CENTRE FOR HUMAN SETTLEMENTS AND URBAN DEVELOPMENT JOURNAL

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

CHSUDJ

VOLUME 4 No. 1 DECEMBER, 2013 ISSN NO: 2141-7601

PUBLISHED BY:
CENTRE FOR HUMAN SETTLEMENTS AND URBAN DEVELOPMENT,
FEDERAL UNIVERSITY OF TECHNOLOGY,
P.M.B. 65 MINNA, NIGER STATE

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CLIMATE CHANGE, DEVELOPMENT AND THE CITIES: PERCEPTION OF THE RESIDENTS OF MINNA, NIGER STATE NIGERIA

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Abstract
The level of an individual or communal understanding of climate change would engender any consequential response to planning activities. The assessment of the urban residence perception of climate change issues in Minna town was measured based on a field survey conducted using structured questionnaires. A total of 2000 structured questionnaires were administered using systematic random sampling techniques. That's 80 questionnaires each was assigned to 25 existing wards covering the entire study area. The result of the field survey analysis reveals that 79.2% of the respondents are aware of changes in the general weather condition of their environment, but attributed it to increase in temperature of natural changes (46.4%). The result also shows that 816 of the respondents representing 81.6% could not directly link urban planning within the environment with climate change. This research has concluded that though the people are aware of the changes in the climatic conditions of their environment, majority of the people felt that emission from vehicles, generators, etc. could not contribute to climate change rather, merely cause environmental pollution. Reasons advanced by most of the respondents were that carbon monoxide emitted from cooking stoves and automobiles are too insignificant to have any negative effect on the global climate.

Keywords: *Environmental Degradation, Desertification, Climate Change, Global warming, urban Climatology, Perception.*

Introduction

The United Nation's Framework Convention on Climate Change (UNFCCC) which was constituted by over 180 nations in 1992 defined climate change as "a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere, and that is in addition to natural climate variability over comparable time periods".

However, Climate change is caused principally by the rising concentration of greenhouse gases in the atmosphere. Greenhouse gases absorb heat, leading to an increase in average temperature and adding to the atmospheric greenhouse effect. The scientific consensus is that human activities are primarily responsible for the rising level of greenhouse gases in the atmosphere. Electricity, heating and transport requirements are all largely met through the combustion of fossil fuels releasing the main greenhouse gas, carbon dioxide (CO_2).

The Intergovernmental Panel on Climate Change (IPCC), in its 4th report published in 2007, gave the analysis of climate change science and the potential impact on our environment. It stated that "The impact of greenhouse gases on the climate is potentially catastrophic, and it is predicted that global temperatures could rise by an average of 1.1 to 6.4 degrees centigrade by 2100 leading to large sea level rises, increased flooding and declining agricultural yields".

Around the world, people are moving to cities. In 1950, 30% of the world's population lived in cities. In 2000, this fraction grew to 47%, and it is predicted to rise to 60% by 2030 (United Nations, 2004). Cities are the engine of capitalist growth. Over time, people move from rural

to urban areas as they seek a higher standard of living (fig.1). In cities, people earn higher incomes and thus have the financial resources to purchase more consumption products ranging from private transportation to larger homes. Urbanization increases the demand for land, residential and commercial, electricity consumption etc.

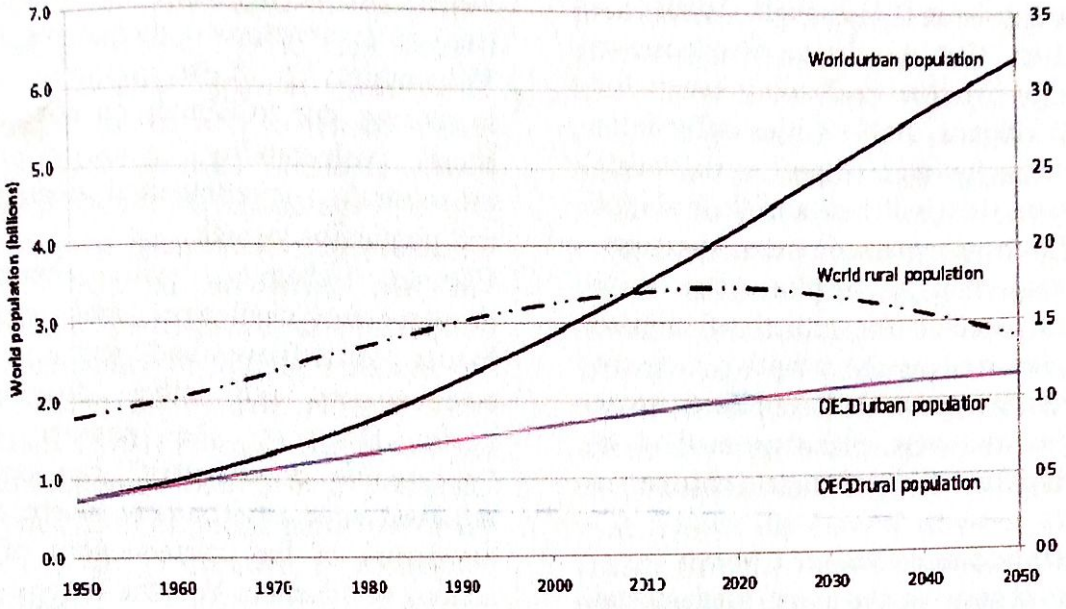


Fig.1: Urban and Rural Populations in the World
Source: United Nations Population Database (2009)

The linkage between climate and socio-economic activities in the pursuit of development became more apparent since IPCC assessment of state of the Earth's climate; evidence of human interference on the global climate system through its activities like rapid urbanization and its associated pressure on natural resources such as vegetation/forest, and water resources through environmental unfriendly practices like intense deforestation/forest depletion, unsustainable mining of soils, etc. About 38% of Nigeria is urban with growth rate of about 5-7%, making it one of the most rapidly urbanizing countries in the world. Expectations are that as global warming sets in, modifications in weather and climate indices would occur at magnitudes not known in historical perspective.

