

CLIMATE CHANGE AND ESTATE MANAGEMENT

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Abstract

The effect of housing and climate change on the Nigerian Environment was assessed employing secondary sources of data. It revealed among other things that climate change is due to natural force and anthropogenic activities of man especially in the course of building his house. This alters the Natural equilibrium of the eco-system. The energy mostly used today in houses is produced from burning of fossil fuels which emits greenhouse gases (GHGs) into the atmosphere. These cause global warming and by extension climate change. The paper recommended adaptation and mitigation strategies through sustainable architecture as panacea. It concluded that climate will continue to change; however, man must only tap the natural resources for his survival in a responsible and sustainable manner.

Keyword: Climate change, estate management, Anthropogenic, natural equilibrium, Eco-system and Sustainable architecture

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Introduction

Global warming is real. It has direct impact on the climate and consequently on the environment, human life and socio-economic activities.

Many countries of the world are experiencing extreme weather conditions and climate change associated natural disasters which scientists have concluded are being induced by human activities (Atilola, 2012). Scientists and major research centres in industrialized countries averred that human activities through the emission of carbon dioxide into the atmosphere is the single major cause of climate change and unpredictable weather conditions the world over. While the industrialized countries of the world, the major contributor to climate change, have the capacity to respond to the impact of climate change, most developing countries do not have adaptive capacity for global warming. They therefore need assistance from developed countries to combat the effects of climate change on their environment and economic wellbeing.

The country is currently having unprecedented rainfall and massive flooding that has wreaked havoc in not less than ten states and still counting. An instance of this is that Anambra State Government established about 28 shelter camp centers in the flood prone areas of the state to help cushion the effect for the flood ravaged people of the state. Other flood prone states also did the same or similar thing to reduce the adverse effect of the flooding in their respective states.

The 28 shelter camp centers were established before the flood increased meaning that more camp centers will be established to reduce long journeys for people not living close to the established centers.

The State Government approved the establishment of 28 emergency shelter centres in flood prone areas to help in the amelioration of hardships for the people. The 28 emergency shelter centres are in some flood prone local government areas of the state like; four in Awka North, three in Ihiala, Idemili South, two in Ayamelum, four in Ogbaru, six in Anambra West, six in Anambra East and two in Ekwusiego.

The emergency shelter centres were set up in flood prone Local Government Areas' secretariats or headquarters. The State Government, however, urged residents to get prepared for emergency evacuation or relocation, in case of flood disaster.

The residents have also been urged to have a small box, where they should put relevant and vital documents, as well as be ready for evacuation anytime the need arises. It is believed that with the forecast of Nigeria Hydrological Services Agency (NIHSA) and Nigerian Meteorological

Agency (NiMet) on flooding in 2018, it might likely be in the same magnitude of 2012, so SEMA had planned ahead.

Imagine a world with affordable, clean energy, sustainable cities and communities, and decent work and economic growth for all. That is the world the United Nations imagined when it defined the 17 Global Goals for Sustainable Development with “the desire to create a future where there is no poverty, the planet is protected, and all the people enjoy peace and prosperity.” But the reality is, that world can’t exist without the equal participation, and leadership, of women as business and political leaders, investors, and contributors to the global economy. Just look at recent events in Nigeria. People are already blaming climate change for the kind of flood ravaging some states in the country. People are also saying and confirming that the kind of rain these days and the kind of flood noticed have not been the usual.

The kind of cold whether that go with it is also very unusual. That is climate change. For instance, in Kogi, DeltaState, Beyelsa, Edo, Benue and other states, their roads have been cut off making road users go through untold hardships to meet their daily needs.

You might know what weather is. Weather is the changes we see and feel outside from day to day. It might rain one day and be sunny the next. Sometimes it is cold. Sometimes it is hot. Weather also changes from place to place. People in one place might be wearing shorts and playing outside. At the same time, people far away might be shoveling snow while others will be busy bailing water.

Climate is the usual weather of a place. Climate can be different for different seasons. A place might be mostly warm and dry in the summer. The same place may be cool and wet in the winter. Different places can have different climates.

