



THE NIGERIAN PERSPECTIVE OF GLOBAL CLIMATE CHANGE: A CASE STUDY OF COASTAL AREAS OF LAGOS.

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ABSTRACT

In recent times, climate change and its attendant impacts have become an interesting subject for many a debate, yet little seems to be understood about it on the local scale more so among the rural populace. The study aimed at evaluating the perception and vulnerability of Ibeju-Lekki and Eti Osa Local government areas to climate change; to introduce effective climate change awareness, mitigation, and adaptation techniques. The study was carried out through field surveys, questionnaire administration, Personal interviews, and Focus Group Discussions (FGD). The data collected were analysed using the Statistical Package for Social Scientists (SPSS). The study showed that on average, the sampled coastal communities recorded climatic changes in their environment, but they have not been able to account for the factors that initiated these changes. The human dimension to climate change is missing in their perception. This relates to how their activities contribute to climate change. The coastal area is highly susceptible to coastal activities that have been exacerbated by climate change. Therefore, given their perception and high vulnerability, there is an urgent need for climate change awareness in the study area to prepare the communities through enlightenment campaigns and to build their adaptive capacity. This study, therefore, recommends that government should intensify its climate change awareness drive until all and sundry are sufficiently sensitized to contribute meaningfully in mitigation and adaptation measures. In tackling the challenge of climate change in coastal areas of Lagos State, emphasis should be given better preparedness, adaptation strategies that are low-tech particularly those that are targeted at the most vulnerable members of the society and communication/awareness techniques.

Keywords: *Climate change, Environment, Eommunication, Coastal communities, Adaptation, Mitigation, Preparedness.*

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INTRODUCTION

Nigeria as a whole is especially vulnerable to climate change (Ruhl, 2010). The impacts of the changing climate are already manifesting increasing drought and desertification in the north, coastal flooding, and erosion in the south. The entire country faces the challenge of aligning with the global trend of low-carbon economic development in the face of its dependence on oil and gas. A clear view of the quagmire we have found ourselves in is evident on the Lagos coastlines, where climate change (through sea level rise and extreme events) is impacting the bio-physical and socio-economic environment (Siaka, 2011).

An obvious example is the storm surges that occurred between the 16th and 17th of August 1995, when a sense of violent swells in the form of the surge was unleashed on the whole of Victoria Bar Beach Lagos (Afiesimama & Olaniyan, 2003). Another climate change event is the erosion caused by the ship wreck on the Lekki and Alpha beach Lagos, threatening the structures and multi-million-naira Jakande Estate and Chevron Twin Lake Estate (Premium Times News, 2011).

The number of casualties and damages caused by a natural disaster, while fluctuating strongly, has been increasing in recent decades (Primeck, 2001). Climate change as part of these natural disasters is already transforming life on earth, because around the globe, seasons are shifting, temperatures are climbing, and sea levels are rising. There is also the inundation of the Lagos coastline because of sea level rise, which is presently experienced in parts of coastal areas of Lagos and is predicted to get worse, if not nipped in the bud, about 2 million Lagos residents are at risk of being submerged by the ocean (Ayo, 2009).

Another obvious impact of climate change is the salinization of the coastal line as reported in the study carried out by Adewuyi *et al.* (2010), where it was observed that groundwater aquifers surrounding Lagos coastline (especially in a settlement like Adeniji Adele, CMS, and Victoria Island) presently contain impermissible conductivity value of about 1000 $\mu\text{S}/\text{cm}$ as compared to 126 $\mu\text{S}/\text{cm}$ for Ikeja and Ikotun respectively. This was attributed to the intrusion of saltwater into aquifers from the Atlantic Ocean (Iriegbu, 2011 & 2012).

In light of the increasing disaster from climate change events and continuous environmental degradation, measuring vulnerability is crucial if science is to help support the transition to a more sustainable world (Kasperson *et al* 2005). Simms (2006) reported that Africa is the continent most vulnerable to all the negative effects of climate change and faces the greatest challenges to adaptation; conflict, disease, governance problems, an unjust international trading system, and the burden of unpaid debt among other factors were noted to be hindering the ability of African communities and nations to handle the shock emanating from the adverse effect of climate change.