- Persistent modification of weather and climate is expected to lead to permanent shifts in global and regional mean climate indicator values – now commonly referred to as climate change.

This paper therefore, assesses the perception of urban residence to climate change issues, with a view to providing useful information necessary for effective urban planning and climate mitigation.

Public Perception on Climate Change Issues

The understanding of people's perception to a pressing environmental challenge is critical to planning for such a community of people. Measuring the level of awareness of the problem of climate change is necessary if any meaningful and sustainable development is to take place. The level of an individual or communal understanding of the problem would engender any consequential response to planning activities.

However, social science research has demonstrated that risk perceptions are critical components of public and social responses to hazards. "In-depth studies often assess public perceptions of the likelihood and severity of potential consequences" (Leiserowitz, 2008).

Unfortunately, not much local in-depth study on urban perceptions to climate change effects has yet been conducted. Therefore, planners and decision makers are left with very little information about how the urban or diverse national publics perceive this issue (Leiserowitz, 2010).

In addition, Climate change also poses a set of high-risk, low-probability events for cities (Weitzman, 2009). Cities differ from region to region with respect to the levels of risk that they will face and their ability to handle these expected natural disasters. It is important to explore how city residents perceive the effects of climate change, as well as the adaptive measure employed to cope with these effects, so as to devise the best planning method at mitigating the effects of climate change.

Urbanization and Climate Change

Climate change is the most fundamental environmental challenge we face. It is an issue that affects every living being directly or indirectly. In a statement released by the UN-HABITAT in 2008, it puts it that "The future of hundreds of millions of people in urban areas across the world will be affected by the different impacts of rapid urbanization and climate change. The impacts will vary depending on the *form of settlement*, *geographic considerations* and the *nature of the local economy*. The overall vulnerability of human settlements will increase as confirmed by various scenarios which predict that further global warming over the next decades is inevitable".

The Intergovernmental Panel on Climate Change recently concluded that climate change is now unequivocally taking place (IPCC, Fourth Assessment Report, 2007). Climate patterns have altered and observations reveal trends of higher global surface temperatures, sea level rise, changes in rainfall patterns, and higher frequency and intensity of extreme events such as floods, droughts and heat waves.

Furthermore, the '*United Nations Oslo Policy Forum* 2008' concluded that "the achievement of the Millennium Development Goals is already jeopardized by current levels of disaster risk. Global levels of disaster risk are intensifying". Climate change is a major contributing factor in increased phenomena such as heat waves, floods, droughts, the intensity of tropical cyclones, and higher sea levels. Vulnerability to these hazards is also increasing, due to continuing poverty and social vulnerability, poorly planned urbanisation, environmental degradation, and population growth.

Climate change will exacerbate development challenges and make it harder to achieve and sustain MDG achievements and other development goals. However, the popular cliché "*sustainable development*" can only be achieved in an environment where people are aware of the consequences of their actions or inactions (on the environment) and are willing to adjust to any planning recommendations aimed at mitigating the effects of climate change; this will dependent on their perceptions to climate change issues.

The Role of Urban Residents Perception in Climate Change Mitigation

It is important to know that in finding solutions to climate change problems, we need to understand the perceptions of the people directly affected by this phenomenon and who live in those urban areas. This is necessary for a number of reasons. First, studies have shown that it is the people's perception of their environmental condition that ultimately defines the quality of their lives or their environment. The public perception informs public participation in the environmental management process; it empowers residence and facilitates their contributions to specific objectives of environmental management and by so doing take ownership of strategies and outcomes. Gould (1966), opines that the mental images that people hold of their environments are critical in the formulation of decisions that restructure

such environments. The attainment of the goal of sustainable development requires the participation of practically all the communities in the city in finding solutions to their own particular problems and a high degree of solidarity between members of the community in helping each other (Omolabi, 1997). This would involve developing popular grassroots initiatives to build and maintain their houses and basic services. Members of the community should be encouraged to go into developing sustainable city projects. This will help in no small way in enhancing the participation of practically all the community in finding solutions to their problems on climate change. The World Bank (1991) revealed that reversing the deterioration of the urban environment through this form of public participation is necessary to improve economic performance.

By ignoring the perceptions of the residents who are directly concerned and who live in these urban environments, government programmes targeted at tackling these problems may fail to meet the aspiration or enthusiasm of the people (Gould, 1966). It also makes for effective public awareness and participation which according to Haworth (1970) ensures that every individual freedom should be realized in the process of determining the growth of the social structure that channels his life. At the urban level, this involves the residents having a significant participatory role in shaping the plans for future development. For fruitful government programmes, Haworth (1970) puts the required effective participation as participation that begins at the very beginning when it is being wondered whether there is a problem at all that needs attention, and participation that continues along the way, through the stages of defining the problems that exists, of devising plans of overseeing their execution and of scrutinizing the results. It encourages the reversal of the present top-down practice in the planning process in favour of a bottom up approach that makes for better community participation in the decision making process, is demand driven and is responsive to local needs and aspirations.