You might live where it snows all the time. And some people live where it is always warm enough to swim outside. There’s also earth’s climate. Earth’s climate is what you get when you combine all the climates around the world together. New research shows that real estate properties in areas affected by extreme weather and sea level rise are losing value relative to less exposed properties.

The effects are already substantial, but they may point to a looming collapse as climate change makes coastal communities untenable. There is no gain saying the fact that man depends on his environment for existence and sustenance such that man’s life is shaped by his environment and this underscores the need for the protection of the environment from all forms of degradation,

especially those brought about by the activities of man.

Realizing the significance and inevitability of the environment for survival of man, environmental experts have been arguing vociferously that without the environment man cannot exist since human activities are made possible by the existence of his environment.

Nowadays, environmental issues are receiving attention at global levels and the global communities are continuously making efforts towards ensuring that the world is a better place for human habitation.

Undoubtedly, the world continues to be under the threat of climate change problems like global warming, greenhouse gas effects, flooding, acid rain typhoons, rising sea levels, soot as is currently in Port-Harcourt, rising sea temperatures resulting in depletion of marine organisms, earthquakes, wind storms, land and mud slides, desertification, tsunami, erosion, volcanic activities, hurricanes, pollution, deforestation among several others.

One of the great ironies of those historic housing patterns in Miami, America is that for decades under Jim Crow, laws and zoning restricted black people to parts of the urban core, an older part of the community that sits on relatively higher ground along a limestone ridge that runs like a topographic stripe down the eastern coast of South Florida.

Now, many of those neighborhoods, formerly redlined by lenders and in some places bound in by a literal colourwall, have an amenity not yet in the real estate listings: They are on higher ground and are less likely to flood as seas rise. Whether it is climate change or an eye for good real estate returns, historically black communities on higher ground are increasingly in the sights of speculators and investors.

Real estate investment may no longer be just about the next hot neighborhood, it may also now be about the next dry neighborhood. Although no region of the world will be entirely spared, the negative impacts are likely to fall most heavily on poor nations in the tropical region. While data on the global impacts of climate change is available, those at regional levels are scanty and scattered. This is why there is a study that took a general overview of climate change impacts in Nigeria.

Mean annual and monthly temperature and rainfall data were collected from the Nigerian Meteorological Agency and some States' airports for a period of 105 years (1901-2005). Published data from different sources as acknowledged in the text were also used.

Histogram, trendline and time series were the statistical tools employed to analyse the data. The

results show that while temperature increased by 1.1 OC for the 105 years, rainfall decreased by 81 mm. Desert encroachment, coastal inundations, drying up of surface waters and shift in crops cultivated over time were also noticed.

The environment consists of all physical, social and cultural factors and the surroundings which support the existence and development of man and other organism. Obas (2011) put it that the built environment depicts man made surroundings that facilitate human activity, including buildings, structures, landscaping, roads, signs, trails and utilities that underpin effective functionality of society to define its physical characteristics. Thus, the built environment is the part of the natural environment formed and shaped by mankind to suit its needs. Man, as a resource, is the most precious within the biosphere. At the same time, he is the most dangerous, as man's activities especially the exploitation of resources for sustenance and creation of wealth produce adverse effects on the environment. In all global warming and environmental issues, man is the problem and man is the solution. Without human activities the environment and nature will take care of the balance of the ecosystem in a sustainable manner. Therefore if man must continue to exist on earth, he has to use the natural resources in the most prudent and sustainable manner.

Housing is a fundamental need of man without which his very existence is under threat (Olotuah, 2005). Housing is one of the three basic needs of man and it is the most important for the physical survival of man after the provision of food (Akingbohunge, 2002; Munonye, 2009). It has a profound influence on the health, efficiency, social behaviour, satisfaction and general welfare of the community. (Okedele et al, 2009) opined that, in the evaluation of man's comfort, growth and development, it is inevitable that housing be considered as a critical element. It has been described as a sine qua non of human living (Yakubu, 1980), and as an index of the standard of living of a people.