The shortage and sometimes nonexistence of data on the vulnerability of these communities to climate change is also a major factor that further exposes them to the effect of climate change since adaptation or coping suggestions cannot be provided without a vulnerability report (British Council, 2010). In this study, using coastal areas of Lagos state as a case study would be most appropriate since the state has the largest human population in Nigeria engaged in

different anthropogenic activities (domestic, commercial, agricultural, and industrial) which constitute a major constituent to global warming and climate change.

This study aims to examine global warming and climate change's impact on coastal areas of Ibeju-Lekki and Eti Osa Local government areas, Lagos State. To achieve this aim, I examined the climate change indices (Temperature Variability) and assessed the actual impacts of observed climate change indices in the study area.

The Study Area

Lagos State has a tropical wet and dry climate that borders on a tropical monsoon climate (Adebisi *et al.*, 2016). Lagos experiences two rainy seasons, with the heaviest rains falling from April to July and a weaker rainy season in October and November. There is a brief relatively dry spell in August and September and a longer dry season from December to March. Monthly rainfall between May and July averages over 400mm (15.7 in), while in August and September it is down to 200mm (7.9 in), and in December as low as 25mm (1.0 in) (Lagos State Government, 2021).

The main dry season is accompanied by harmattan winds from the Sahara Desert, which between December and early February can be quite strong. The highest maximum temperature ever recorded in Lagos was 37.3 degrees Celsius and the minimum was 13.9 degrees Celsius (Lagos State Government, 2021).

