woody vegetation, occupying an extensive area of land (Aiyeloja & Ajewole, 2006). While aforestation involves the regular replacement and replenishment of forest resources, deforestation is the rates at which forests trees are cut down faster than they are replaced.

According to Farhana (2005), it is known that deforestation causes 5.9 billion tonnes of CO<sub>2</sub> per year to be released into the air, this constitute about a quarter of all carbon emissions. Forests are the lungs of the planets, breathing in carbon and exhaling out oxygen. Thus as fewer trees are left to absorb CO<sub>2</sub>, it builds up in the atmosphere, affecting the temperature, thereby threatening the sustainability of the environment.

It is therefore imperative for humans to rise up to the challenges of climate change which has prevailed on the atmosphere due to poor environmental attitude of human being. This can be achieved by adopting strategies of Urban Environmental Greening which can keep the built environment cool, green and mitigate against further increases in temperatures in urban areas. This paper therefore sets to discuss the influence of urban environmental greening on climate change challenges in Nigeria with an intention of contributing to the global research efforts at finding adequate solutions to different challenges emanating from climate change phenomenon. The specific objectives include: understanding urban environmental greening concept, identifying the effects of climate change challenges on sustainable city development in Nigeria and analysing the appropriate strategies of urban environmental greening at combating climate challenges.

## **2. Concept of Urban Environmental Greening**

According to Sorensen (1997), urban greening is an integrated, citywide approach to the planning, care and management of all vegetation in a city to secure multiple environmental and social benefits to urban dwellers. Urban environmental greening is the practice in which a significant percentage of urban environments are allowed to maintain adequate vegetal cover. This cover may however include trees, shrubs, vines, flowers, grasses and other form of (vegetal) ground cover. It also include creation and maintenance of green spaces, such as parks; planting and care of trees; and the creation of green infrastructure such as rain gardens, green roofs, street trees, community and private gardens, biowells, urban agriculture and other green spaces.

The importance of urban environmental greening ranges from the ability of the concept to mitigate against further increase in temperature, to tackle the concerns about environmental sustainability as well as controlling fragmentation of natural environment. Other relevance of the concept is in its ability to create and maintain more liveable cities. Some recent studies had discovered that cities with full tree canopies and extensive park system and trails have higher property values, are safer, and cooler (Bowler et al. 2010; Noiseux & Hostetler, 2010; Otegbulu, 2011, Dipeolu, 2014).

In her submission, Westphal (2003) pointed out some of the numerous benefits available to individuals, organisations and communities from a green environment. At the level of the individual, she opined that views of green space can have dramatic impacts on people in the following ways; reduce domestic violence, improved human health, shortens healing times, improved workers productivity, provide greater sense of well-being and neighbourhood satisfaction, and support children's development of skills and cognitive abilities. At the level of organisations, she reported that workers achieved greater productivity when they have view of green space from their place of work, and their supervisors also feel that these workers are more productive. Business districts with trees are considered more desirable and are thought to have more desirable goods and services. At the community level, Westphal explains that greener space can increase perception of safety. Public housing neighbourhoods also tend to be safer, with fewer activities and reported crimes.

## **3. The Nigerian Environment**

Nigeria, a nation of about 150 million people and an area of 923,000 square kilometres has a variety of ecosystems; from mangroves and rainforests on the Atlantic coast in the south to the savannah in the north. While excessive flooding during the past decade has hurt farming in coastal communities, desertification is ravaging the Sahel region with all of these attributed to the current trend in global climate change. Traditionally, desertification in the Sahel has been blamed on overgrazing practices of the animal farmers. But it has been discovered that the real problem is climate change (Apata, 2012). Peoples' livelihoods are being harmed, and people who are already poor are becoming even more impoverished. The Intergovernmental Panel on Climate Change (IPCC), did identify Nigeria as a climate change "hot spot" likely to see major shifts in weather in the twenty-first century (Odjugo, 2005).

## **4. Climate Change and Challenges of Sustainable City Development in Nigeria**

The rate at which the climate is changing is a constant challenge to issues of sustainable city development in Nigeria. This is because, a sustainable development is not possible when the resources (natural and artificial) and other valuable elements of the city are constantly been challenged without an appropriate breeding space to grow. Sustainability is a state of dynamic equilibrium achieved by taking responsibility for balancing long-term economic, environmental and social factors (Newman & Kenworthy, 1999). The concept of sustainability has as

its fulcrum to tackle the most powerful human needs in the following areas: economic development to overcome poverty; the need for environmental protection of air, water, soil, and biodiversity, upon which human being ultimately depend; and the need for social justice and cultural diversity to enable local communities to express their values in solving these issues (Newman & Kenworthy, 1999).

