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ANALYSIS OF THE PERCEPTION OF URBAN RESIDENTS ON RISK OF CLIMATE CHANGE IN ILORIN METROPOLIS

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ABSTRACT

Understanding public perceptions of climate change is critical for developing an effective strategy to mitigate the effects of human activity on the natural environment and reduce human vulnerability to the impacts of climate change. The main objective of this paper to evaluate the level of people's awareness and perception on the risks of climate change in Ilorin metropolis. In order to realize this objective, the study employed descriptive type, survey method and mixed approach of research. Primary data were collected using questionnaire survey. A total of 200 residents were selected through random and systematic sampling, The study also used secondary data from the literature. We compared meteorological data for the metropolis with residents views gathered through questionnaire survey. We explored the local significance of seasonality, climate variability, and climate change. Rainfall and temperature magnitudes and patterns are of great importance to understand the climatic changes and trends in the study area. Therefore, a trend analysis of rainfall and temperature data from 1975 to 2017 for Ilorin was carried out. In the analysis of the rainfall, it was proved that the annual rainfall variation is increasing with time at a rate of 0.24 mm per year. In the analysis of temperature, the temperature variability among years was proved (maximum and minimum) to increases by about 0.01^{o}C every year. It was concluded that the changes in climate of Ilorin Metropolis are considerable.

Keywords: Climate changes; Rainfall; Temperature; Trend Analysis; Risk perception.

1.0 INTRODUCTION

cities arise from the transformation of natural ecosystem into a built environment and today are particularly exposed and vulnerable to climate change (Weyrich, 2016). Moreover, fast urbanization in developing countries has already increased the number of greatly vulnerable urban communities living in informal settlements, many of which are at high risk from extreme weather events. More than half of the world population currently lives in cities, which have increased urbanization process and the exposition to direct climate change impacts and consequences today and the future (Hunt and Watkiss, 2011).

Climate change has become the concern of current times, a concept that carries profound social, political and environmental connotations. These overtones are further stressed by the emerging and substantial scientific consensus that anthropogenic climate change may cause irreversible damages to the fragile ecosystem (Vassiki et al, 2018). It is imperative to understand the public's perceptions of climate change in order to organize and implement effective strategies for mitigation and adaption that will reduce human vulnerability to global and local impacts. Although there is not perfect correspondence between environmental perceptions and behavior (Corral-Verdugo et al. 2003; Kurz 2002; Mainieri et al. 1997), individual responses to environmental problems cannot be predicted without knowing how environmental threats are perceived (Fischhoff 1985).

Perceptions of environmental problems are also important because most researchers agree that, directly or indirectly, what the public thinks has a great deal of influence on policy-making (Bostrom et al. 1994; Kempton et al. 1995; Read et al. 1994). For example, Leiserowitz (2006) asserts that public perceptions of climate change risks will influence national and international support or opposition to policies, legislations, regulations, and treaties designed to lessen the harms of global change.

Evidence is mounting that climate change presents unique challenges for urban areas and their growing populations (UN-Habitat, 2011). Climate change aggravates the existing urban environmental management challenges in cities. The climate in and around cities and other builtup areas is altered in part due to modifications humans make to the surface of the earth during urbanization. The surface is typically rougher and often drier in cities, as naturally vegetated surfaces are replaced by buildings and paved streets. These changes affect the absorption of solar radiation, the surface temperature, evaporation rates, storage of heat and the turbulence and wind of climates of cities and can drastically alter the conditions of the near surface atmosphere.

Although cities themselves form a very small fraction of the Earth's surface area, the world's population has become increasingly urbanized and is now affected by urban climates. Cities too are important sites for greenhouse gas emissions because of the high energy demands by urban residents and activities. These emissions extend the (indirect) influence of cities on climate to much larger scales. Although humans live in wide-ranging climate regimes, people are highly sensitive to weather and climate as a result of physical reactions, social preferences, recreation, and discussions about their local environment (IPCC 2001; List 2004). Each scale of climate and climate processes global, regional, and micro is important for understanding the biophysical and social contexts that influence how people perceive climate change.

