



CLIMATE CHANGE INDICATORS' ASSESSMENT IN SELECTED AREAS OF IBADAN

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ABSTRACT: Climate change is a global challenge and its effect is felt everywhere including the local communities, therefore the need to assess the indicators of climate change such as Rainfall irregularities, Flooding, Heat waves, and Drought in Ibadan Southwest, Oluyole, and Akinyele local government areas of Oyo state using a carefully prepared questionnaire, the data obtained were analyzed using a descriptive statistics. The Result showed that larger percentage of respondents in the study areas strongly and partially agreed with occurrence of extreme weather events, where South-West, on rainfall irregularities recorded; (47.4%, 31.6% and 21 % strongly agree, partially agree, and disagree respectively), Oluyole (15% , 35% and 50% strongly agree, partially agree, and disagree respectively), Akinyele (65%,30%,5% strongly agree, partially agree, and disagree). On flooding, South-West recorded; (57.9%,26.3% and 15.8% strongly agree, partially agree, and disagree respectively), Oluyole (85% strongly agreed,10% partially agreed, and 5% disagreed), Akinyele (50%,25%,25% strongly agree, partially agree, and disagree), while on heat waves, South-West (68.4% strongly agreed, 31.6% partially agreed, 0% disagree), Oluyole (60% strongly agreed, 30% partially agreed, and10% disagreed), Akinyele (85% strongly agreed, 15% partially agreed, while none disagreed), and on drought prevalence, South-West (31.6%,57.9% and 10.5% strongly agree, partially agree, and disagree respectively), Oluyole (60%, 30% and 10% strongly agree, partially agree, and disagree respectively), Akinyele (35%, 60%, 5% strongly agree, partially agree, and disagree). It is therefore imperative for individuals, government agencies, and groups to help sensitize the public against inimical human activities.

Keywords: Indiscriminate dumping, biodiversity, deforestation, rainfall.

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1. INTRODUCTION

The world at large from time immemorial have always been confronted with one challenge or the other, like volcanic eruption, coastal erosion, flooding, desertification, and most recently climate change, a global challenge which has now become more pronounced and has further aggravated those environmental challenges afore mentioned (Papalexiou *et al.*, 2018). Climate is the descriptions of the long-term pattern of weather in a particular area; climate often undertakes cyclic changes over a long period of

time. As human activities change the properties of the atmosphere, understanding how the atmosphere works and what the future weather and climate conditions may be, becomes extremely difficult (Cunningham *et al.*, 2001).

In the year's past, issues concerning climate change mitigation have been so stressed through various conferences, treaties and summit, such as Montreal Action Plan (1987), Bruntland Report (1987), Rio Earth Summit (1992), Kyotol protocol (1997) Copenhagen,

Paris climate conference, but recently, several of the studies are now seeking for climate change adaptation. Africa as a continent contributes less than 2-3% of world's output of greenhouse gas yet receives more of the impacts (Brown *et al.*, 2007; Enarson *et al.*, 2004; Bartlett, 2008), it is therefore imperative that Africa and Nigeria especially, should not trivialize climate change issues. Change in climate has been mainly influenced by human activities (Trenberth *et al.*, 2012) such activities have led to the annual release of about 6.3 billion metric tons of CO₂ into the air and since CO₂ is a green house gas it absorbs infrared radiation and warms surface air thus significantly raising global mean temperature. Methane absorbs about 20-30 times as much infrared and is built up in the atmosphere faster than CO₂, it usually finds its way into the environment through various human activities (Cunningham *et al.*, 2001).

Intergovernmental Panel on climate change predicts that in years to come about 250 million people will experience increased water stress in Africa due to climate change, Lake Chad, once the largest water reservoir in the Sahel region, with an area of 26,000 square kilometers and economic sustainability of about 30 million people across four countries, is now drastically reduced. The World Bank also predicted that by 2080, annual rainfall may decrease by 30% in southern and east Africa and by 2030, dry and arid regions will expand by 10% especially in southern Africa and parts of West Africa (Dai, 2012; Hendrix, *et al.*, 2007). Climate change will also affect the agricultural sector significantly due to an increase in global average temperature by 1.5°C to 2°C by 2040 (Lobell *et al.*, 2011; Smoyer-Tomic *et al.*, 2003). Yield from rain-fed agriculture could be reduced by 50% by 2020, which is likely to negatively affect food security and aggravate malnutrition (Benfield, 2012).