It also positions policy-makers and development planners as community officers that should work with the people and not for the people. Perhaps, the most compelling reason for examining the mental images or perception people hold of their environments in our cities relates to one underlying assumption regarding the attitudes of developing countries to environmental issues. In view of these realizations, it becomes increasingly necessary to examine the mental images which city residents hold of their urban environmental conditions, most especially as it regards the current wave of climate change; because an understanding of such perceptions is useful in designing solutions to the problems posed.

The Study Area

The area under study is Minna, a town in the middle belt region of Nigeria; it lies at latitude 09°37'North of the Equator and Longitude 06°32' East of the Greenwich Meridian. The town is in the north-west direction of the Federal Capital Territory, Abuja. Over the years Minna became an administrative centre of increasing importance, and its function as a railway junction attracted more investment and people. In February 1976, Minna became the state capital of Niger State. The present town is widely dispersed along the main spin from Chanchaga in the south to Bosso in the north where the Federal University of Technology Minna (Bosso campus) is located (Fig. 2). It enjoys a strategic location and relatively easy accessibility from all part of the country. Minna has total population of 201,429 (105,803 males and 95,626 females) by 2006 National Population Census (Provisional Result). At a growth rate of 2.85%, the projected population of Minna stands at 225,480 in 2010.

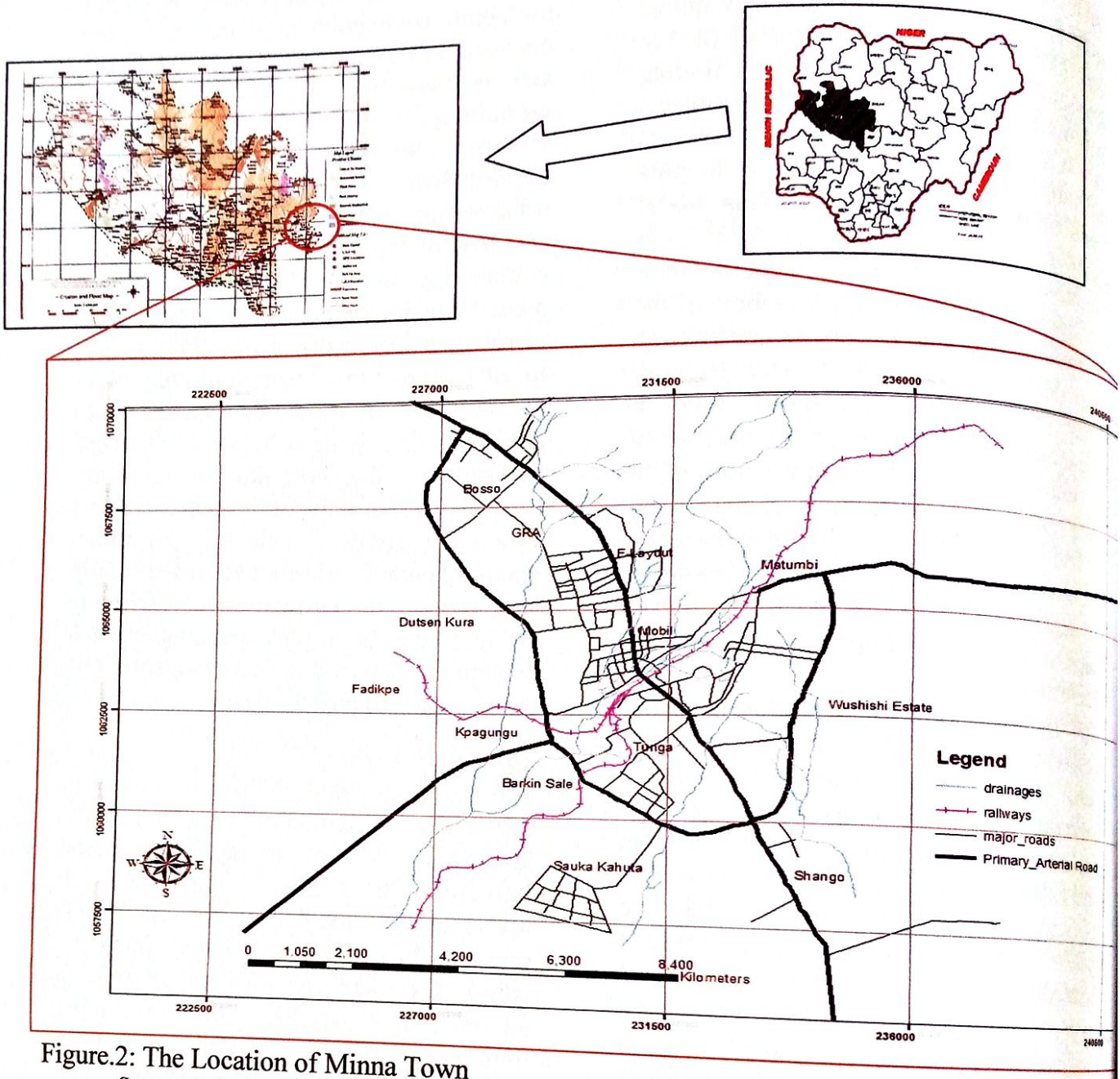


Figure.2: The Location of Minna Town

Source: Author's Field Survey, 2010.

Climatic Characteristics

Temperature and Rainfall: The average temperature in Minna is 27.25°C (81.05F). The lowest monthly average temperature (occurring in December) is 19°C (66.20F) while 37°C (98.60F) is the highest monthly average temperature which occurs in March (Fig. 3). Thus the average temperature range is 5.5°C (41.90F). The highest precipitation reads 280mm in August, with almost none in December and January (fig.4). Rain usually starts by mid-April and ends in October.