Climate change differs from the hazards. Firstly, climate change occurs over an extensive period of time, making it impossible to directly perceive the changes as they occur (Weber, 2006, 2016; Van der Linden, 2015). Second climate change is global, differing from other regional or local risks. Third, climate change is perceived as psychological distant; people think climate change will harm people other than themselves in far future (Carmi and Kimhi, 2015; McDonald et al., 2015; Weber, 2016). These attributes hamper human engagement and imply that intervention which serves to bring climate change closer and make it more concrete may be fruitful to explore in empirical research. Engagement with climate change depends on the perceived risk of climate change. Perceive risk to the product of an uncertainty aspect, i.e, how probable a negative outcome is perceived and a severity aspect, i.e, the magnitude of the consequence of the hazard should manifest (Brum, 1994; Wolff and Larsen, 2012).

However, there still exists some uncertainty regarding the levels of impact that will result from this change in atmospheric conditions and impacts may also turn out to be locally specific (Morton 2007). These impacts extend far beyond the physical risks posed by climate change, such as sealevel rise and extreme weather events. Cities could face difficulties in providing even the most basic services to their inhabitants as a result of climate change. Climate change may affect water supply, ecosystem goods and services, energy provision, industry and services. It can disrupt local economies and strip populations of their assets and livelihoods.

Climate change risk perceptions are generally defined as people's awareness about causes of climate change and its adverse impacts (Leiserowitz, 2006; Whitmarsh, 2008). Although perception is narrowly defined here with an explicit importance on awareness or familiarity of the issue. This research has extended the concept of perception to the level of knowledge, which reflects individuals' awareness of facts, concepts and relationships concerning causes, consequences and solutions to climate change. This definition of perception indicates a conscious understanding of climate change and associated risks, not a mere 'awareness' or 'familiarity' of the topic. For the purpose of this study, 'Risk' is defined here as the combination of the magnitude of the impact with the probability of its occurrence.

The goal of this research was to examine the perceptions of urban population of Ilorin metropolis regarding the risk of climate change. The specific objectives in this study were to conduct an indepth survey on the spatial pattern of perceptions of air temperature and rainfall among residents of Ilorin metropolis, carrying out a trend analysis on temperature and rainfall data to verify the peoples' perceptions by analysing 42 years data of temperature and rainfall related to climate change and to find out the resident's perceptions of the impacts of climate change.

1.1 Theoretical Framework

Several approaches and theories have explored risk perception. The literature particularly points to three schools of thought in the research area of risk perception: the psychometric paradigm (Slovic, 1987), cultural theory (Douglas & Wildavsky, 1982) and the social amplification of risk framework (SARF) (R. E. Kasperson et al., 1988).

The psychometric paradigm presents a theoretical framework that implies that risk means different things to different people due to the influence of different psychological, social, institutional, and cultural factors (Slovic, 2000). In contrast, cultural theory posits that risk perception is socially and culturally constructed. Studies using cultural theory infer risk perception by investigating the views of individuals depending on their association with different social groups. Lastly, Social amplification of risk' (Kasperson et al., 1988) implies that risks are communicated through different signals such as images, signs, and symbols. By interacting with psychological, institutional or cultural processes in society, these signals can amplify or attenuate the perception of risks and their manageability. The study will try to gain from the strength of the three approaches in exploring the risk perception through the lens of Ilorin Urban residents'.

2.0 THE STUDY AREA

Located in the North-central region of Nigeria, Ilorin, the capital of Kwara State comprised of three Local Government Areas namely: Ilorin West, Ilorin East and Ilorin South. The city has been selected because of the occurrence of climatic extremes over the years and urbanization, which made it a good ground for the study of this nature. The city performs the function of a state capital and headquarters for the three local government areas. Ilorin is located approximately on latitude
8^0 30' and 8^0 50' North of the equator and longitude 4^0 20' and 4^0 35' East of the Greenwich Meridian. Ilorin is the gateway between the Southern and Northern Nigeria. The city of Ilorin occupies an area of about 468 sq. km.