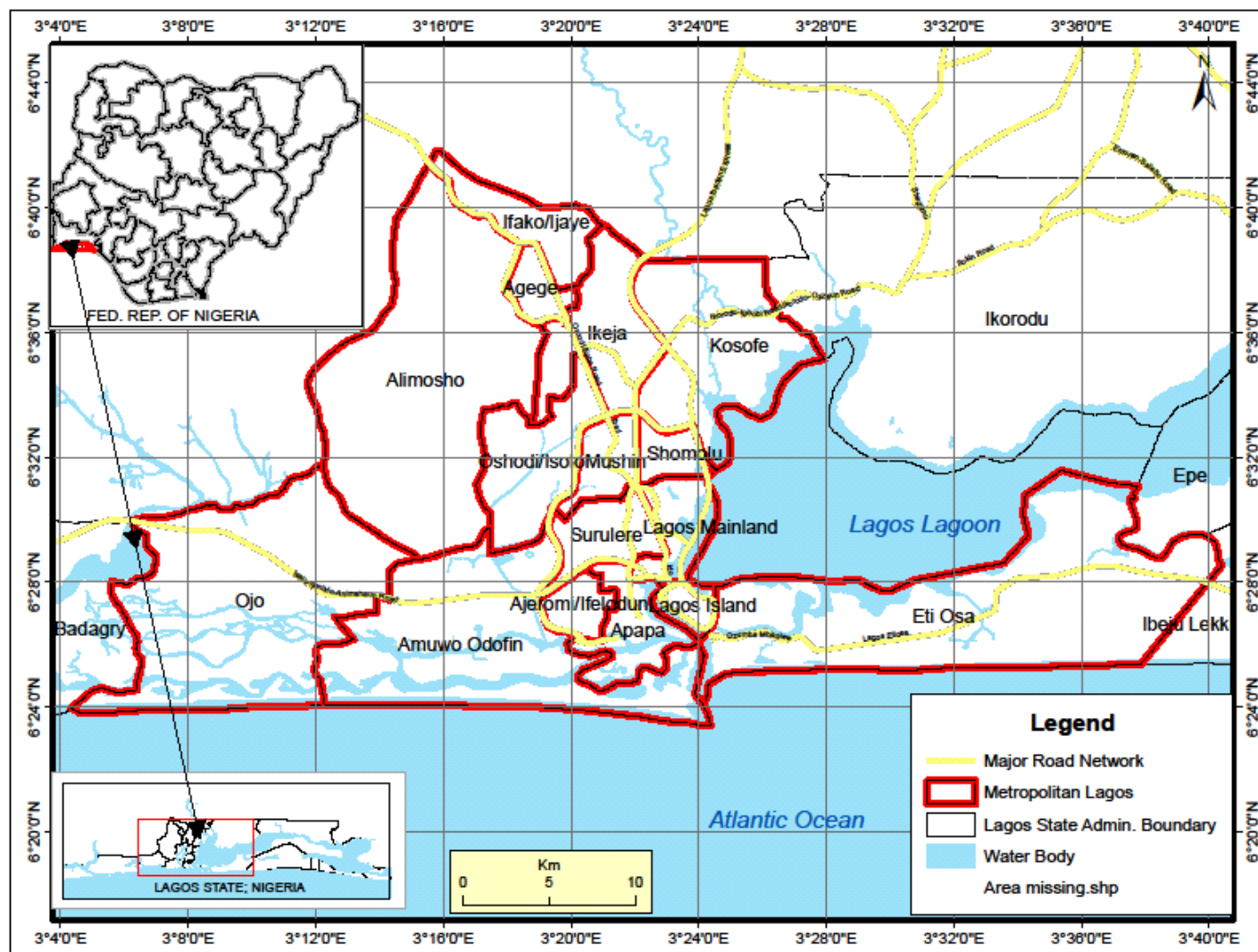


Figure 1: Base Map of Nigeria showing Lagos State

Climate change, according to Obioh (2002) “is the permanent departure of climate pattern from mean values of observed climate indices”. Chen (2009), questioned the difference between the present and 10,000 years ago when the earth started warming after the last ice age. The former warming took place over thousands of years and was due to natural variations, such as solar radiation, volcanic eruption, and vegetation. The present warming has taken place over only a century and a half, and it is due not only to natural variations but also to increased emission of greenhouse gases, such as carbon dioxide, methane, and nitrous oxide, since the time of the Industrial Revolution (IPCC, 2007). Both proxy data measurement and actual measurement have shown an exponential increase in these gases over the period (IPCC, 2007).

Climate change due to anthropogenic greenhouse gas emissions has become an issue of key political and economic importance. The scientific background has become quite cleaner, as shown by the summary of policymakers of the Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report published in 2007 (IPCC, 2007). The

IPPC report stated that the “warming of the climate system is unequivocal, as is now evident from observation of increases in global average air and ocean temperature, widespread melting of snow and ice, and rising sea level,” and most of the observed increase in globally averaged temperatures since the mid-20th century is likely due to observed increase in anthropogenic greenhouse gas concentrations”.

On the other hand, Art. 1.2, of the United Nations Framework Convention on Climate Change (UNFCCC), 1992, defined Climate Change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable periods” (United Nations, 1992).

Causes of Global Warming and Climate Change

Climate change is usually caused by the rising average temperature of the earth due mainly to global warming (Igbokwe, 2012a). During the last one hundred years, the global temperature has increased from 0.7-1.5°C. It is predicted that global temperatures in 2100 will hit 1.4-5.8°C. Global warming is caused by greenhouse gases such as Carbon dioxide (CO₂), Methane (CH₄), Nitrous oxides (NO, NO₂), Oxides of Sulphur, Chlorofluorocarbons (CFCs), Water vapor (to a lesser degree), hydrofluorocarbons (HFCs) and ground-level ozone (O₃). Accelerated global warming is occurring because of enormous increases in the concentration of greenhouse gases in the atmosphere, because of the following:

- Constant burning of fossil/ fuels such as coal, oil, and natural gas - beginning from the industrial revolution for transportation, manufacturing, driving machines, heating, and cooling, and generating electricity for different purposes (Pachauri, 2009).
- Biomass burning – firewood, charcoal, bush fire, farm residues, among others.
- Land use and land use change, especially deforestation and desertification, which reduces the size of “the sink” for carbon dioxide absorption. (Okali, 2004; Pan, 2009; Igbokwe, 2012).