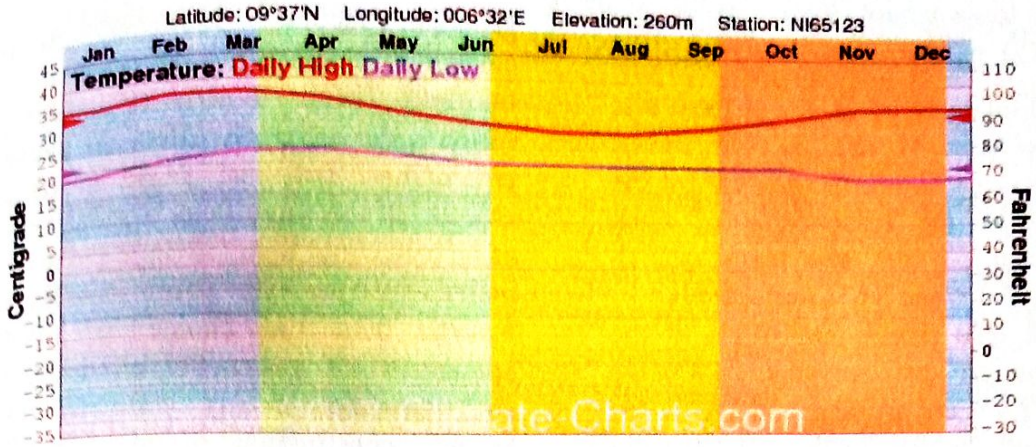


Fig.3: Minna Monthly Average Temperature
Source: Climate-chart.com,2010.

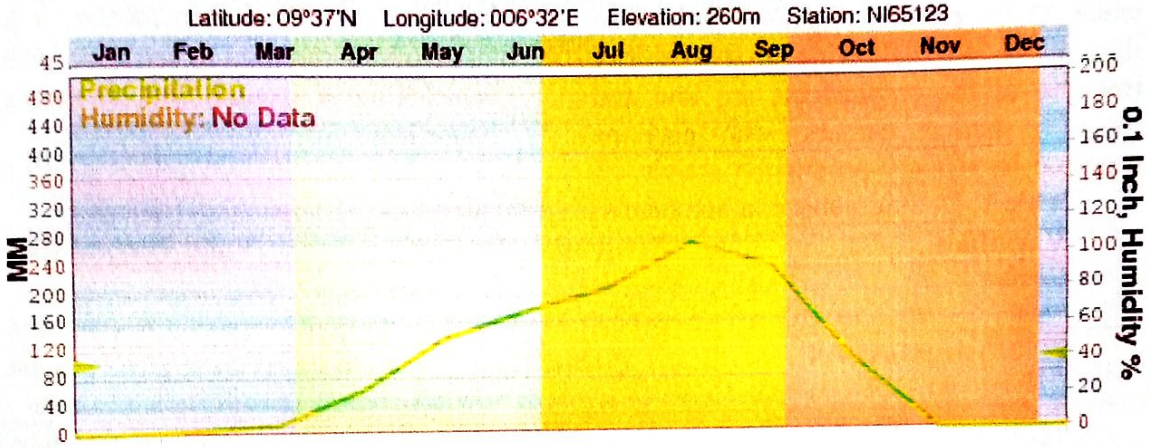


Fig 4: Minna Monthly Rainfall
Source: Climate-chart.com,2010.

Methodology

The study used primary data collected from the study area (Fig. 1). The 2006 National population census puts the population of Minna at 201,429 (provisional result) and at growth rate of 2.86%. However, the projected population from 2006 give 225,480 in 2010. In all, 2000 households representing 0.88% of the 2010 projected population of Minna were sampled.

Questionnaire was designed to assess household-based perception of climate change issue in Minna. These include their understanding of increase in urban temperature, variation in precipitation level, issue of global warming, green gas emission and the relationship between human activities. Therefore, the study analysis was based on the 2000 surveys questionnaires processed representing 100.0% response rate.

Result and Discussion

Demographic Characteristics of Respondents

The demographic characteristics of the samples used in this study were measured by gender, age, education, marital status, income and occupation of the respondents. The summary of the demographic characteristics is shown inTable 1.From the Table it is shown that the respondents comprised of male(70.2%)and female(29.8%) and the average of the

respondents' age was 45 years old, although 32.8% of them ranged between 31 and 40, followed by 28.4% of them that ranged between 41 and 50 and 24.0% ranged between 18 and 30 years from the result. While the respondents of aged greater than 51 and age less than 18 represent 11.4% and 3.6% respectively.

The result also shows that 30.4% of the respondents are civil servants, 26.4% are traders, 22.4% are artisans, and 12.8% are unemployed, while 2.4% are basically farmers. Income level per month showed that 46.4% earn between ₦7, 500- ₦ 15,000 and 29.4% earn above ₦22, 500 while 22.2% earn less than ₦7, 500. This finding is an indication that majority (69.6%) of the respondents are low and medium income earners, who may be engaged in primary production activity to generate income. However, income generation implies utilisation of natural resources (either directly or indirectly), which could adversely affect the physical environment that may result in climate change. In the same vein, a stable source of income could foster savings and thereby increases the ability to afford some level of luxuries like the choice of cooking appliances (e.g. gas cooker, kerosene stove etc.), purchase of cars, ability to travel around, construction of more building apartments etc. All these would contribute to the process of global warming. For instance trees may be cut down to give way for building construction; Carbon monoxide is released to the atmosphere as vehicles move around, thus, damaging the ozone layer.

