The Challenges of Climate Change in National Development
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REDUCING THE EFFECTS OF CLIMATE CHANGE THROUGH THE RESTORATION OF INLAND URBAN WATER ECOLOGY IN OWERRI, IMO STATE, NIGERIA

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Abstract

In urban development, water bodies and wetlands, the ecological resources suffer degradation and disequilibrium. This often leads to the destruction of vegetation, soil degradation, and aquatic and marine life which escalates the effects of climate change. The paper examines this situation as it affects the two water bodies of Nworie and Otamiri rivers in Owerri urban, with a view to proffering strategies for restoring the ecology of the rivers and mitigating the effects of climate change. Historically, the rivers formed the socio-economic, socio-cultural and environmental backbone for Owerri urban. However, over the years, the surrounding rainforest vegetation, wetlands, and river bank have been destroyed, leading to ecological disequilibrium, erosion and pollution. The paper identifies the components of the river ecosystem along the river stretch and identifies some of the resulting ecological problems using satellite technology, Geographic Information System, and Geographic Positioning System. It found that it is possible to restore the ecology of the growing urban area through replanting of local cash economic trees, re-grassing, community participation, and repopulation of the aquatic and marine elements. It is also possible to restore the recreational potential of the rivers and improve tourism, urban agriculture and economy. It is therefore proposed that a policy direction that can not only restore the ecology of urban water bodies but also improve the management of ecological resources of other emerging urban areas should be pursued.

Keywords: Community participation, Climate policy, Ecology restoration, Urban water bodies

INTRODUCTION

While the weather is the totality of the changes in the atmospheric conditions in a short period, climate is the observation of these changes for a long time (not less than thirty (30) years), (National Geographic Society, 2022). Climate change is sustained observed changes in the indices of weather. Under natural conditions, it is gradual but human activities scale it up making it very drastic and accelerated over a long time. This has been attributed to Green House Gases which depletes the ozone layer of the stratosphere which shields the earth from the ultraviolet rays of the sun. This then causes changes in average temperature, humidity, cloud cover, precipitation, evaporation, trans-evaporation,

vegetation cover, and water and sea levels. Water bodies normally exist in lowland areas of the environment, hence the tendency to receive surface runoff and flood water thereby acting as receptacles and water basins. On land, during this process soil weathering, erosion and flooding may take place depending on the soil texture, elevation and components. The route of this is normally the natural waterways and any obstruction is normally cleared as water must find its way.

Ecology refers to the relationship between the physical environment and organisms in the environment. While the physical environment is made up of soil, water and air, organisms such as plants and animals, and the interaction of the biotic and abiotic components form the complex ecosystem of energy exchanges and transmission, (Jhingam & Chandar,2008). Negative climate change has a lot of costs on the micro and macro ecosystem including human beings. These costs are in the form of inclement weather indices, flooding, desertification, sea and river levels, the salinity of water bodies, aquatic and marine life, health issues, herders and farmers conflict, and energy crises to mention a few. Hence climate change generally affects the effectiveness of the overall physical, cultural, socioeconomic and environmental development at global, regional and national levels, enriching environmental economics including Nigeria, (Barry & Martha, 2013).

Problem Statement

Owerri is fast developing into an Owerri Capital Territory megacity with increasing flooding, erosion and urban heat island problems in the face of the increasing threat of global climate change, there is a need to arrest the decline with a pragmatic urban water management design framework. This issue has not been addressed properly leading to incessant flash floods, erosion and destruction of the ecosystem. There is therefore the need for an urban flood and natural water bodies' management system that can be used to create an integrated microclimate framework to proactively address the negative effects of emerging climate change.

Aim

To highlight the importance of water bodies in mitigating the negative effects of climate change in cities to harness their potential in the Owerri urban area.