These predictions are indeed alarming and there is a need for an urgent, decisive action if the predicted approaching consequences are to be curbed, thus this study considered it necessary to assess the possible indicators (such as extreme drought, heat waves, floods, irregular rainfall etc) of climate change in selected areas of Ibadan Oyo state.

Ibadan which is the most populous city in Oyo state, the third most populous in Nigeria, the largest in Nigeria by geographical area and with the population of over 3 million (Toyin *et al.*, 2018) cannot but have its own urban climate created by the largeness of its anthropogenic interferences and therefore more

vulnerable to climate change and for the purpose of formulating, implementing and enforcing a proactive climate change mitigation and adaptation strategies/policies, there is a need to understudy the level of influence climate change is already having on the environment.

2. METHODOLOGY

2.1 Study Area

The study area (Ibadan) was characterized by tropical climate where much rainfall is experienced in summer than in the winter. The average annual temperature was 26.5°C and about 1311mm of precipitation falls annually, the precipitation reaches its peak in June with an average of 190mm, with march being the warmest month at 24.1°C on average and August being the coldest month of the year, the annual variation in temperature was around 4.5°C (CLIMATE-DATA.ORG). The study was conducted in Ibadan Southwest, Oluyole and Akinyele local government areas. South-West (DMS Coordinates 7° 21' 2.48"N and 3°51' 55.84"E) whose headquarters were located at Oluyole Estate axis of Ibadan has an area of 40km² and a population of 285,585 (National population census (NPC), 2006) and time zone UTC+1(WAT).

Oluyole (DMS Coordinates 7°13' 59.99"N and 3°52' 0.01"E) is one of the oldest local government in Ibadan and its headquarters was situated at Idi-Ayunre, it occupies about 4000km² with a population of 202,725 (NPC, 2006), and several companies such as British American Tobacco (BAT), Rom oil RCC Quarry amongst others were sited there.

Akinyele (DMS Coordinates (7° 33' 41.47 "N 3°54' 21.92"E) was one of the local governments that make up Ibadan metropolis, it has ten wards, with headquarters at Moniya and it occupies a land area of 464.892sqkm² and population of 516 persons per square kilometer and according to NPC,2010 the population was 239,745. Primary data were obtained through a carefully prepared questionnaire, administered by a Trained Extension Officer. A hundred households were randomly selected for the study while the data Obtained were analyzed using SPSS, version 16 (IBM, Chicago, IL, USA), descriptive statistics basically bar chart and frequencies were used for the variables. Indicators assessed were Rainfall pattern, Flooding, Heat waves, and Drought. The study areas were randomly selected.