Ilorin experiences two climatic seasons, i.e., rainy and dry seasons. The rainy season often occurs between March and November. The annual rainfall varies from 1000 mm to 1500 mm with a peak around September to early October. The mean monthly temperature is generally high throughout the year (Ajibade, 2002). The average daily temperatures vary from 25 ºC in January to 27.5 ºC in May and 22.5 ºC in September. The type of vegetation found in ilorin is derived savannah with a riparian forest along the river banks. The drainage system is dendritic. The general elevation of the land on the western part varies from 273 m to 364 m (i.e. 900 to 1/200 ft.) above sea level. In the northwestern part of Ilorin lies an isolated hill known as Sobi hill, which is about 394 m above sea level. Large portions of the land surface of Ilorin are as high as 100 m above sea level, with the highest point having an elevation roughly 394 m above sea level. The geology of the study area consists of Precambrian basement complex rock. The population of the city as of the year 2006 is 766,000 according to the census report of the Nigerian Population Commission (NPC, 2006).

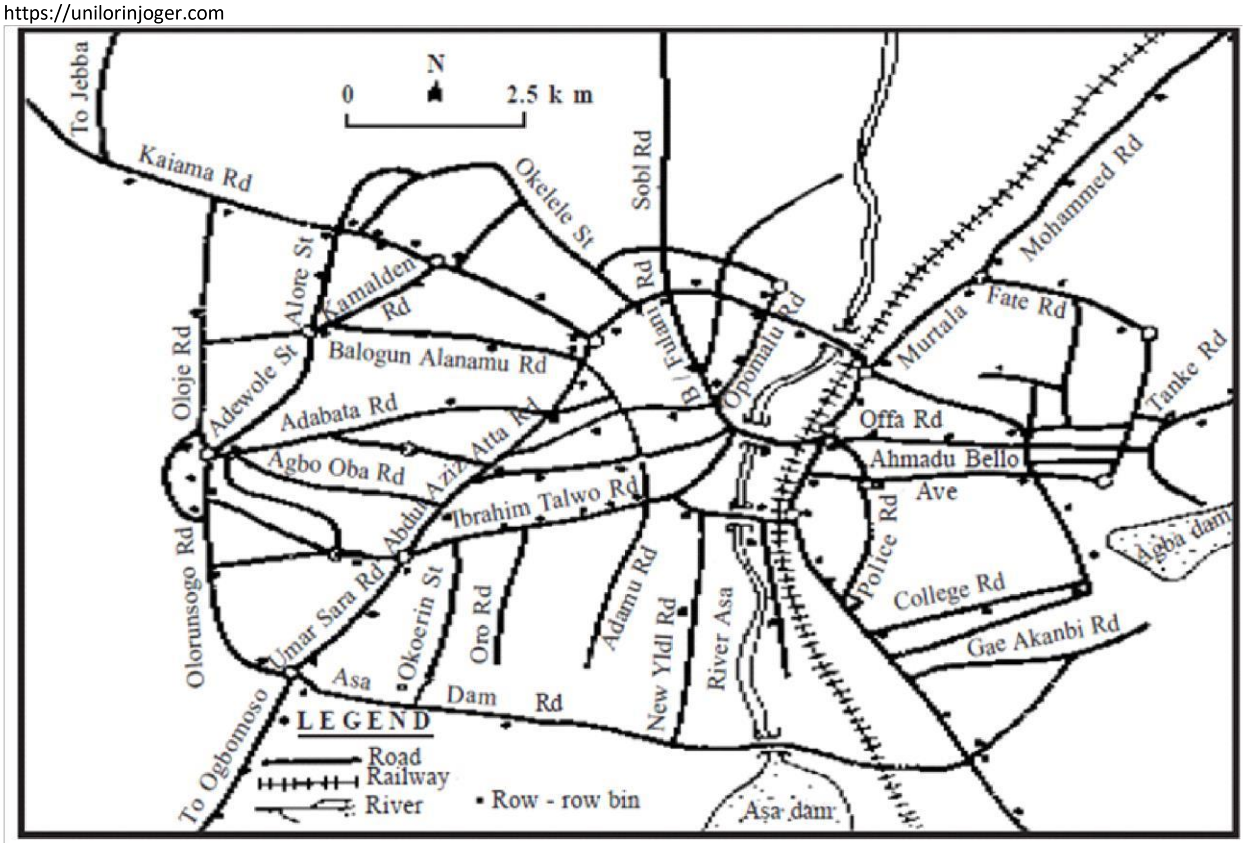

Fig. 3.1: Map of Ilorin Metropolis Source: Ministry of Lands and Surveys, Ilorin (2013)

3.0 METHODOLOGY

3.1 Data Collection Methods

This study was carried out on both primary and secondary data to enable the research objectives to attain its goal. To assess the climate variability trend pattern in Ilorin, the rainfall and temperature data used in this study for Ilorin metropolis were obtained from the Nigeria meteorology Agency (NIMET). Trend analysis was conducted for detecting climate change for both rainfall and temperature. The cumulative sums of deviations were calculated over a 42 years period (1975 to 2017), in order to analyze non-abrupt changes in the rainfall and temperature series. The t-test was used to check whether decreasing or increasing trend (climate change) significant or not.