Nigeria has a population of more than 140 million people (Preliminary census, 2006). According to the National Rolling Plan, the national housing requirement is between 500,000 and 600,000 units, considering the prevailing occupancy ratio of three and four persons per room (Ojenuwah, 2006). As Muoghalu (1999) puts it, the rapid population increase coupled with high rate of urbanization has contributed in no small way to the shortage of urban

housing in Nigeria. Also, a number of scholars have posited that an enormous backlog of housing shortage exists in Nigeria, particularly in the urban areas. For instance, the United Nations survey between 1991 and 2001 looked at Nigeria's urban areas and reported that an annual production of more than 700,000 housing units would be required to sustain the upward population trend (Onyebueke, 2002; Isimi, 2005).

Increasing demand for housing as a result of recent population upsurge and the quest for economic development in developing countries further push up energy consumption and release of more greenhouse gases from the housing sector (Ogwu, 2012). Adeleke (2011) remarked that if nothing is done, greenhouse gas emissions from houses will more than double in the next 20 years.

According to Munonye (2009), housing is synonymous with building and recent estimates of the United Nations Environmental Programme (UNEP) Sustainable Construction and Building Initiative (SCBI, 2009) assigns 30-40% of global energy use to the building sector. This includes energy used in the production and transportation of materials to housing construction sites, as well as the energy used to operate houses. The housing sector is the key source of demand for energy and materials that produce by-product greenhouse gases. Moreover, there are the GHG emissions from deforestation when vegetation is cleared to make way for houses.

This paper therefore aims at highlighting the impacts of houses and climate on the Nigerian environment. The specific objectives are to:

- i) Highlight the causes and effects of climate change in the built environment
- ii) Impact of housing on the built environment
- iii) Suggest strategies to be adopted in reducing their impacts on the environment.

Climate Change and Global Warming

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change of climate which is attributable directly or indirectly to human activity that alters the composition of the global atmosphere and which in addition to natural climate variability observed over a comparative time period (IPCC, 2007). (Adekeye, 2011) defined climate change as "the generally observable prolonged alteration in global weather pattern resulting in temperature increases, storm activity, flash floods, drought and rising coastal water level as polar ice melts because of global warming. Climate scientists have generally agreed

that climate is changing and these changes are largely caused by human activities.

Global warming which has now become synonymous with climate change is the measurable increase in the average temperature of the earth's near surface air, ocean and land masses in the mid-20th century (Encarta, 2008). The Intergovernmental Panel on Climate Change (IPCC) concluded that most of the observed temperature increases since mid-20th century was likely caused by increasing concentration of greenhouse gases in the atmosphere resulting from human activities such as fossil fuel burning and deforestation (Wikipedia, 2010).

Greenhouse gases are gases in the atmosphere that absorb and emit radiation, the process being the fundamental cause of greenhouse effect. The main greenhouse gases in the atmosphere are water vapour, carbon dioxide, methane, nitrous oxide and ozone. Although the greenhouse gases are useful in making the earth livable by keeping the earth surface conducive and warm for life to thrive, yet, when their concentration increases in the atmosphere, the earth's temperature rises above tolerance level. This is because more heat is absorbed and radiated to the earth surface and as the earth's atmosphere thickens with more greenhouse gases as a result of human activities, the earth gets warmer due to retention of more radiation (Obot, 2010).

Uncontrolled exploitation of the natural resources and activities that contribute to global warming are factors that could jeopardize the sustainability of the environment. Indeed climate scientists have warned that climate change may become catastrophic if global warming is not kept under 2°C above pre-industrial level, which is the threshold above which the risk becomes dangerous (IPCC, 2007).

The level is currently at 0.7°C above the pre-industrial level (Obot, 2012).