Among many factors threatening sustainability in the built environment is the issues of climate change. Studies have shown that for the past few decades, anthropogenic factors likes urbanization, deforestation, population explosion, industrialization and the release of greenhouse gases are the major contributing factors to the depletion of the ozone layer and its associated global warming and climate change (DeWeerd, 2007; Odjugo, 2007).

Since the industrial revolution, humans have increasingly altered the global carbon cycle and the rising concentration of atmospheric carbon dioxide (CO<sub>2</sub>) has become a growing concern (Parry, Canziani, & Palutikof, 2010). Cities play an important role in the global carbon cycle, emitting large amounts of CO<sub>2</sub> due to energy consumption, transportation, and land conversion from natural or semi-natural ecosystems into built environment (McPherson, 2001; Churkina, 2008; Svirejeva-Hopkins, Schellnhuber & Pomaz, 2004). This global industrial revolution has brought with it divers kind of challenges to the environment. Very noticeable among this is the extreme weather events (both cold and hot) which have caused havoc to lives and properties in recent years (Dipeolu & Fadamiro, 2013).

As stated earlier, another human activity identified as major way by which humans have and are continuing to change the amount of GHG in the atmosphere is deforestation. The reduction in the amount of forest trees and many green infrastructure facilities within the built environment has led to more greenhouse gases remaining within the atmosphere. In addition to the foregoing, modern agricultural practices also constitute a source of climate change. For example, nitrous oxide from chemical fertilizers and methane given off by animals and manure also has significant impacts on the GHG (Bonan, 1997).

The result of the aforementioned challenges currently been experienced, has dilapidated the sustainability of both biodiversity and the human environment. The cases of flooding, rainstorm, urban degeneration, drought, erosion and many other dysfunctional environmental phenomenons have become routine occurrences in Nigeria. For example, the extreme weather conditions that generate heat and drought of the desert in Northern Eastern Nigeria, poses threat to sustainable livelihood. There is threat to food security and livelihood because agriculture in Nigeria is largely sustained by rainfall and can be adversely affected by changes in rain patterns; threat to health because of the prevalence of diseases such as malaria, cholera, cerebro-spinal meningitis and other diseases which could be exacerbated by extreme weather events such as flooding, and changes in temperature and humidity patterns. In Niger Delta region, the cumulative practice of environmental degradation arising from pollution of land, gas flaring, and release of various carbon contents during oil exploration has contributed a lot to climate change challenges in the environment. (Salihu & Ali, 2007; Jackson, 2013).

Furthermore, flooding after rainfall has become a routine experience in Nigeria. For example, the furious flood of 7th and 8th, July 2011 in Lagos state (South western) Nigeria, forced residents to relocate as a result of heavy rain with the following week witnessing a more devastating torrential rain in Lagos Metropolis (Mordi, 2011). The 2012 floods that ravaged nearly 25 states with untold economic, social and political consequences clearly debunk the notion that Nigeria is insulated from these environmental problems (Jackson, 2013).

Sustainable urban development is essential to enhance the quality of life of the citizens and to decrease the impact of cities upon resources outside the urban context (Odjugo, 2007). Redeveloping and planning green spaces and urban structure become the fundamentals of the sustainable urban planning of a city. An effective urban planning using urban greening strategy is required to contribute to the physical and social development of the cities through promoting the land value and the local economy. Reducing CO<sub>2</sub> emissions by creating more urban environmental greening and infrastructure that is energy and resource efficient, and by encouraging more liveable cities is urgently required to solve the challenges of sustainability in the built environment (Metz et al., 2007).

## **5. Strategies of Urban Environmental Greening on Climate Change**

### *5.1 Carbon Sequestration*

This is the process of removing carbon dioxide CO<sub>2</sub>, (which is one the main causes of global warming) from the atmosphere. It can be done through engineering processes, chemical processes and biological or agricultural processes. It equally describes long-term storage of carbon dioxide or other forms of carbon to either mitigate or defer global warming and avoid dangerous climate change (Changnon & Changnon, 2010). It has been proposed

as a way to slow the atmospheric and marine accumulation of greenhouse gases which are released by burning of fossil fuels. In agricultural sequestration, plants absorb carbon dioxide during growth and release oxygen which is needed for man effective respiratory system. It simply implies that the more the green spaces in the environment, the less the amount of carbon dioxide that will be present in such an environment since there will be rapid competition for the few available carbon dioxide for the survival of the green plants in such environment. Carbon sequestration will be very applicable in areas where there are huge amount of fuel burning activities; especially on major traffic ways, industrial compounds and various manufacturing sites laden with heavy power generating equipments.