Forests contain a large amount of sequestered carbon and their destruction or degradation is currently estimated as accounting for 12-15% of all carbon gas emissions into the atmosphere (Okali, 2004; Sabastin, 2007). According to Earth day net, despite the natural emission of carbon dioxide, (CO₂) emitted by volcanoes, for example, human activities are adding about 7 billion metric tons of carbon into the atmosphere every year (Surjadi, 2009).

Impacts of Climate Change in Lagos State

The former president of the United States of America Barrack Obama in one of his statements on the road to Copenhagen in 2009 said “All across the world, in every kind of environment and region known to man, increasingly dangerous weather patterns and devastating storms are abruptly putting an end to long-running debate over whether or not climate change is real. Not only is it real, but it’s also here, and its effects are giving rise to frightening new global phenomenon; the man-made natural disasters” (Udofa, *et al.*, 1978; Banire 2010). As Ruhl (2010) puts it, “Climate change is projected to increase the frequency and severity of extreme weather events and no nation is immune. Consequently, economic losses caused by natural disasters could increase significantly. It is particularly precarious for Africa, characterized by exceptionally high climate variability. Climate change hits poor people and

regions the hardest and soonest” under present trends the livelihoods of millions of farmers in Africa and other people around the world would be lost due to shifting hydrological patterns, higher temperatures, and more extreme weather events (Siaka, 2011). The major impact of climate change are as follows:

- Endangered human settlement due to sea level rise and storm surges
- Bleaching and possible death of coral reefs
- Depletion of coastal resources, including the death and migration of fishes to cooler waters.
- The possible extinction of some plant species. Compounded with concomitant conditions that could lead to a reduction in tourism, this study concluded that all the above, except the former, would lead to human suffering and poses a serious challenge to social peace and economic progress”.

For a coastal Mega City such as Lagos, the consequences of climate change could be great. The impacts may include coastal erosion, sea, level rise and flooding, saltwater intrusion, wetland depletion, endangering mangroves, and possibly affecting millions of people by flooding every year (Ruhl, 2010).

MATERIALS AND METHODS

In this study, both qualitative and quantitative methods of data generation were used to acquire information. The designed methodology framework was as follows:

Interviews:

Various individuals from all works of life were interviewed, such as teachers, students, traders, doctors etc., from the communities who are affected by the impact of global warming and climate change and other academics from Nigerian Universities and professionals in the field of environment, were interviewed to gain different perception of the problems of global warming and climate change. These interviews were done in a face-to-face verbal conversation.

Observations:

A checklist method was used to physically observe several sites where some of the impacts of global warming and climate change are seen like flooding in Ajah, Ajegunle, and Yaba, as well as Coastal erosion in Alpha and Kuramo beaches.

Visitations to the communities were made to have an in-depth perception of the social and economic implications of the effect of global warming and climate change. In addition, visits were accorded to the administrative offices of the environmental agency in Lagos State (NIMET) and temperature data was collected.

This study made use of data both from primary and secondary sources respectively. Data on temperature variation (maximum and minimum) was collected from Nigeria Meteorological Agency Oshodi Lagos for the period of 4years (2004 to 2007). Photographs from an online source (National mirroronline.com 2011 to 2012 and vanguard news online 2012) were collected.

RESULTS AND DISCUSSION

The data comprises the maximum and minimum temperature for 12 months. The maximum and minimum temperature for each month was recorded for the 12 months (January to December), this was done for a period of 4 years (2004 to 2007). For each year a table was drawn showing the maximum and minimum temperature for each month and a mean average was calculated for each month and stated on the table showing the mean temperature for each month. Two separate graphs were plotted showing the maximum and minimum temperatures for the respective years. From the graph, it could be deduced that there has been an increase in temperature over the years. The photograph collected from online sources on flooding, coastal erosion, rainstorms, and sea level rise were placed in the appropriate segment in preparation for analysis.

Observed Climate Change Indices (Temperatures Variability)

The result derived from the temperature variation for the year 2004 as shown in Table 1 indicates that the maximum and minimum temperature for each month experienced fluctuation. There were months when the temperature was low and suddenly experience an increase.