Ilorin metropolis was divided into two broad sub-areas on the basis of residential characteristics.

The sub- divisions are:

1) The New Residential Areas: These are the post-colonial residential areas, which are built up around the core area of the city such as Tanke, Basin, Gaa-Akanbi, Asa Dam, Adewole, Okoerin etc.

2) The Government Reservation Area (GRA): This is the high-status neighbourhood area of Ilorin metropolis. It occupies the southeastern sector of the city.

The field survey was mainly conducted in Ilorin Metropolis. Some ~~and~~ 200 questionnaires were administered effectively filled and returned. The survey questionnaire contained both openended and close-ended questions. The questionnaire entails seventeen (17) questions divided into five sections. Each section seeks to answer specific questions related to one of the research objectives: Demographic Information; Knowledge and Awareness of the Concepts of Climate Change; Sources of Information; Climate Risk Perception; and climate change mitigation and adaptation.

3.2 Sampling Procedure and Size

Random and systematic sampling was employed due to the micro scale of the study. It was estimated that there are One thousand households in each of the sub-division. However, ten per cent of this gives a hundred respondents. Hence, hundred copies of structured questionnaires were distributed and administered in each of the two residential areas. On the whole, two hundred questionnaires were randomly administered in the study area.

3.3 Data Analysis

Data analysis was undertaken in line with the research objectives beginning with a thorough analysis of the collected raw field data. This was achieved by utilizing descriptive and detailed statistics using R package and Microsoft Excel 2013. Frequency counts, charts and chi square tests were largely used to assess this objective. The rainfall and temperature data were used to analyze the changes in trend happening over the years. The results obtained from these tests were triangulated with secondary data (rainfall and temperature data for the study area) and was analyzed using trend analysis. Likert Scale was used in this study to measure respondents' perception on risk of climate change. The statistical parameters such as Mean and coefficient of variation were calculated on annual basis. The data was logically interpreted along with simple tables, charts and graphs.

4.0 RESULTS AND DISCUSSIONS

4.1 Climate Variability in Ilorin Metropolis between 1975-2017

The descriptive characteristics of the examined climatic variables in the area for the period under study are presented in Table 1. Minimum temperature ranged between 20.50^{o}C to 22.30^{o}C with a mean of 21.54^{o}C and a coefficient of variation of 1.83%; this implies that minimum temperature recorded in the area between 1975 and 2017 was homogenous (similar). Furthermore, maximum temperature ranged between 30.80^{o}C to 33.40^{o}C with a mean of 32.24^{o}C and a coefficient of variation of 1.50%; meaning that maximum temperature recorded in the area during the period of study is homogenous.

Table 1: Descriptive Characteristics of Climatic Variables

Variables	Minimum	Maximum	Mean	CV%
Minimum Temp	20.50	22.30	21.54	1.83
Maximum Temp	30.80	33.40	32.24	1.50
Average Temp	26.16	27.55	26.89	1.33
Rainfall	58.10	143.00	101.51	18.13

Source: Author's Computation (2019)

Over the period studied, the temperature in Ilorin is observed to have had fluctuating values that were not too broad. From the table, it can be inferred that the lowest average temperature recorded in the area during the period of study was 26.16^{o}C while the highest was 27.55^{o}C. The mean average temperature between 1975 to 2017 was 26.89^{o}C with a coefficient of variation of 1.33%; meaning that average temperature recorded in the area during the period of study was homogenous. In the same vein, the lowest rainfall recorded in the area during the period of study was 58.10mm while the highest was 143.00mm. it was also observed that the average rainfall was 101.51mm for the 42-year period with a coefficient of variation of 18.13%; implying that the rainfall received in the area during the period of study was homogeneous.