Objectives

- To identify existing water bodies in Owerri Urban
- To create more artificial water bodies in Owerri Urban
- To improve and harness water bodies in reducing the effects of climate change in Owerri Urban

Study Area

Owerri is located within latitude 5^{o} 10'N and 5^{o} 45'N and longitude 6^{o} 45'and 7^{o} 25'E with elevation below 100m normal sea level and is the capital of Imo State, Nigeria (Figure 1). It is bordered by the Otamiri River on the east and Nworie to the south (Soluap, 2022). Otamiri River is joined by the Nworie River at Nekede. Otamiri River spans south from Egbu through Owerri, Nekede, Ihiagwa, Eziobodo, Mgbirichi and Umuagwo to Ozuzu in Etche, Rivers State into the Atlantic Ocean covering a

watershed of approximately 10,000km. Owerri is located in a hot humid tropical climate with a mean rainfall of 2,500 mm, annual mean temperature of 29° C and high relative humidity during the rainy season. It originally had good forest storey vegetation with a forest grass floor, oil palm, mango, elephant grasses, and star grasses that form a vegetative canopy to accommodate fauna such as earthworms, millipedes, centipede with other trees and plant crops, (Onweremadu & Peter, 2016). With the creation of Imo State in 1976, Owerri became the capital of Imo State. With the Twin City physical development plan for its development in 1977, a lot of physical changes had since taken place (see Figure 2). This however has been largely destroyed by urbanisation such that one hardly sees traces of forest and grassland in Owerri urban. Nworie and Otamiri are its natural rivers, Lake Nwaebere at Imo State University premises with artificial lake/ water body around the prefab housing area, around the Ikenegbu housing area and along Chukwuma Nwoha road. Although a lot of natural water flood water routes have been obstructed due to poor urban planning and regulation, there is the underground water drainage pipe in disuse that can be reactivated for effectively regulated channelling of flood water into the rivers.