Table 1: Maximum and Minimum Temperature Variations for Ikeja, Lagos (2017)

MONTHS	MAXIMUM TEMPERATURE (°C)	MINIMUM TEMPERATURE (°C)	AVERAGE TEMPERATURE (°C)
January	35	21	28
February	35	20	27.5
March	36	21	28.5
April	36	21	28.5
May	33	21	27
June	32	21	26.5
July	31	21	26
August	31	21	26
September	31	21	26
October	32	21	26.5
November	34	23	28.5
December	35	22	28.5

Sources: LASG, 2017 and NIMET, 2018

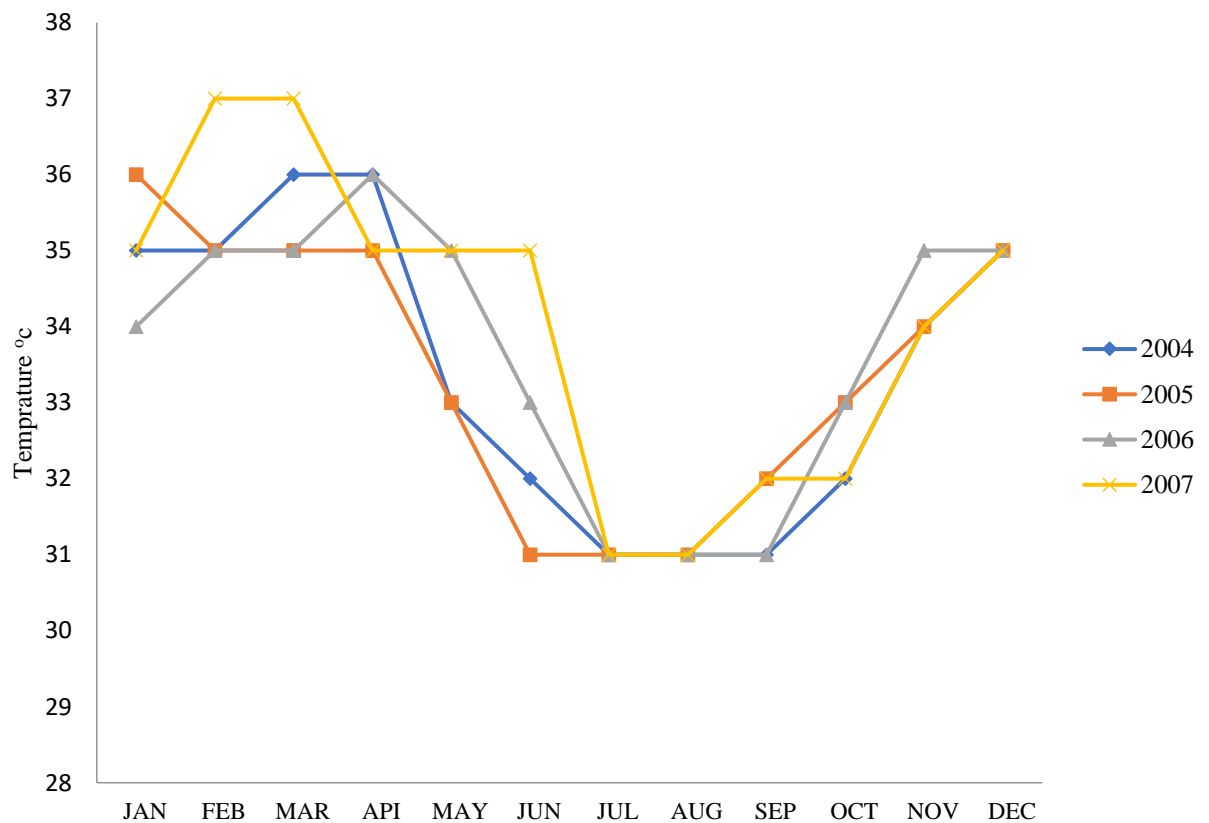
Also, it can be observed that in July, the maximum temperature dropped to 31°C and the minimum temperature recorded at 21°C, but by December there was a steady increase from 31°C for the maximum temperature to 35°C and 22°C for the minimum temperature. It was also observed that the mean average temperature rose from 26°C to 28.5°C.