Pattern of Minimum Temperature 1975 -2017

The Figure 4.1 gives the trend of the annual variation of the Minimum temperature in Ilorin

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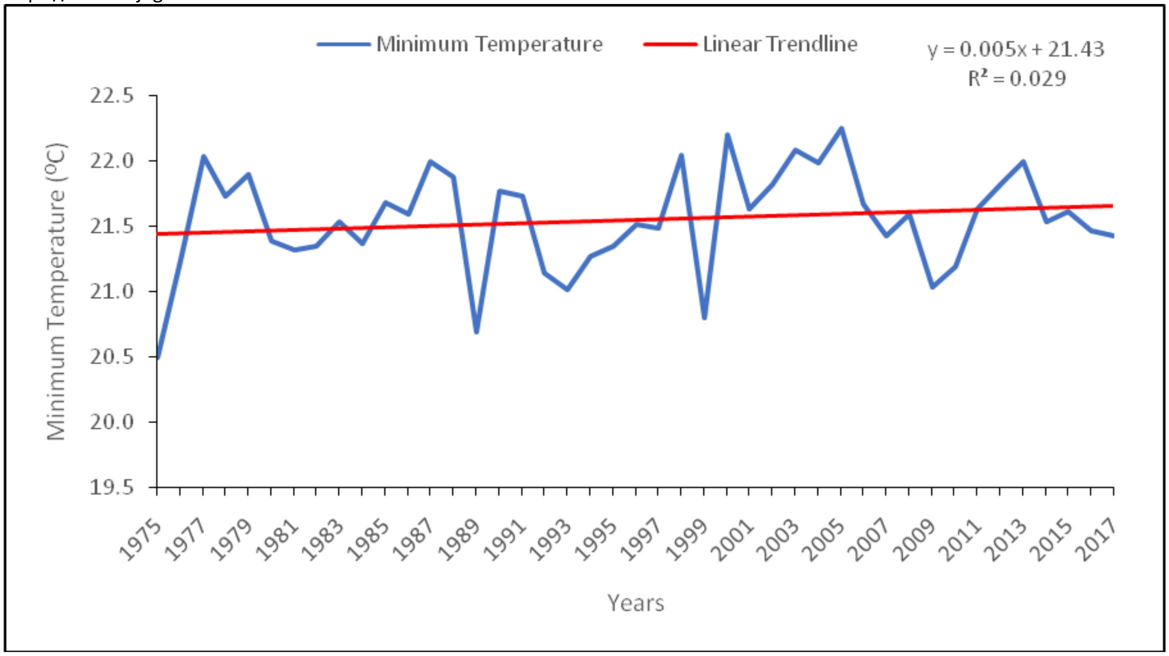

Figure 4.1: Pattern of Minimum Temperature
Source: Author's Computation (2019)

Minimum temperature in the area is characterized by marked variability from year to year. The lowest minimum temperature was recorded in 1975 while the highest minimum temperature was recorded in 2005. The trend line equation (Y= 0.0054x + 21.431) is positive; meaning that the area experienced an increase in minimum temperature between 1975 to 2017. This corresponds to an increase of 0.01°C every year. Other result indicates that the area experienced an increase of 2% per annum. The trend of the minimum temperature is very important, because it casts a glance on the probable substitution of the former maximum temperature by the minimum temperature. This shows that both night and day are becoming hot and therefore it may impact human well-being and health.

Pattern of Maximum Temperature (1975-2017)

The Figure 4.2 gives the trend of the annual variation of the maximum temperature in Ilorin.