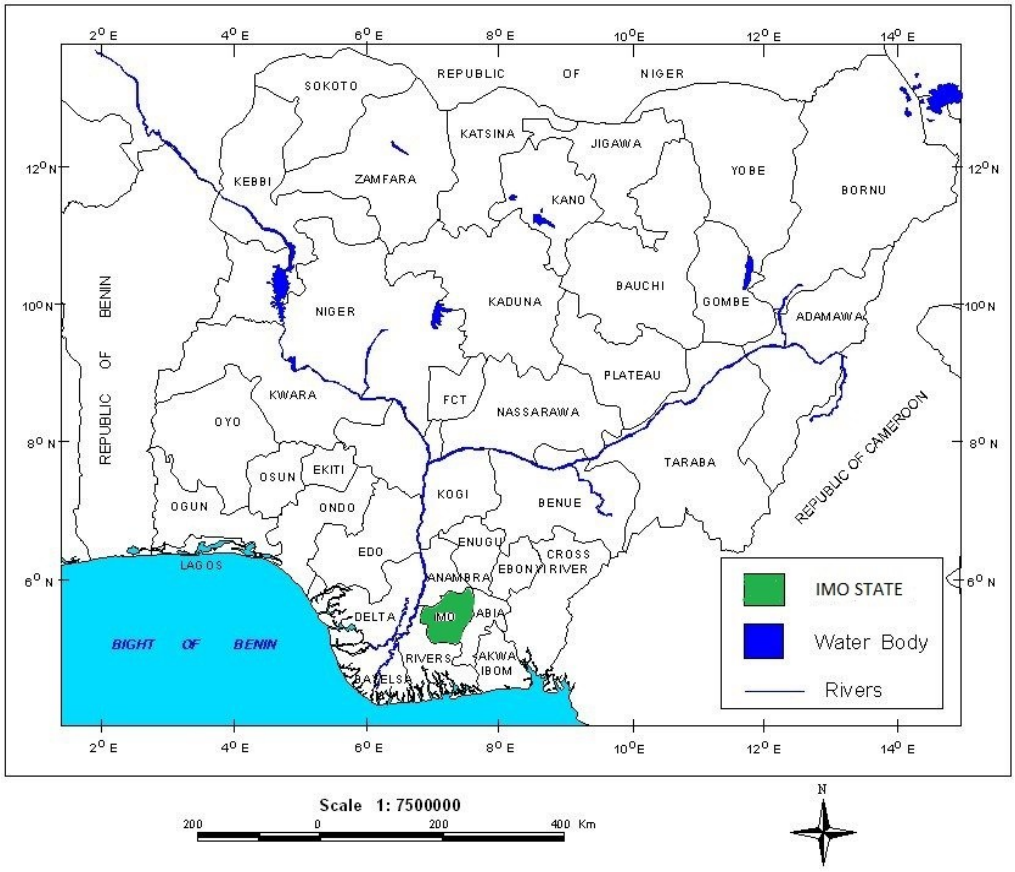

Figure 1: Imo State in Nigeria

Source: (Agoha, 2016)