Table2: Maximum and Minimum Temperature Variations for Ikeja, Lagos (2018).

MONTHS	MAXIMUM TEMPERATURE (°C)	MINIMUM TEMPERATURE (°C)	AVERAGE TEMPERATURE (°C)
January	36	19	27.5
February	35	22	28.5
March	35	23	29
April	35	22	28.5
May	33	22	27.5
June	31	22	26.5
July	31	22	26.5
August	31	22	26.5
September	32	21	26.5
October	33	21	26.5
November	34	21	28
December	35	23	29

Sources: LASG 2017 and NIMET 2018.

From Table 2, the same temperature fluctuation was experienced in 2008. The maximum temperature started on a high note (36°C) compared to the minimum temperature which started on a low note (19°C) by the end of the year the maximum temperature dropped to about 35°C, while the minimum temperature increased from 19°C to 23°C. Looking at the mean average temperature, there was an increase from 27.5°C to 29°C.

**Figure 2:** Maximum Temperature variation between 2004 to 2007

From Figure 2, it was observed that the peak maximum temperature for the period overview was 37 °C in 2007, depicting maximum raining occurred with a high rate of evapotranspiration within the metropolitan area. This variation also revealed that they have been an increase in the temperature variability between the years and at each month from the years of study.

Similarly, using the minimum temperature scenario as depicted in Figure 3, the lowest amount of temperature conditions in 2007 still stands out to be higher. This reveals that there is a gradual increase in general atmospheric conditions as the year increases.