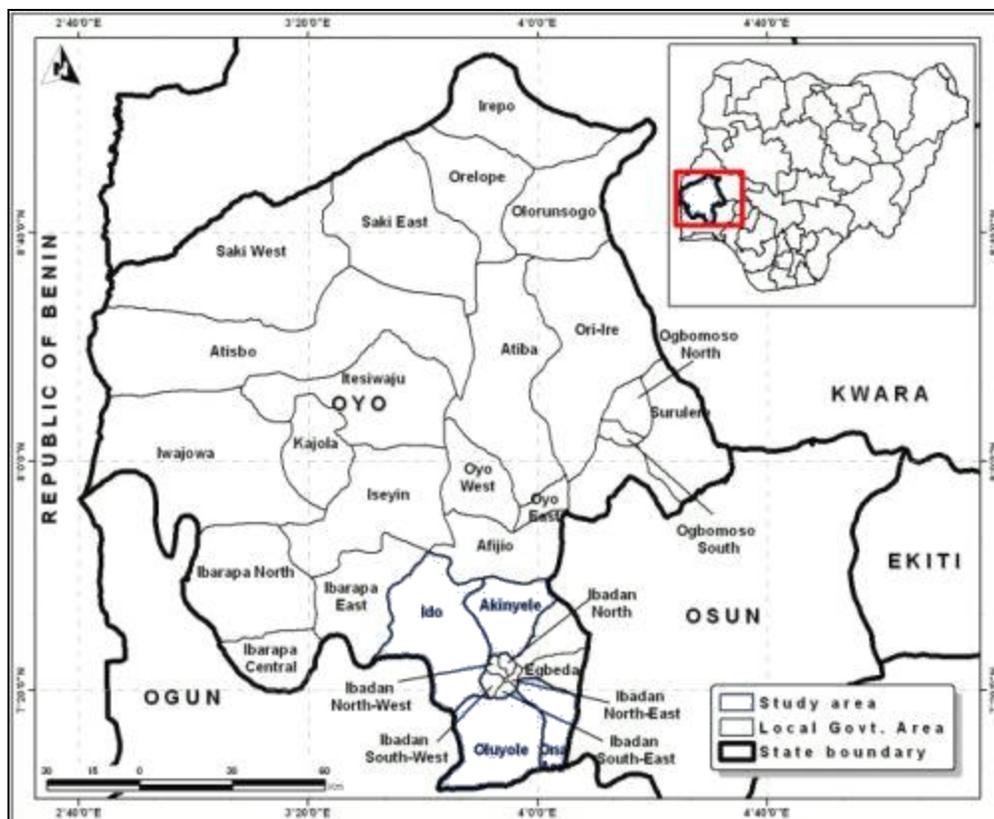


Figure 1. Map of Oyo State showing the study area (Source: <http://www.open-science-repository.com/images/70081902fig1.jpg>)

3. RESULTS AND DISCUSSION

3.1 Heat Waves and Drought

Figures 1,2 and 3 showed the prevalence of heat waves and drought as climate change indicators in the three local government areas understudy, as higher percentage of the respondents agreed with the occurrence of heat waves and drought in their domain. Heat waves are periods of abnormally hot weather, lasting days or weeks. This result is in consonance with the findings of (Clark *et al.*, 2006) who reported that the intensity, duration, and frequency of summer heat waves are expected to be significantly greater over all continents. The reason for the heat waves might be connected to human induced climate change as extremely warm seasons were strongly predicted to become much more common in response to doubled CO₂ emission the world now experience (Barnett *et al.*, 2006). According to (Coumou *et al.*, 2012), heat waves would almost certainly not have occurred in the absence of global warming and other studies have also clearly ascribed individual heat waves, notably those in Europe in 2003 (Stott *et al.*, 2004), Russia in 2010 (Otto *et al.*, 2012), and Texas in 2011 (Rupp *et al.*, 2012) to the

human influence on the climate. Therefore, the prevalence of heat waves in the study area can be said to be a clear indicator of climate change. Drought was also observed to be prevalent in the study area in that water became very scarce even at the onset of dry season although rainfall intensity was observably very high during the wet period yet drought set in quickly as soon as the rain stops. Reasons for this have been attributed to changes in temperature and precipitation patterns as these changes were projected by Kotir (2011) to shift and expand patterns of aridity. Arid regions are projected to spread, most notably in Southern Africa but also in parts of West Africa. There is marked increase in the intensity of dry spells and where and when is not raining the extra heat dries things out, aggravating heat waves as the evaporative cooling is lost. Hence, droughts set in quicker and more intense. This result is not in isolation as drought or aridity was observed by Kotir (2011) to be a function of precipitation deficit. In regions where the soil dries out due to a lack of precipitation, no more heat can be converted into latent heat and all heat results in increased surface temperatures. This additional heating of the land (brought about by temperature increase) increases evaporative demand of crops and amplifies the

precipitation deficit thus drought set in quickly. Carmago *et al.* (2013) also affirmed that higher temperature has led to increased rates of evaporation, including more loss of moisture through plant leaves

and even in areas where precipitation does not decrease, these increase in surface evaporation and water loss from plants are expected to cause more rapid drying of soils if higher temperature persists.