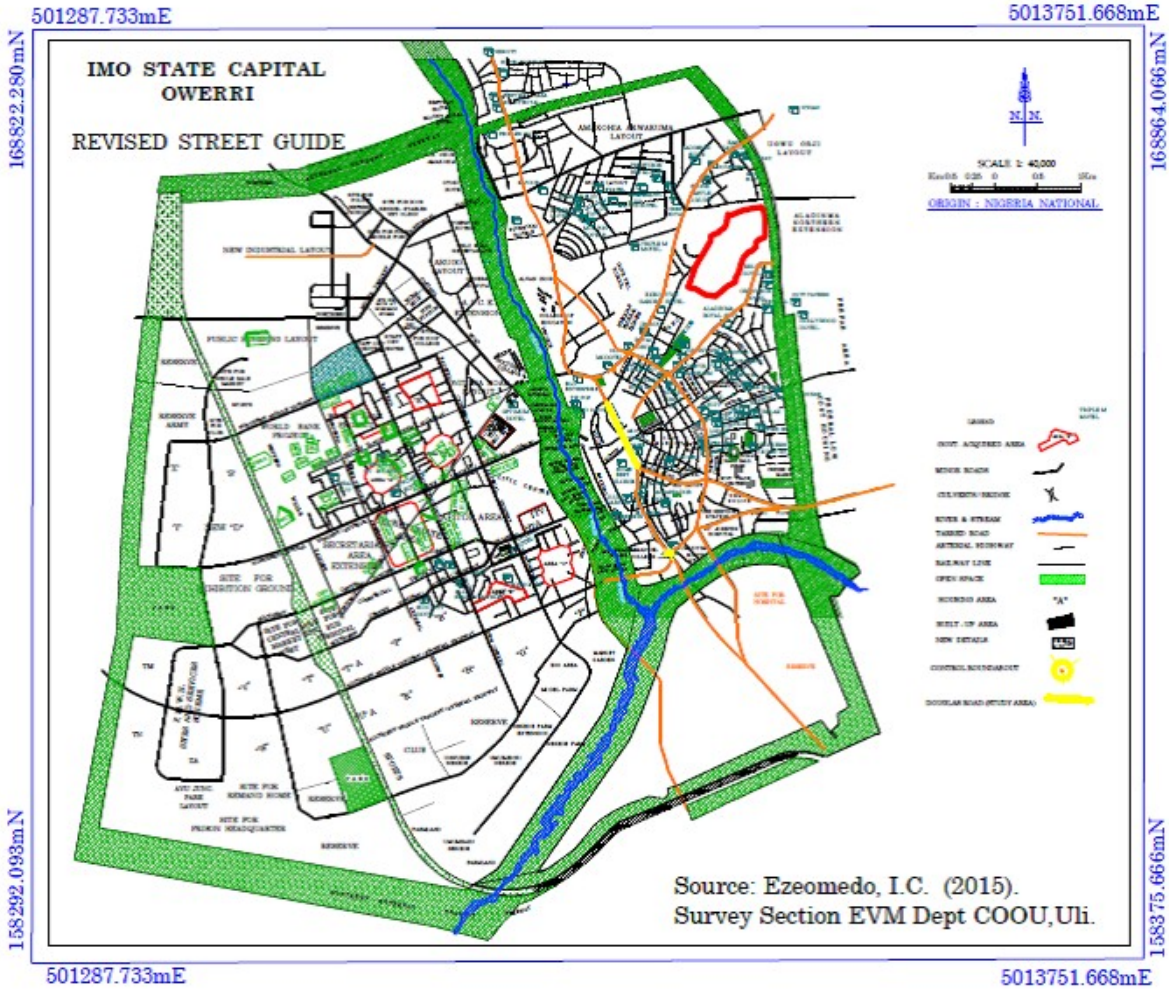

Figure 2: Owerri twin city master plan with Otamiri and Nworie rivers

Source: (Fingerhut, 1977; Ezeomedo, 2015)

LITERATURE REVIEW

Theoretical Framework

The most potent statement on climate change is the Greenhouse theory. This theory states that the depletion of the ozone layer by greenhouse gases, GHG, such as Carbon dioxide, and methane causes the increasing transmission of heat energy and thus temperature of the earth. This makes the earth receive more infrared energy from the sun over the years making more heat reach the earth. Most of the heat received is reradiated under normal situations while much is absorbed by the soil, vegetation and water bodies. The industrial revolution with increased deforestation has increased the volume of GHG thereby aggravating the ozone layer depletion with the attendant progressive increase in the heat reaching the earth and the temperature of the earth with its negative effects on the climate popularly called climate change.

Related literature

In the 1800s, it was discovered that carbon dioxide (CO2) and other gases which collect in the atmosphere insulated the earth reducing the reradiated heat into the atmosphere hence increasing the temperature to warm the earth progressively. In the 1950s, Joseph Fourier a French Mathematician and Physicist corroborated this and gave more insight into the global warming theory, (Spencer,2008). He propounded that heat reaching the Earth from outer space must be balanced by heat energy returning to space within a given period. However, the earth was seen to have a thin glass that traps the reradiated heat. It was discovered that the infrared radiation was not only trapped but absorbed by CO2, methane, nitrous oxide, fluorinated gases, Ozone and other volatile hydrocarbons in the air. Between 1940 and 1970 due to the post-war aerosol and industrial revolution activities, the earth's temperature continued the rise without check. By the 19th century, the earth's planet temperature rose to 1.1'centigade, (2'F), sea level rose to 2.3mm (0.2 inches) consistently almost every year. This led to grave concern and the convening of the conference of Intergovernmental Panel on Climate Change, (IPCC), known as the Kyoto Protocol of 1997 to raise alarm on global warming. Since then, another series of conventions named the Conference of Partners, COP, have been convened to place limits on global warming with the Paris Climate Agreement setting a limit of 2'C or 3.6'F earth temperature. COP28 is scheduled to come up in Dubai in November 2023 to continue the discussion on climate change crises. For the seriousness of the problem and threat, in October 2018, the IPCC, reduced the limit to 1.5'C or 2.7'F to avoid irreversible consequences on the earth planet. These conventions individually and severally among other measures have advocated for the industrialised nations to reduce carbon emissions, popularly called carbon footprint, carbon market measures, climate change finance measures, compensation for vulnerable groups and countries, energy transition from fossil to renewable energy regime and setting up of national and regional regulatory bodies. Vested interests, lack of political will and superiority complex have not only made these attempts ineffective but reduced the developing countries who are at the receiving end into a helpless situation as the climate change problem is global without boundaries. However, local and national actions are still important and relevant as both micro and macro climate actions are necessary in the fight against the negative effects of climate change. United Nations Environment Programme, UNEP, (2022), recommends ways countries can adapt to climate crises as; early warning systems, ecosystems that can absorb carbon dioxide, restoration through vegetation, climate resilience infrastructure, water supply security and long-term planning.