Therefore, actions need to be taken now to reduce the emission of greenhouse gases into the atmosphere, otherwise, the earth could warm by average of 6°C in the next 100 years, the effect of which will be catastrophic to the human society, (Adeleke, 2008). Collaborative efforts by governments around the world and non-governmental organizations are already on with the aim of reducing the greenhouse gas emissions. For example, the Kyoto Protocol, a supplementary treaty of the United

Nations Framework Convention on Climate Change sought commitment from the advanced countries of the world to reduce the greenhouse gas emission by 5% below the 1990 levels commencing in 2008 and ending 2012 (Mastrandrea, et al, 2009). The protocol concerns itself mostly with greenhouse gases from vehicles, power generation and industrial plants. (Obot, 2010) observed that “ in our quest to cut greenhouse gas emissions, we have worked extremely hard to reduce our energy consumption by lessening our dependence on fossil fuel and overlooked the biggest source of energy consumption and thus greenhouse gas emissions: houses and the energy they consume each year”. In fact, the lion share of the pollutant that causes global warming attributable to housing (Energy Information Administration, 2010). It is therefore, logical that houses should be the vehicle for ecological reform. The possibilities are there as it is estimated that the housing sector worldwide could deliver emission reduction of 1.8 billion tons and a more aggressive policy could deliver over 2 million tons (UNEP-SBCI, 2007).

Impact of Housing on the Built Environment

Houses could be considered as instruments whose central function is to modify the environment in favour of man. However, man by overexploiting the natural resources of the environment to provide his own comfort has initiated processes that jeopardize his own existence in the environment. Hence sustainable issues are becoming important factors requiring the attention of the architect in his approach to the design and production of houses.

The impact of the housing sector on the physical environment is so significant considering the fact that the materials and methods used to construct and maintain houses and the energy used to service them are enormous, coupled with 50 to 100 years life expectancy of houses (Bougdah and Sharpel, 2010). The enormity of the impact of the housing sector on the environment and climate can be better understood from the perspective of the design, materials, energy and water consumption.

Design

Every time we design a house, we set its energy consumption and greenhouse emission pattern for the next 50-100 years. Even, at the end of its useful life, the energy required for its demolition and the attendant waste generated are determined by the design. The life span of

houses makes the housing sector more critical than the other sectors, say transportation sector on wheels whose turnover period is about 12 years (Mazria, 2012)

A conscious effort in achieving sustainability at the design stage by thorough analysis and coordination of the various factors like climate, culture, technology and so on will go a long way in saving the environment from the impending catastrophes.

Material

Houses are constructed from a variety of natural and manufactured materials, the exploitation of these natural materials and their processing impact adversely on the physical environment as they are resource intensive. For example in the Philippines, wood consumption by the housing sector had increased by 40% between 1990 and 2000. In Chile, 60% of all wood leaving Sawmill is consumed by the housing sector (Ebohon, 1996). This intensive consumption of wood results in deforestation with the attendant environmental degradation such

as landslides, topsoil erosion, desertification and so on. Of particular significance is the increased concentration of carbon dioxide in the atmosphere as less number of trees are available to convert carbon dioxide to oxygen through photosynthesis.

Cement production is a major source of carbon dioxide emission. It makes up 5% of global emission and 50% is directly from the chemical process and 40% from burning fossil fuel. Cement manufacture contributes to greenhouse gas mission directly through the production of carbon dioxide when calcium carbonate is heated. Its manufacture also causes the emission of air borne pollution in the form of dust, gases, noise and vibration when operating machinery, disturbance to the landscape and disruption of local biodiversity from quarrying of limestone, the raw material for cement (Adeleke, 2008).

Energy

Administration, 2010), most of this energy comes from burning fossil fuels. This, therefore, confirms the huge amount of carbon dioxide emission into the atmosphere by the housing sector which is put at approximately 50%. Other greenhouse gases emitted by this burning are 10% methane, 25% Nitrous oxide and 25% sulphur oxide (Salami, 2012).

The processing of natural resources into construction materials involves a lot of energy. The manufactured products embody huge energy resource which occurs during process of

conversion from raw material to finished construction products. Embodied energy is the total amount of primary energy during the life time of a material from extraction to disposal. The unit is megajoule per Kilogramme of material. (Ebohon, 2011) revealing the energy intensity of building material stated that the conversion stage of building material accounted for 75% share accounted for total energy consumed in the construction sector. For example, the embodied energy for a square metre of fire clay is 15 MJ, while a square metre of corrugated iron sheets require 605 MJ of energy to process. Apart from the huge amount of energy embodied in these products, massive amount of pollution occur during processing when toxic gases and effluent are discharged into the environment using degradation and atmospheric pollution.