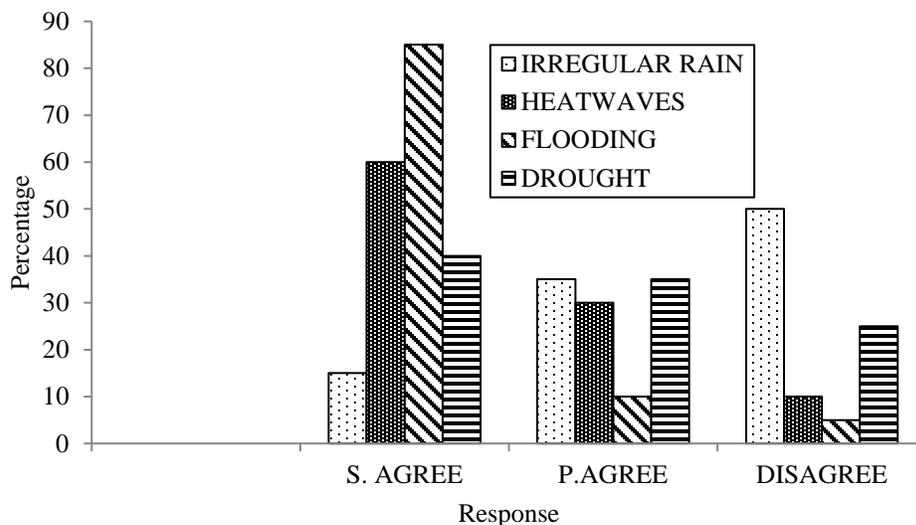


Figure 1. Climate change indicators and response in Oluyole Local Government

3.2 Rainfall Irregularities

The results presented in figures 1, 2 and 3 has shown that rainfall is indeed becoming irregular, this irregularity in rainfall may be referred to as the timing and intensity of rainfall especially in the rainforest region where according to Theophilus, 2004, rainfall usually starts by March and ends in September. Larger percentage of the respondents reported irregularity in commencement and intensity of rainfall in the study area. Rainfall was observed to be more intense and this might be connected to climate change as IPCC in 2007 reported that earth's climate is getting warmer and this increase in Temperature has led to higher rate of evaporation which in turn has contributed to extreme rain and snow events.

The atmosphere holds about 4% more moisture per 1°F and increase in temperature has led to increased water vapor in the atmosphere and this has led to 5 to 10% more water vapor in the atmosphere (Trenberth, *et al.*, 2005). This might be the reason for the irregularities and increased rainfall intensity observed in the course of this study in the study area as Trenberth (2007) also observed that this unprecedented rise in the earth's atmospheric water vapor has raised precipitation rate to

about 5-20%. This has therefore, further confirmed the link between climate change and rainfall irregularities in the study area.

3.3 Flooding

Rains are notably heavier as increase in temperature is reportedly (IPCC, 2007) leading to higher rate of evaporation and this in turn has contributed to more extreme rain and thus flooding. Although, climate change might be the ultimate cause of flooding but observably flooding in the study area might be largely due to factors such as structural failures of dams, poor drainage, indiscriminate dumping of waste on water ways and land cover alteration, this might be the reason for the significant difference in the level of agreement amongst the residents of the selected area, in that Oluyole had the highest level of respondents that agreed with the occurrence of flooding (figure 1.), followed by southwest (figure 3.) and the least was Akinyele (figure 2.) This was also observed by Hoerling *et al.* (2013) in their works, where it was affirmed that floods are caused or amplified by both weather and also poor drainage and other human factors.