In Nigeria, following COP26, in Glasgow aimed at achieving net zero carbon emission by 2030, the Climate Change Act 2021 is in place with a national Council on climate set up. The climate action plan includes the annual carbon reduction target for any company with fifty (50) employees scaling down to conferences and awareness at local levels.

METHODOLOGY

Geographic Positioning System, GPS, Geographic Information System, GIS, drone photography, satellite image production, physical visits and relevant literature review were used to gather data and information. The data were analysed, synthesised and developed for the discussions. Proposals were then made from the analysis and discussion to restore the pivotal role of water bodies in ecological balance and reduce the negative effects of climate change.

DISCUSSIONS

Although Owerri has Nworie and Otamiri Rivers as the natural water bodies together with the lake Nwaebere, there is a functional artificial flood water body catchment basin beside Assemblies of God Church Prefab Housing Estate, Egbu Road, Owerri (Figure 3).

Figure 3: Functional artificial flood water body catchment basin beside Assemblies of God Church, Prefab Housing Estate, Egbu Road, Owerri

Source: (Google earth, 2023)

There are also water basins that need to be explored and developed at Chukwuma Nwoha by the Scripture Union Nigeria Area office (Figure 4).

Figure 4: Water basin at Chukwuma Nwoha by the Scripture Union Nigeria Area office

Source: (Google earth, 2023)

There is another at Works Layout by Standard Shoe Industry Road (Figure 5) that should be developed as catchment basins to creatively harness the surface runoff water in Owerri into artificial water bodies for an effective environmental control system.

Figure 5: Water basin at Works Layout by Standard Shoe Industry Road

Source: (Google earth, 2023)

These can be linked through underground pipes for inter and intra groundwater and overflow surface water regulators in Owerri urban. They could also with the natural water bodies be used to develop flora and fauna ecology to mitigate the negative effects of climate change through the creation of an effective microclimate system This could be by way of temperature control, humidity, Green House Gas absorption and regulation of oxygen content of the microclimate of built environment in Owerri.

RECOMMENDATIONS

1. Surface runoff water should be filtered and treated before discharge into the natural and or artificial water bodies since most of the water is polluted. This is important to protect and preserve marine ecosystems

2. The underground drainage system into the natural water bodies of Nworie and Otamiri of the late Samuel Onunaka Mbakwe should be traced and the manholes identified cleaned up to desilt with a treatment system installed.

3. There should be an underground network system to connect the artificial and natural water bodies to act as buffers and receptacles for the creation of an excess water management system.

4. Natural wetlands of Nworie and Otamiri should be re-established, repopulated and nurtured with green vegetation populated with local and traditional fauna and flora species. Cash crops and fruit trees like palm trees, coconut trees, and mango trees should be planted

5. Artificial water recreational facilities should be created around the Nworie and Otamiri with local cuisine provisions to encourage tourism.

6. Urban agricultural and aquacultural facilities should be created to encourage intensive urban agricultural practices.

7. A protective legislation and management system to develop other water body systems in the State should be created and developed to protect other water bodies in the urban, suburban, semi-urban and rural areas to reduce abuse of water ecosystems.

CONCLUSION

Although climate change cumulatively is global, it has regional and local effects. Moreover, it affects the microclimate of places, especially the urban areas. It is therefore very important that as more places urbanise, physical planning must take measures to ameliorate the negative effects both in existing and emerging urban areas. Water bodies as important components of the urban ecosystem as modifiers of the built environment must be maximally employed for urban development. With Nworie and Otamiri rivers traversing Owerri urban, more artificial water bodies have been identified and created as effective instruments in taking proactive steps to effectively contain and harness the potentials of climate change for the development of the emerging city of Owerri thereby turning a seemingly hopeless situation into planning opportunities.

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