Transportation is a major component of embodied energy thus using local material and locally produced building materials can have significant impact. Equally, durable materials that will not corrode or rot quickly relative to life span of the houses can help save large energy overhead during replacement. (Salami, 2012) posited that in general, natural building materials, such as timber, stone, rammed earth and straw bales, have lower embodied energy than their manufactured equivalents.

Water

The housing sector accounts for 12% of all freshwater use (Adeleke, 2011). Although the housing sector consumes a lot of water, only 4% of the total is needed as potable water for drinking purpose. The rest are used in the following proportion; Washing-25%, toilet-18%, laundry-15%, garden-4%, dishwash-4% and other uses-6% (Bougda and Sharples, 2010). This data is indicative that large amount of non-potable water such as harvested rainwater could be used for services in houses.

Rainwater harvesting and other alternative ways of collecting and reusing greywater can help conserve usable water which is a scarce resource globally.

Impact of Climate on the Built Environment

Climate change impacts are physical, ecological, social and economic. However, the impact most relevant to the housing sector is the physical evidence including increased warming, erratic and variable precipitation, accelerated sea level rise, coastal erosion, drought

and desertification.

High Temperature

Odjugo(2010a)reportedanaverageairtemperatureincreaseof1.1°CacrossNigeriaforthe past105years.This confirms a steady increase in air temperature across Nigeria.The effect of this climate change indicator isincreased urban heat Island around the urban centres which will result in increased demand for energy forcomfort like air conditioning and ventilation to ameliorate the reduced thermal comfort in the built environment.It may also affect the life span and performance of certain building components.Soil movement and clayshrinkageresulting fromthisimpactmaydamagebuildingfoundationand increased certification.

ErraticandVariablePrecipitation

Studiesindicate thatpartsofNigeriafallwithintheglobalzone,wheremoreintenseandvariableprecipitation events with increasedmeanandpeak precipitationintensities fortropicalcyclones arelikelyto occur.Sucheventsareexpectedtoleadtoincreasedrunoffsandflashfloods(IPCC,2001;Ogbonna,2011).Weareallwitnesses tothesescenariosnowinthecountrywithfloodinLagos,Port-Harcourt, Yola, Katsina, and Ibadan at various times in the year, but within the raining season. The flood could cause damage to houses, civil works like roads, power line and sewage lines. Other effects include water supply shortage for industrial and domestic waterplants.

ShortageofWaterSupplyandNaturalResources

Climate changewould alter allaspects of hydrological cycle ranging from evaporation through precipitation, runoff and discharge (McGuire et al. 2002).According to Odjugo (2009), global warming and decreasing rainfalltogetherwith the erratic pattern of rainfall produce a minimal recharge of groundwater resources,wells, lakesand riversinmostpartsoftheworldespeciallyin Africa therebycreatingwatercrisis. Lake ChadandsomanyRiversinNigeria,especiallyintheNorthernNigeria,areinthedangerofdisappearing. Thewaterscarcitywouldcreate the tendency for concentration of users around the remaining limited sources of water.Under suchcircumstances, there is increased possibility of additional contamination of the limited sources of water andtransmissionofwaterbornediseaseslikecholera,typhoidfever,guineaworminfectionandriver blindness.One major problem of agriculture in Nigeria due to climate change is the reduction of arable lands. While these incursion is reducing the arable land of the coastal plains, the desert encroachment with its associ

ated sand dunes is depriving farmers of their agricultural farmlands and grazing rangelands. Moreover, the frequent droughts and lesser rains have started shortening the growing season thereby causing crops failure and food shortage.