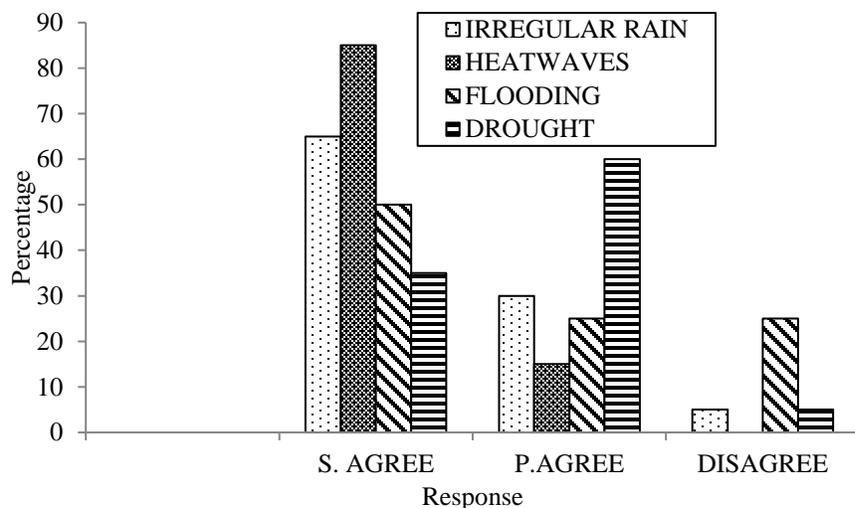


Figure 2. Climate change indicators and response in Akinyele Local Government

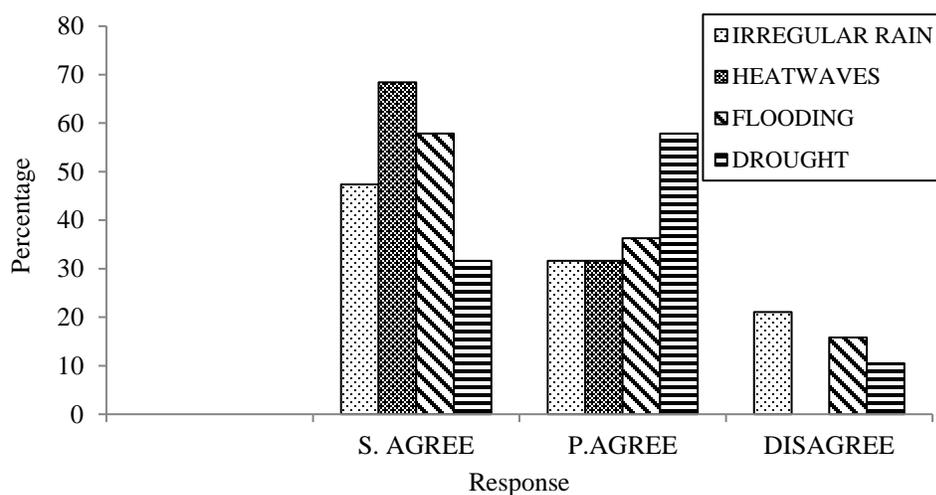


Figure 3. Climate change indicators and response in Southwest Local Government

4. CONCLUSION

This study has assessed the indicators of climate change in randomly selected local government areas of Ibadan namely Southwest, Oluyole and Akinyele and the reality of climate change has been established through the prevalence of its indicators in the study areas as majority of the respondents in this area confirmed the existence of those climate change indicators, but while indicators such as Heat Waves, Rainfall irregularities, Drought might be mainly attributed to climate change, flooding might not have been totally caused by weather factors but partly by other factors such as indiscriminate dumping of refuse in drainages and water bodies, decayed or lack of engineering structures as it was observed in the study areas. It is therefore, urgent for every individual to be engaged in climate-smart

practices within the environment to ensure a healthy world for all. Forest has been confirmed by many scholars to be a carbon sink per excellence thus forest regeneration and conservation through a sustainable community-inclusive forest policy should be brought to the fore. Infrastructure needed to cushion the effect of extreme climate events such as good drainage facilities and others should be put in place to reduce humans' vulnerability to the changing climate. Indiscriminate dumping of refuse in drainages and water bodies, causing blockage of water ways and invariably flooding must be avoided. This study is thus meant to create awareness on the emergence of climate change and also to arouse the interest in individuals, government bodies and groups to take decisive measures towards mitigating/adapting to climate change.

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