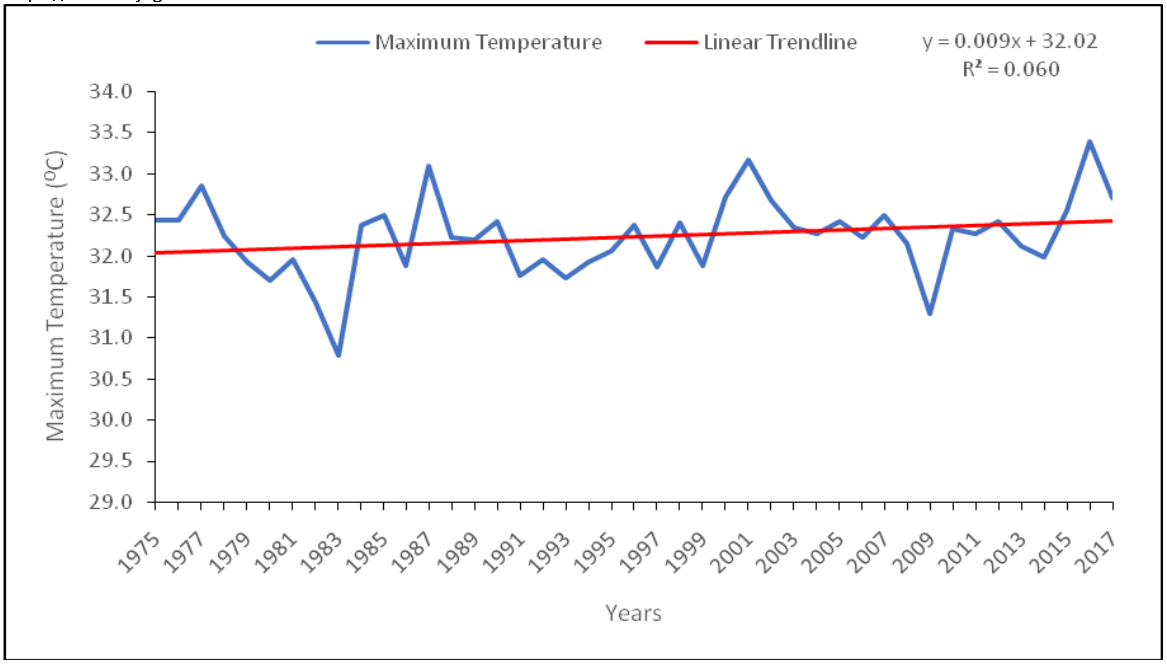

Figure 4.2: Pattern of Maximum Temperature **Source:** Authors Computation (2019)

Maximum temperature in the area is marked by variability from year to year. The lowest maximum temperature was recorded in 1983 while the highest was recorded in 2016. The linear trend line equation (Y= 0.0095x + 32.023) is positive; this implies that maximum temperature experienced an increase in the area during the study period. The curve shows an up and down variability4.2of the temperature with an increasing trend of 0.01°C every year. Even though the coefficient of correlation R^2= 0.060.

4.3 Trend of Mean Temperature (1975-2017)

The pattern of average annual temperature in the study area between 1975 to 2017 is presented in Figure 4.3. Average temperature in the study area during the period of shows there was variability among years, with the lowest average temperature recorded in 1983 and 2009 respectively while the highest was recorded in 1987. The linear trend line equation (Y = 0.0073x
+ 26.731) is positive; this implies that the area experienced an increase in average temperature during the period of study. The mean annual temperature shows an increasing temperature at correlation coefficient (R^2=0.066). This significance of the increasing trend of the temperature over the years indicates that the weather is becoming hotter over time. Rate of increasing temperature can be estimated at 0.01 °C every year.