### *5.2 Restoration and Protection of Biodiversity*

Biodiversity is from the word **biological diversity**, it includes all organisms, species, and populations; the genetic variation among these; and all their complex assemblages of communities and ecosystems. It also refers to the interrelatedness of genes, species, and ecosystems and their interactions with the environment. Part of the concept of urban environmental greening is to restore and protect the organisms, species, and various populations which might have been depleted from an environment due to human practices like urbanisation, deforestation and various form of bush burning.

### *5.3 Control Urban Heat Island Effects*

The temperatures in urban areas are often significantly higher than in surroundings rural areas. This phenomenon is referred to as the urban heat island (UHI), and results from the generation and retention of heat by urban buildings and paved surfaces. The UHI results in higher energy demand during the summer season but the effect can be reduced by increasing the vegetation density of the urban environment through efficient urban greening practice.

In some cities where hot temperatures are high, tree planting is one of the most cost-effective means of mitigating urban heat islands and associated expenditures for air conditioning (Gómez-Muñoz, Porta-Gándarab, & Fernández, 2010; Ayeni & Adedeji, 2014). Trees and other vegetations are considered essential to moderating the heat gained by asphalt parking lots. Also, the radiative and thermal effects in shaded areas have proved to be significantly lower relative to the non-shaded areas (McPherson, 2001). In addition, the evaporative cooling effects of the plants have resulted in lower air temperature around shaded walls. Apart from the energy savings that can be achieved from the use of trees as shading devices, there are also significant improvements on the environment which result from the reduced emissions due to the energy savings and the aesthetic influence of trees on urban landscape.

### *5.4 Access to Nature*

Access to some form of nature is always considered to be a fundamental human need from generation to generation. So also are attractive, green and well-watered landscapes as an essential constituent of the ideal, paradisaal, healthy environment (Lau & Yang, 2009). Writers from the earliest times have recognised that the landscape not only provides for human nutritional needs, it also supports at every level of human wellbeing. The challenge faced in today's society is that human being have often created environments for daily living and working which present more hazards to health than benefits (Ayeni & Adedeji, 2014). Global warming and natural environmental catastrophes brings to mind of the fragility of humankind's engineering and urban constructions at a world scale and it can be seen how insensitive development and pollution can create problems which transgress regions or national boundaries.

### *5.5 Improved Health Conditions*

Human beings are exposed to climate change through changing weather patterns (temperature, precipitation, sea-level rise and more frequent extreme events) and indirectly through changes in water, air and food quality and changes in ecosystems, agriculture, industry and settlements. Though, the effects of climate change to date may have been small in some region, they have been projected by researchers (Easterling et al., 2000; Chang et al., 2014) to progressively increase in all countries and regions. The benefit of urban environmental greening according to a research by Sugiyama et al. (2008), those living in greener areas report their physical and mental health status to be better than those living in less green areas because of constant access to green environment. Neighbourhood green areas such as urban parks, public open space, sports facilities with green amenity and nature reserves are thus likely to have a role to play in promoting residents' health (Bedimo-Rung, Mowen & Cohen, 2005).

### *5.6 Pollution Abatement and Cooling*

Trees and other plants have been labelled as the "lungs of cities" (McPherson, 2005) because they have the

ability to remove contaminants from the air that is breathed. Acting as natural filters and reducing air pollution, it has been shown that plants generate health benefits by reducing the mortality rate and reducing visits to the hospital (Powe & Willis, 2004). Every tree helps fight global warming by reducing the amount of greenhouse gases in the atmosphere. By absorbing carbon dioxide and pollutants fuelling climate change, parks and green space offset the warming effects on cities, making them cooler.

## 6. Summary, Conclusions and Recommendations

The 21st century has presented diverse kinds of environmental challenges requiring urgent human action. Some of these challenges include, flooding, rainstorm, urban degeneration, drought, erosion and many other dysfunctional environmental phenomena. While researchers are working tirelessly at resolving the challenges of urbanization, challenges of global climate change have apparently caught up with these efforts. It is therefore essential that human beings who are the major collaborators with global warming inducing agents should work out the solutions to these daunting challenges.

One of these actions is to work more on how to maintain the natural ecosystem within the built environment through the concept of urban environmental greening. It should be noted that apart from natural green plantings or forest areas, conscious efforts should be made by individuals to develop positive environmental attitudes and support the action towards greening up the built environment. More awareness campaigns should be intensified by the government and other stakeholders for people to be more knowledgeable on the concept and benefits derivable in urban environmental greening as this will determine the extent of support the concept will receive from the society. Also, the practice of fall a tree, replace with 10 other plantings should be established by all state governments in Nigeria and should be massively supported by all citizens. If all the above stated recommendations on urban environmental greening are well articulated and carried out appropriately by all stakeholders then, climate change challenges in Nigeria, and other nations of the world will be appropriately tackled.

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