Table 1: Demographic characteristics of respondents

Variables	Frequency (N= 2000)	Valid Percent (%)
Gender		
Male	1404	70.2
Female	596	29.8
Age		
< 18	72	3.6
18-30	480	24.0
31-40	656	32.8
41-50	224	28.4
> 51	224	11.2
Education		
Primary school	420	21.0
Secondary school	884	44.2
Tertiary institution	336	16.8
Informal (Qur'anic) education	400	20.0
Marital status		
Single	936	46.8
Married	1680	48.0
Widowed/Divorced/Separated	104	5.2
Occupation		
Civil servant	608	30.4
Farmer	48	2.4
Trader	528	26.4
Fisherman	112	5.6
Artisan	448	22.4
Unemployed	256	12.8
Income per month		
Less than ₦7, 500	444	22.2
₦7, 600– ₦15, 000	928	46.4
₦15, 500– ₦22, 000	440	22.0
₦22, 500 or more	588	29.4

Source: Author's Field Survey, 2010.

Length of Residence in Minna

The analysis also reveals that 47.6% of the respondents have stayed in Minna for 25-30 years, 30.0% have stayed in the study area for over 35 years. Equally, 22.4% indicated that they have been in Minna between 5 - 10 years. That should have given them the advantage of being able to detect any obvious changes in the climatic condition of the town.

Residence Awareness to Climatic Change and Related Issues

The analysis of field survey in Minna town reveals that 79.2% of the respondents are aware of changes in the general weather condition of their environment (Table 2). However, the form of changes observed by the respondents varies, in that 29.6% have noticed increase in temperature and change in rainfall. While 29.2% believed the changes in weather condition has to do with increase in temperature. In all, 16.4% observed changes in amount and duration of rainfall, whereas 24.8% declined in their opinion (Table 3). This implies that the people are to some extent aware of the changes in the climatic conditions of their environment.

Table 2: Respondents Awareness of Changes in Climatic Condition

Awareness	Frequency	Percentages (%)
Aware	1584	79.2%
Not Aware	416	20.8%
Total	**2000**	**100%**

Source: Author's Field Survey, 2010.

Table 3: Forms of Changes Observed in Climatic Condition by the Respondents

Forms of changes observed in climatic conditions	Frequency	Percentages (%)
Increase in Temperature	584	29.2%
Change in rainfall	328	16.4%
Change in temperature and rainfall	592	29.6%
No change observed	496	24.8%
Total	**2000**	**100%**

Source: Author's Field Survey, 2010.

Factors responsible for increase in temperature

It makes no sense to discuss the vulnerability of urban populations to climate change and responses to separate from their vulnerability to extreme weather events or disasters that are not caused by climate change. The result of the survey analysis has shown that, 46.4% of respondents attributed the increase in temperature to natural changes (Table 4). The reasons advanced are mostly due to natural cause. On the other hand, 30.2% of respondents believed that the observable changes are caused by increasing human activities in the environment; while 23.4% declined in their option (i.e. they are not sure whether the cause is natural or human activities). This goes a long way to imply that though, the people are aware of changes in the climatic conditions of the town, their knowledge and understanding of the phenomenon is still minimal. And that, the respondents might not find it necessary to desist from activities that have negative impacts on the climate or imbibe such attitudes/manners that could help reduce climate change rate.

Table 4: Factors Responsible for Increase in Temperature

Factors	Frequency	Percentage (%)
Human Activities	604	30.2%
Natural Changes	928	46.4%
No Option	468	23.4%
Total	**2000**	**100.0%**

Source: Author's Field Survey, 2010.

Observation of changes (variation) in rainfall Pattern

Changes in rainfall pattern have been observed by 1,760 respondents representing 88.0% (Table 5), whereas 12.0% declined. The field survey analysis also reveals that 1,320 respondents representing 66.0% believed that the period of rainfall is now shorter than what it used to be, while 32.0% of them said they observed longer period in pattern of rainfall (Table 6). In the same vein, 80.0% claimed that the amount of rainfall is lesser than what it used to be, while 20.0% said there is more rainfall than what obtained in the past (Table 7). This is an indication that the rainfall pattern has truly changed over the years and the people are aware of these changes, which is manifested in the people's attitude towards planning mitigating measures.

Table 5: Observed Variation in Rainfall Pattern

Variation	Frequency	Valid Percentage (%)
Yes	1760	88.0%
No	240	12.0%
Total	**2000**	**100.0%**

Source: Author's Field Survey, 2010.

Table 6: Observed Changes in Period and Pattern of Rainfall

Period	Frequency	Percentages (%)
Longer	640	32.0%
Shorter	1320	66.0%
Normal	40	2.0%
Total	**2000**	**100.0%**

Source: Author's Field Survey, 2010.

Table 7: Observed Changes in Amount of Rainfall

Amount of rainfall	Frequency	Percentages (%)
More	400	20.0%
Less	1600	80.0%
Total	**2000**	**100.0%**

Source: Author's Field Survey, 2010.

Factors Responsible for the Variations in Temperature and Rainfall

The respondents were asked to give their views on the factors responsible for the

variations in temperature and rainfall. About 44% believed that it is natural for variation in temperature and rainfall to occur (Table 8). The major reason advanced for this is that it could be a natural cause. On the other hand, 40% blamed it on human activities, and the major reason given for this is that Carbon monoxide emitted from automobiles, generators, aeroplanes etc. could be a major factor. However, only 16% of the respondents were categorical in linking these variations to climate change phenomenon. This could be an indication that the knowledge of climate change among the people is low.