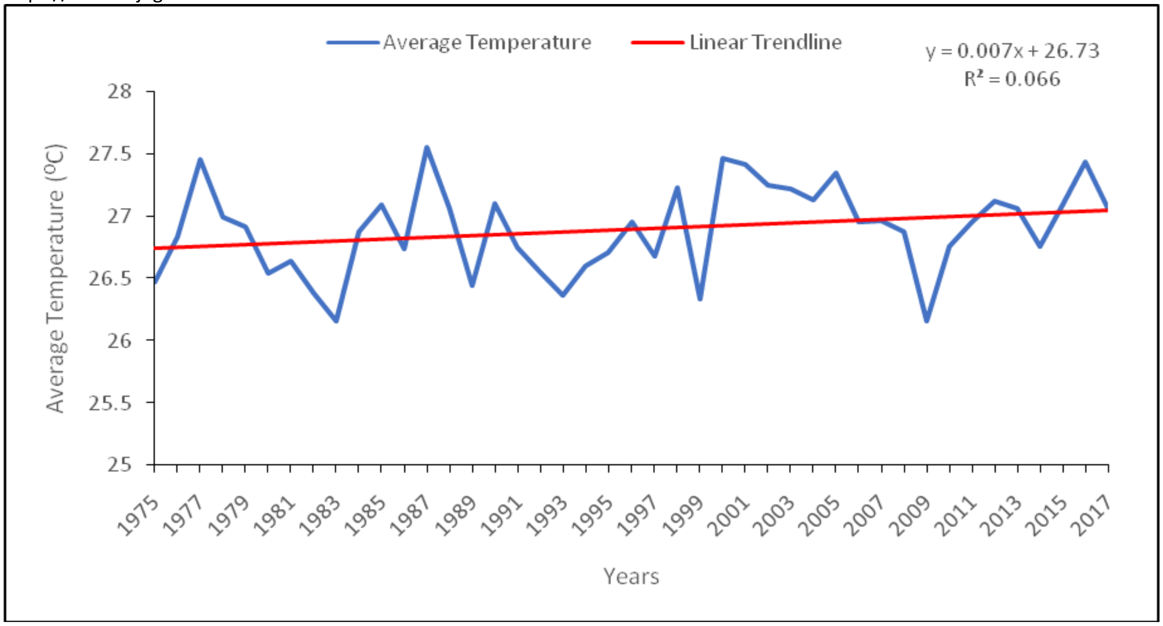

Figure 4.3: Trend of Mean Temperature **Source:** Authors Computation (2019)

4.1.6 Rainfall Pattern (1975-2017)

Figure 4.4 presents the pattern of rainfall in the study area during the period of study.

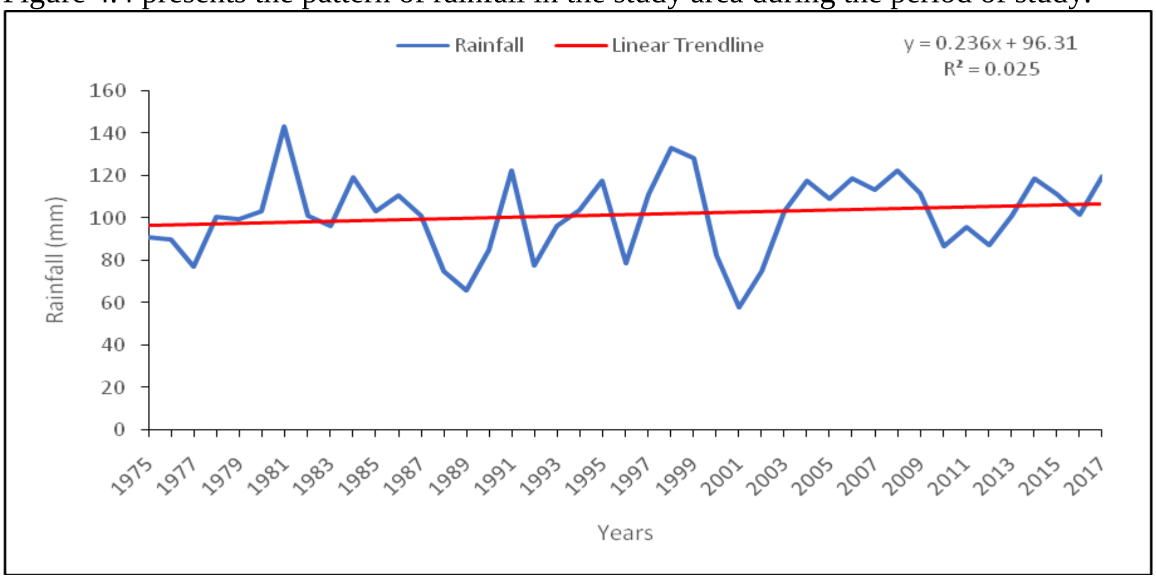

Figure 4.4: Pattern of Rainfall Source: Authors Computation (2019)

Rainfall in the study area is characterized by marked variability from year to year. The lowest rainfall was recorded in 2001 while the highest was recorded in 1981. The slope of the trend line is not very high in magnitude but it is positive indicating an increase in rainfall for the period. This study showed that annual rainfall is increasing at a rate of 0.24 mm per year. This finding is similar to the findings of Ifabiyi and Ashaolu (2015) who revealed that the area is experiencing an upward trend in rainfall of amount 0.30mm, 0.40mm and 0.2mm in the 3 stations in the area. This result affirms the findings of IPCC (2002) and Adefolalu (2003) who revealed that amount of rainfall and its frequencies in different parts of the world have gone up triggering the occurrence of environmental hazards such as flooding erosion and sedimentation. Flooding is a frequent hazard in Ilorin causing destruction of lives and property in the area. This result is inconsistent with the analysis of the respondent's perception.