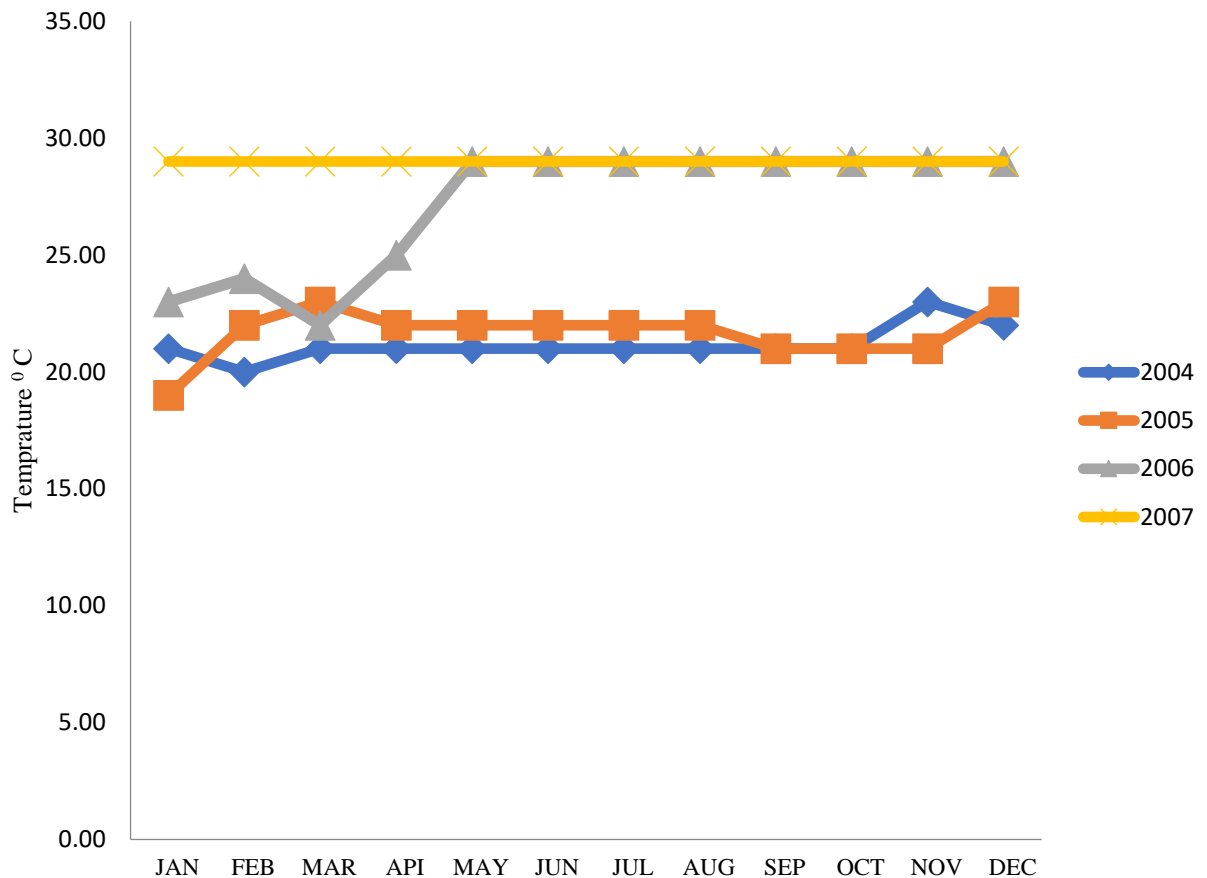


Figure 3: Minimum Temperature Variation between 2004 to 2007

The implications of these monthly and yearly comparisons of the temperature data within the metropolitan area contributed to a high level of flooding and rainfall pattern observed currently within the various path of Lagos state, particularly in 2006 and 2007.

The actual impact of climate change

The coastal location and mega City status of Lagos state have an impact on climate change so far observed in the state (2004 to 2007) in terms of high precipitation, flooding, coastal erosion, rainstorms, and heat waves. The impacts are

particularly extreme weather events and are related to each other. Extreme weather events have been on a steady increase due to the impact of global warming and climate change.

Rainstorms and flooding events

As Lateef (2012) observed, 'In 2011, we thought we have had the worse of bad weather, as hell was let loose with the heavy rains that pounded the earth in a ceaseless frenzy, thereby causing untold hardship, death, and turmoil across the globe. Back home, we thought Lagosians would no longer have the unfortunate experience of July 10, 2011, in which the city experienced 16 hours of heavy rain that lead to the loss of lives and properties. Unfortunately, signals from metrological predictions for 2012 indicate another gruesome season, if not worse.

NIMET and NEMA had jointly predicted that there would be persistent and torrential rainfall and that the torrential rainfall could trigger off flooding in most states in Nigeria including Lagos state. Flooding submerge houses in Lagos communities was the caption on a piece written on flood in Lagos state by Eniola (2011). The author explained that the torrential downpour in the southwest is taking its toll on Lagos communities, especially the coastal ones. Already many residents have been forced out of their homes. Houses have been submerged in Owode-elede, Owode-Onirin, Ajegunle, and other flood-prone communities on the Ikorodu road.

The rainstorm also pulled down telecommunication mass leading to the death of a motorist who was said to be driving to work near Dondan barracks at Obalende. Also, in Ikoyi, a building under construction at plot 6, Alhaji Adele Odunewus street park view, caved in causing panic in the estate.



Plate 1: Car crushed after rainstorms in some part of Lagos metropolis (Adapted from: Vanguard News, 2012a)



Plate 2: Billboards falling on public road infrastructures in some parts of Lagos metropolis (Adapted from Lagos Today, 2022)



Plate 3: Flooding of the road and drainage on Lagos Abeokuta Expressway (Adapted from Vanguard News, 2012b)



Plate 4: Flooding of some roads in Lagos metropolis (Nkwunonwo *et al.*, 2016)

Coastal Erosion and Sea Level Rise

Lagos and other rapidly growing megacities in Africa and Asia face the highest risk from rising sea levels, floods and other climate change impacts according to a global survey aimed at guiding city planners and investors (Parnell *et al.*, 2009).

Dolphin and Parkview Estates are some of the exclusive areas in the coastal city of Lagos that are highly vulnerable. These estates are always flooded when it rains, thus placing a burden on the movement of vehicles and pedestrians. The situation in these estates is such that, rather than water flowing into the lagoon, the lagoon flows back into Parkview. Experts say these disasters are mostly the result of climate change which many areas in the coastal cities in the country are facing. The report explains that carbon-based emissions, reliance on fuel to power vehicles, and a rapidly growing slum population in coastal cities are discouraging trends (Huq *et al.*, 2007).