Table 8: Factors Responsible for the Variation in Temperature and Rainfall.

Factors responsible for the variation in temperature and rainfall	Frequency	Percentage (%)
Natural	880	44.0%
Human activities	800	40.0%
Climate Change	320	16.0%
Total	**2000**	**100.0%**

Source: Author's Field Survey, 2010.

Linking Human activities with Climate change

Minna residents obviously prioritize poor sanitation in the environment as the number one human activity that may cause climate change (Table 9). Poor sanitation and solid waste (36.4%) as the human activity which results in climate change followed by deforestation and emissions from vehicles, cooking appliances and generators constituting 27.4% and 23.6% respectively. But of concern is the fact that only 8.6% of the respondents actually linked urban development with climate change and 4.0% of the respondent linked extensive/intensive agriculture with climate change. This implies that a considerable number of the urban residences do not really bother about the growth and development of the town as it relates to climate change. This should be a major concern to town planners in their decision in urban management.

Table 9: Human Activities and Climate Change

Activities	Frequency	Percentage (%)
Deforestation	548	27.4%
Extensive/Intensive Agriculture	80	4.0%
Urban Development	172	8.6%
Poor Sanitation/Solid waste	728	36.4%
Vehicle/generator fumes	472	23.6%
Total	**2000**	**100.0%**

Source: Author's Field Survey, 2010.

Sources of domestic Energy

The major sources of energy used for cooking and other domestic heating are charcoal and firewood, respectively representing 40% and 36% of the energysource (Fig.5). Hypothetically, the major domestic energy source are both extracted primarily from sources whose reverse effect could lead to the process of deforestation and in turn reduce the number of trees which could have helped

in reducing the effects of climate change by absorbing CO_2 from the atmosphere.

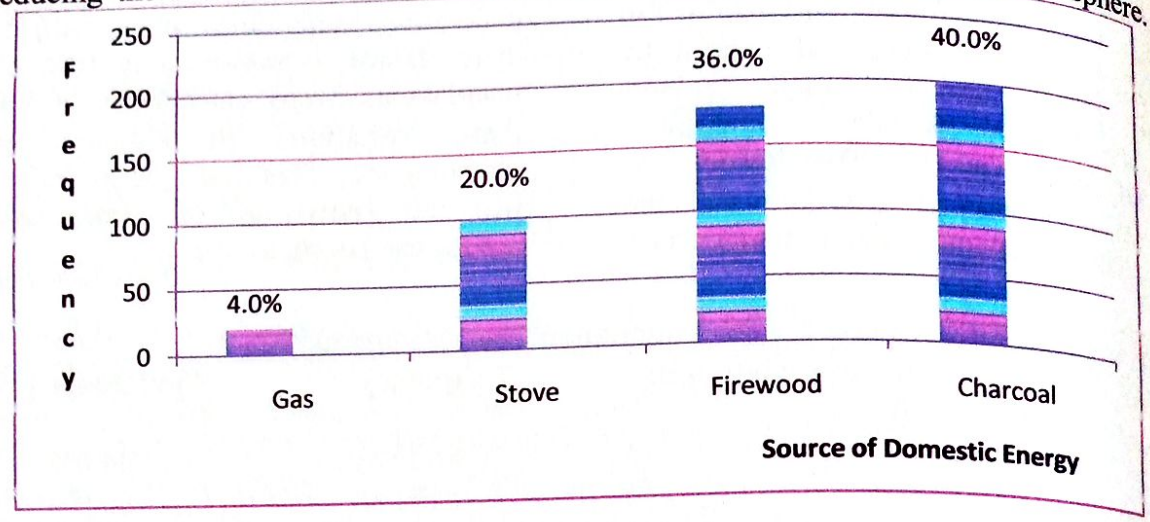


Fig.5: Domestic Energy Source
Source: Author's Field Survey, 2010.

Knowledge and Understanding of Climate Change

The knowledge of climate change is very minimal among the Minna residents. Only 62.4% admitted that they have heard about climate change(Fig.6). But when asked what they knew about it, their responses showed that they have divergent understanding of climate change, as many of them were confusing climate change with *solar eclipse*. However, a few of them did give a good description of what climate change phenomenon means. Some of the descriptions given were increase in atmospheric temperature, change in rainfall pattern and excessive heat radiation from the sun. All of which could result into natural disasters.