4.4 Comparison between Respondents' Perceptions and Meteorological Data

Most studies on peoples' perceptions of climate variability and change focus on how people's perceptions fit climate data (West and Vàsquez-León 2003, Gbetibouo 2009). The validity of the respondents' perceptions of climate change was assessed by qualitatively comparing their perceptions in temperature and rainfall with meteorological data for 1975-2017 time periods. Both respondents perspectives (35% of the respondents) and meteorological data (R^2=0.025 coefficient of variation) indicate an increment in annual rainfall.

There was wide agreement among survey respondents that the metropolis is getting warmer over time. From Figure 4.1 it can be inferred that the respondents' perspectives were similar to what was portrayed by the meteorological data. All the respondents had reported increase in temperature, the meteorological data showed a positive coefficient of variation for mean annual minimum and mean annual maximum temperatures which signified increment in temperature and consequently warmer days. These results are in alignment with respondents as well; from the changes in climatic parameters (rainfall and temperature).

4.5 Sensibility and Concern about Climate Change

Knowledge of climate change is used in the current study as an auxiliary "instrument". The survey shows that 90 % of the respondents are aware of climate change. Hence, public sensibility to climate change is high. A total of seven items were used to assess concern about the impact of climate change. All constructs were measured on five-point Likert-type scales. The respondents were asked how serious they would rate current impact on the seven items. The data shows agriculture as a topmost impact (93%), then water availability (90%), power supply (85%) and human health and wellbeing (80%). On the other end of the scale, residential building was ranked fifth (78%), followed by industry and commerce (50%) and transportation system (30%).

After considering the impact of climate change on respondents, for the impact of climate change as a threat the numbers of respondents who agree or disagree that ‘‘the impact is threat’’ account for 83 %, and the share of respondents who disagree is 17 %. Therefore, respondents generally accept that the seriousness is not exaggerated. That is to say, the impact of climate change should be alert.

5.0 SUMMARY AND CONCLUSION

Many studies have examined perceptions of risk of climate change but few have considered how urban residents understand local climate and how their knowledge might contribute to developing better risk strategies. Our study fills an important gap in this area by contributing to a more refined understanding of how residents’ in Ilorin metropolis may formulate attitudes about climate change.

By comparing local and technical knowledge on climate, we have been able to identify gaps and areas of agreement.

The analysis conducted in this paper focused on the climate variability of rainfall and temperature. Time series of rainfall and temperature data were studied and annual and seasonal trends were reported. In investigating our research objectives, we made the following contributions. The first objective is to document the spatial distribution of environmental conditions and social perceptions of temperature and rainfall within an urban setting. Our analyses indicate that residents were exposed to varying levels of variability of rainfall and temperature. Similarly, public perceptions of relative temperature and rainfall differences among residents reflected spatial variability of responses when aggregated to the trend analysis.

The second objective is to confirm an association between the trend analysis of rainfall and temperature and residents’ perceived temperatures and rainfall. An overwhelming majority of respondents believed the metropolis is getting warmer over time, which is an accurate assessment of local climate change when compared with historical temperature records. Rainfall in the study area is characterized by marked variability from year to year. The lowest rainfall was recorded in 2001 while the highest was recorded in 1981. The slope of the trend line is not very high in magnitude but it is positive indicating an increase in rainfall for the period. This study showed that annual rainfall is increasing at a rate of 0.24 mm per year.

The third objective is to demonstrate the relative importance of environmental conditions and social frames of reference in explaining how people perceive climate change at different scales. Overall, the respondents generally accept that the seriousness of climate change is not exaggerated. This conclusion is supported by both the results of a scale of concern question, which found that 83% said they considers it as a threat. Appropriate policy and programme intervention for the resident’s can be formulated based on the findings such as campaign on climate change awareness.

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