Accelerated Rise in Sea Level

Odjugo (2010b) reported that in the coastal region of Nigeria, there is a sea level rise of 0.2 m and incursion of salt water into the coastal plains, 2016-34 square cm. This rise results mainly in storm/wave surge, coastal inundation, high water table, runoffs and flooding. The effect may cause significant damage to or complete loss of the houses. Other effects include temporary or permanent damage to civil infrastructure and compromising the quality of water supply.

Wind Event

Like thunder storm, hail and tidal waves have become common lately. For example in August, 2012, some villages near Dutsa in Jigawa State were affected by hail stones. Effect of these includes destruction of building elements, power lines and communication network, higher wind speed aggravates pollution.

Climate-related Health Risks

The human health impacts of climate change in Nigeria would occur in various ways and because of the poor health status of many citizens, the impacts could be devastating. The impacts could either be direct or indirect. Some of the indirect impacts of climate change on health in Nigeria would include deaths, stroke, illness and injury due to increased exposure to heat waves and effects upon respiratory systems. Indirect effects of climate change and sea level rise include altered spread and transmission of vector-borne diseases (including malaria) and altered transmission of contagious diseases like cholera, influenza etc.

Combating the Impacts of Climate Change

Mitigation and adaptation are two strategies used in combating the impacts of climate change. Mitigation

refers to planned activities aimed at reducing the greenhouse gas emission and lessening demand on nature. Adaptation on the other hand refers to actions taken to manage the effects of climate change. Since houses contribute greatly to greenhouse gas emission, design decisions can equally help in reducing greenhouse gas emissions from the houses. Similarly, design of houses can provide adequate solutions that can reduce risks of damage from climate change. Both the

mitigative and adaptive measures can be achieved through sustainable Architecture or (green architecture).

Sustainable Architecture

Wikipedia defined sustainable architecture as a general term that describes environmental conscious design techniques in the field of architecture. It is defined as a design philosophy that values the natural environment as an integral factor in creating new products and modifying old ones. The goal of sustainable or "green" architecture is to create structures which are beautiful and functional but which also contribute to a sustainable lifestyle and culture. This can be achieved by creating optimum relationship between people and their environment and also the responsible management of a healthy environment that is resource efficient and ecologically balanced. The products of sustainable design and sustainable construction are sustainable houses (Okpoechi 2011). Sustainable houses have minimal adverse impacts on the built and natural environment (OECD, 1996).

Conclusion

In order to reduce the effects of houses and adverse effects of climate on the environment, the following are recommended.

- i) **Smaller houses:** To reduce the impact on land and resources, the size of houses should be reduced. Houses should be rightly sized to avoid unnecessary energy consumption.
- ii) **Use of recycled and local materials manufactured locally** to minimize the energy required or their transportation.
- iii) **Use of sustainable harvested material,** for example the construction industry should use timber which can easily be replaced through a forestation to reduce impact on forest.
- iv) **Water catchment system:**
water is a greatly wasted resource and the use of rain water can reduce the impact on wells or water treatment plant.

Recycling of houses: A commitment to salvaging existing structures and adaptive re-use of houses.

- i) **Preservation of the natural environment:**
This should be an important consideration when building a house in any location.
- ii) **Energy efficiency:** Use of diverse resources of energy, passive solar, wind power, water power etc to reduce dependency on fossil fuels.

- iii) Wastemanagement: A focus is needed on the on-site use of waste, for example grey water system and food waste composting.
- iv) Access to public transport: Houses should be positioned close to public transport to reduce the use of private vehicle.

Houses orientation and strategic placement of window around elevation of the houses. Sustainable or “green” housing techniques used designing, constructing and operating houses and landscape to incorporate energy efficiency, water conservation, waste minimization, pollution prevention, resource efficient materials and indoor environmental quality in all of a building life (SMART e, org, 2009). Applying these principles is like killing two birds with one stone in combating the causes and effects of climate change as it concerns the housing sector.

Man cannot stop building houses despite their impact on climate and the environment. Man has to fell trees, excavate soils, mine iron and so on if he must build his house. There would also be need to build more houses as the population increases. The implication of this is that climate would continue to change and the adverse effects of this would continually be felt. However, man must utilize the natural resources in a responsible and sustainable manner.

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