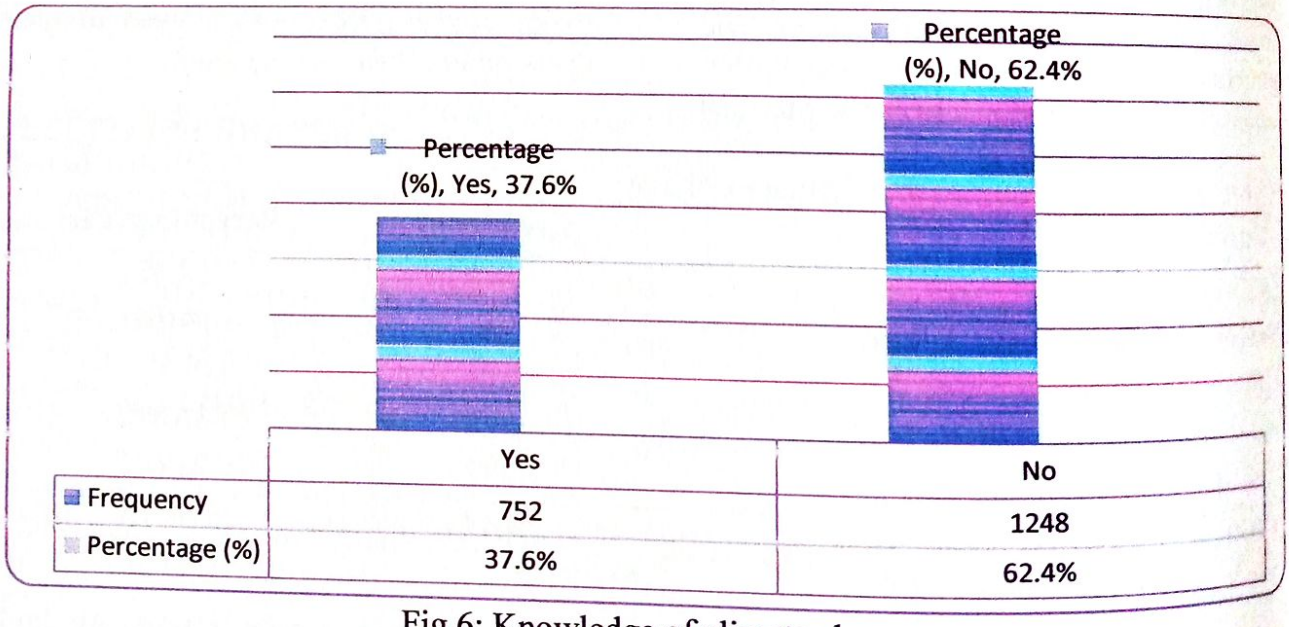
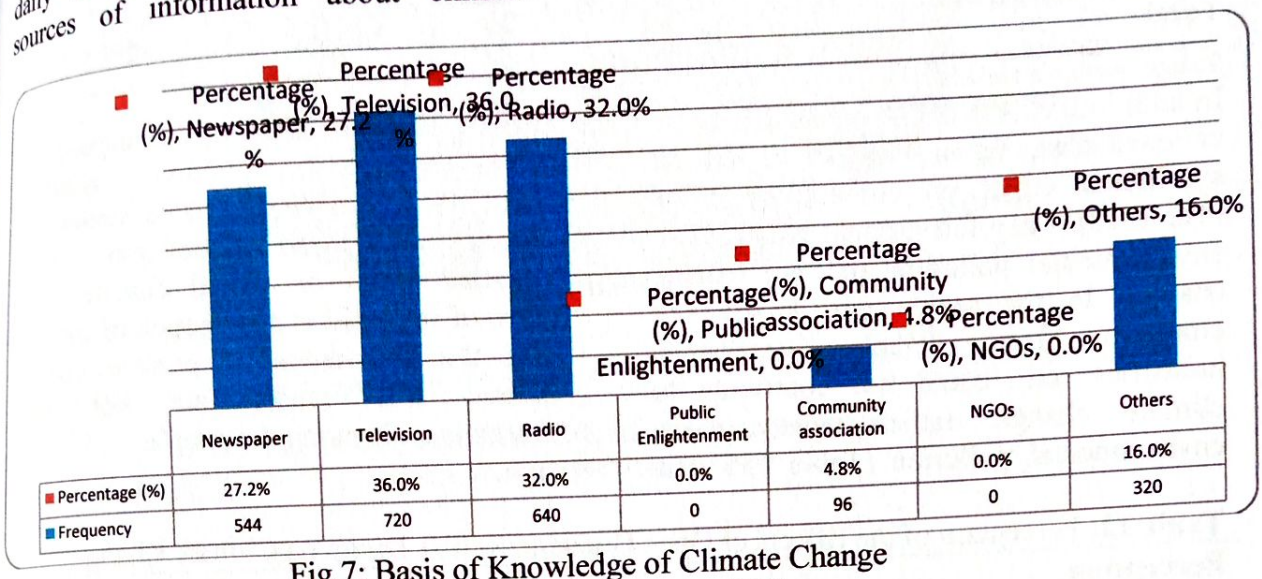


Fig.6: Knowledge of climate change
Source: Author's Field Survey, 2010.

The field survey analysis also shows that majority of the respondents got their knowledge of climate change from Television (36.0%), Radio programme (32.0%), daily newspapers (27.2%). However, 16.0% of the respondents were

informed through other means and only 4.8% had the knowledge through community associations (Fig.7). This implies that Television Radio media and daily newspapers remained the major sources of information about climate change to residents of Minna town. This could be partly due to the fact that Radio and Television (broadcast media) is more accessible to the people than the daily newspapers (print media).



	Newspaper	Television	Radio	Public Enlightenment	Community association	NGOs	Others
Percentage (%)	27.2%	36.0%	32.0%	0.0%	4.8%	0.0%	16.0%
Frequency	544	720	640	0	96	0	320

Fig.7: Basis of Knowledge of Climate Change
Source: Author's Field Survey, 2010.

Furthermore, 72.0% of the respondents believed that climate change is real (Table 10). However, their understanding of climate change is not a true reflection of the true meaning.

Table 10: Perception of the Reality of Climate Change

Perception	Frequency	Percentage (%)
Yes	720	72.0%
No	280	28.0%
Total	**2000**	**100.0%**

Source: Author's Field Survey, 2010.

Environmental planning and climate change

In relating environmental planning and climate change, the survey analysis result shows that 816 of the respondents representing 81.6% believed there is no direct link between poor planning with the environment and climate change (Table 11). This could be as a result of lack of in-depth understanding of the climate change phenomenon and the complex web of human activities that could lead to it. Consequently, this could provoke bitter resistance to any form of town planning recommendation aimed at mitigating climate change effects.