The implication of the rise in the water level within the river is that residents living in Mile 12, Ajegunle, Agiliti, Ikorodu, Majidun, Owode, and Isheri North are likely to witness flooding; indeed these predictions came to pass. Before this time, the Bar Beach coast in Lagos Island was probably one of the fastest-eroding beaches in the world, according to Ivbijaro *et al.* (2006). It was reported that Bar Beach has an annual erosion rate of 25 to 30 meters. They explained further that coastal erosion is the result of a deficit of sand occasioned by both natural and anthropogenic activities. These activities however differ from area to area in varying intensities. Some of the natural causes include low-lying coastal topography, intense wave and tidal regime, vulnerable soil characteristics, the nature of shelf width, topography, and the occurrence of offshore canyons. The anthropogenic activity of import is responsible for the high rate of erosion including damming of rivers, construction of harbor protecting structures and jetties, as in the Lagos Bar Beach; sand mining, dredging activities, and deforestation of coastal vegetation (Igbokwe, 2012). The image below further illustrates the impact of climate change on the coastline.



Plate 5: Coastal erosion Alpha beach in Eti-Osa Local Government Area in Lagos State. Climate change impacts are being felt seriously (Environ News, 2017).



Plate 6: Coastal erosion Kuramo Beach and Lekki Beach in Eti-Osa Local Government area Lagos State (Environ News, 2017)



Plate 7: Sea level rise in Ifako-Ijaye and Ilaje area of Lagos state (Adapted from Guardian News, 2019)

The findings of this study revealed that available information supports the fact that the sign or symptoms of global warming and climate change are already experienced in Lagos state in the form of uncertainty in weather conditions. It is not in doubt that significant variations exist in temperature, rainfall patterns, wind systems, and precipitation patterns in Lagos state. What is lacking though is sufficient relevant empirical data to support this variability over time and space. This has been due to a lack of sufficient baseline data upon which reliable estimates could be made. This finding probably suggests that a lot of research is needed at various levels of weather and climate conditions. Data from this study could help to convince policymakers that truly, global warming and climate change are here with us.

The findings of the study showed that the most devastating impacts of climate change in Lagos state are constant flooding, coastal erosion, rainstorms, and heat waves. The findings further revealed that these impacts resulted in huge losses in terms of human lives, properties, social dislocation, hardship, and displacement of people. This finding supports the view of UNEP (2011) that the challenges of climate change are made clear by the array of recent extreme weather events.

CONCLUSION

Variability in temperature, rainfall patterns, wind systems, and sustained sea level rise are the major signs of a changing climate in Lagos state. Lagos state loses so much in humans and material in terms of the associated impacts of climate change such as flooding, rainstorms, heat waves, sea level rise, and coastal erosion. Both the poor and the rich are equally vulnerable to climate change impacts in Lagos state due primarily to low-lying coastal locations and uncontrolled urbanization. Effective mitigation and adaptation to climate change impacts in the state would require the effective involvement of the general populace with the government providing leadership.

RECOMMENDATIONS

The Government should intensify its climate change awareness drive until all and sundry are sufficiently sensitized to contribute meaningfully in mitigation and adaptation measures. They should also work with private sector partners to promote research development in climate change. In tackling the challenge of climate change in the state, emphasis should be given to adaptation strategies that are low-tech, particularly those that are targeted at the most vulnerable members of society.

Based on the findings and conclusions of this study, the following recommendations are made in the hope that they would help to mitigate and adapt to climate change impacts in Lagos state. There is also the need to substantially improve our emergency response capacities to minimize losses during an emergency such as flooding. All stakeholders (Government, private sector, civil society, and communities) at all levels must be involved in tackling the menace of climate change. Effective land use and urban planning will go a long way in helping to mitigate and adapt to climate change impact in Lagos state. The state government should develop and implement an energy policy in which a substantial part of electricity from renewable sources, especially solar, wind, and biogas from waste.

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