Table 11: Perception of the Result of Poor Environmental Planning on Climate Change

Perception	Frequency	Percentage (%)
Yes	184	18.4%
No	816	81.6%
Total	**2000**	**100.0%**

Source: Author's Field Survey, 2010.

In addition, 62.4% of the respondents also believed that, liquid/solid waste has no significant effect on climatic condition (Table 12). They felt it could only lead to environmental pollution and not climate change. In the same vein, 86.4% felt emission from vehicle; generators, industries, etc. could not contribute to climate change, rather merely cause environmental pollution (Table 13). The reasons given by most of the respondents were that the little fumes (Carbon monoxide) from their cooking stoves and automobiles are too insignificant to have negative effect on global climate. This form of response is a reflection of the fact that the knowledge of climate change effects and causes are not well disseminated among the people.

Table 12: Perception of the Effects of Open Drainage/Refuse Dump on Climate Change

Perception	Frequency	Percentage (%)
Yes	752	37.6%
No	1248	62.4%
Total	**2000**	**100.0%**

Source: Author's Field Survey, 2010.

Table 13: Perception of the Effects of Human Activities on Climate Change

Perception	Frequency	Percentages (%)
Yes	272	13.6%
No	1728	86.4%
Total	**2000**	**100.0%**

Source: Author's Field Survey, 2010.

Effects of climate change on the people

Food scarcity, High cost of living and urban heat remained pertinent among the various effects of climate change (Fig.8). Respondents do not consider flooding as a threat in this environment. This is probably because of adequate drainages in the study area.

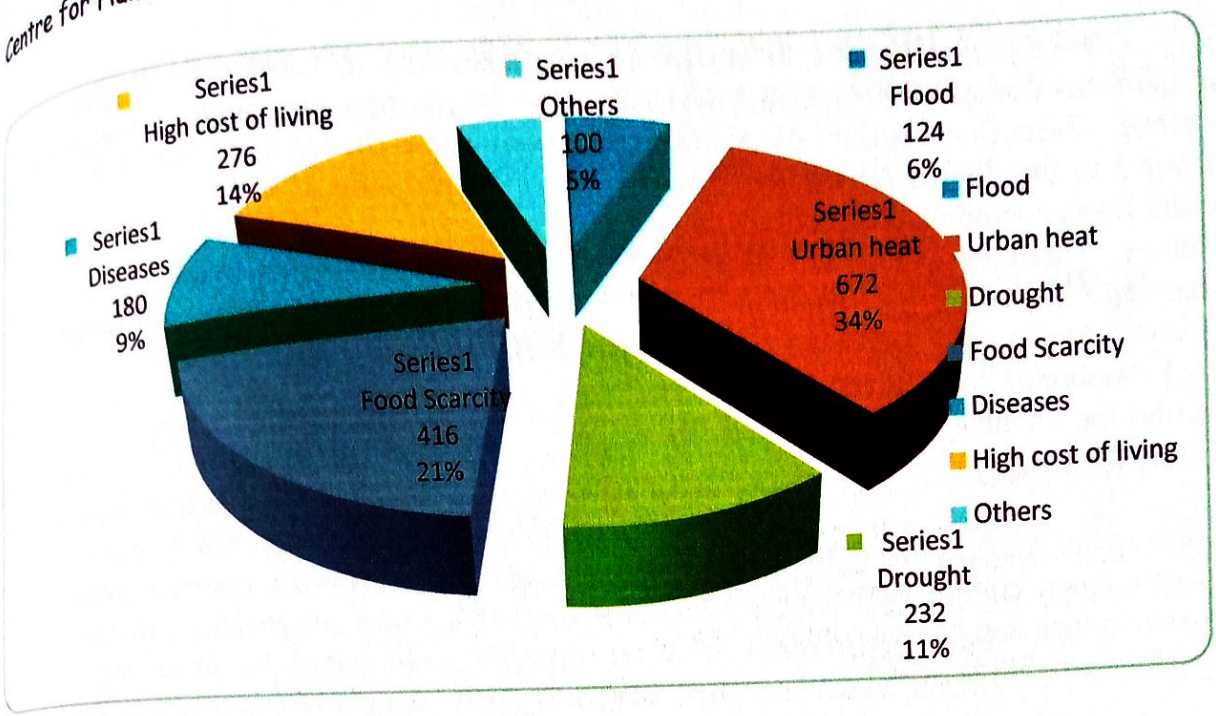


Fig. 8: The Perceived Effects of Climate change
Source: Author's Field Survey 2010

Climate Change Adaptation Strategies by the Respondents

However, the various strategies adopted by most respondents in Minna to cope with the effects of climate change are mainly short term solutions like; putting on of light clothes during heat, staying away from the sun, drinking of much water, working harder to earn more, cutting down on food consumption etc. The only strategy adopted which could have long term positive effect in mitigating climate change is the use of energy saving bulbs (which is becoming popular among the residents) and planting of trees.

Climate change Mitigation strategies suggested by the respondents

Different mitigation strategies were suggested by the respondents, amongst which are tree planting as can be found in the native core of the town, enforcement of strict laws on bush burning and the use of alternative sources of energy that is ecologically friendly.

Conclusion

It is established that weather and climate affect all spheres of human activities and as such, its current increasing variability and changes have grave consequences on the study area's environment. The research has shown that though the people are aware of the changes in the climatic conditions of their environment, majority of the people felt that emission from vehicles, generators, etc. could not contribute to climate change rather, merely cause environmental pollution. Reasons advanced by most of the respondents were that carbon monoxide emitted from cooking stoves and automobiles are too insignificant to have any negative effect on the global climate.

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