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Community Adaptation towards the Shrinking of Lake Chad Basin, Borno State North East Nigeria

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Abstract-*This study was to assess the community adaptation towards shrinking of Lake Chad Basin Borno State, north east Nigeria. The objectives were to: investigate the evidences of climate change in the communities of Lake Chad Basin Borno State, assess the communities challenges due to climate changes, recommend possible solutions to the problems associated with the effects of climate changes in the affected communities; Data for the study were obtained from both primary and secondary sources, secondary data were obtained from meteorology station and trend analysis of time series was done to examine the evidences of climate changes in the study area, while primary data was sourced through the administration of guided questionnaires to 252 respondents in the study area and human responses were analysed by Descriptive statistics of simple percentages, while bar charts were used to investigate and assessed the several community's measures against the effects of climate change to water resources in the communities of Lake Chad Basin, Borno State North East Nigeria. Few Possible recommendations were also made for the future.*

Keywords: *Community Adaptation, Shrinking of Lake, Nigeria*

Introduction

Practically, adaptation to climate change means doing things differently because of climate change (UNDP 2004). Most often, it does not mean doing completely new things, but rather purposefully modifying development interventions. Adaptation itself is not a development objective, but necessary for safeguarding beneficial outcomes. Adaptation measures may be compared with a baseline of 'doing nothing', resulting in bearing losses and not making use of opportunities. Bearing losses occurs particularly when those affected have no capacity to respond in any other way (for example in extremely poor communities) or where the costs of adaptation measures are considered to be high relative to the risk or expected damage.

Study Area

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Borno state lays in the north eastern corner of Nigeria between latitudes 11.00 and 13.45 east. It occupies an area of 69.435 Sq km sharing border with three states, Adamawa to the South, Gombe to the South Westland Yobe to the West as well as three countries, namely, Republic of Niger, Chad and Cameroon to the North, North-East and East respectively. (Waziri, 2009).

According to National Population Commission Borno state has a total population of 4, 151, 103 people, with annual growth rate of 2.8% per annum (NPC, 2006).

Maiduguri Metropolis is situated in a semi-arid climate zone. It has basically two seasons: dry and wet seasons. These are further distinguished by the local population into: Binəm (cool dry season), harmattan season from December to February; Bey, (hot dry season), from March to late May: Nəngəli, raining season from June to September and Biila, humid dry transitional period between September and November (Waziri, 2009). According to (Wakil *et al* 2009) empirical findings have shown that rainfall is dwindling in Maiduguri both in volume and number of rainy days since the 1970s.The raining season never exceeds four months in the area, with an annual rainfall mean of 577mm. The rainfall type is usually convectional which is mostly in the afternoon hours (Iloeje, 2009). Rain fall is usually heavy and within a short duration with some variations within a small distance. Temperatures generally range between 29.4ºC and 35ºC. There is a sudden rise in temperature during the day around April, May and June, occasionally exceeding 40ºC, and high terrestrial radiation in the night. With these weather conditions coupled with the low humidity (40% to 60% relative humidity), evaporation is always high and the environment can only support the growth of a scanty vegetation.

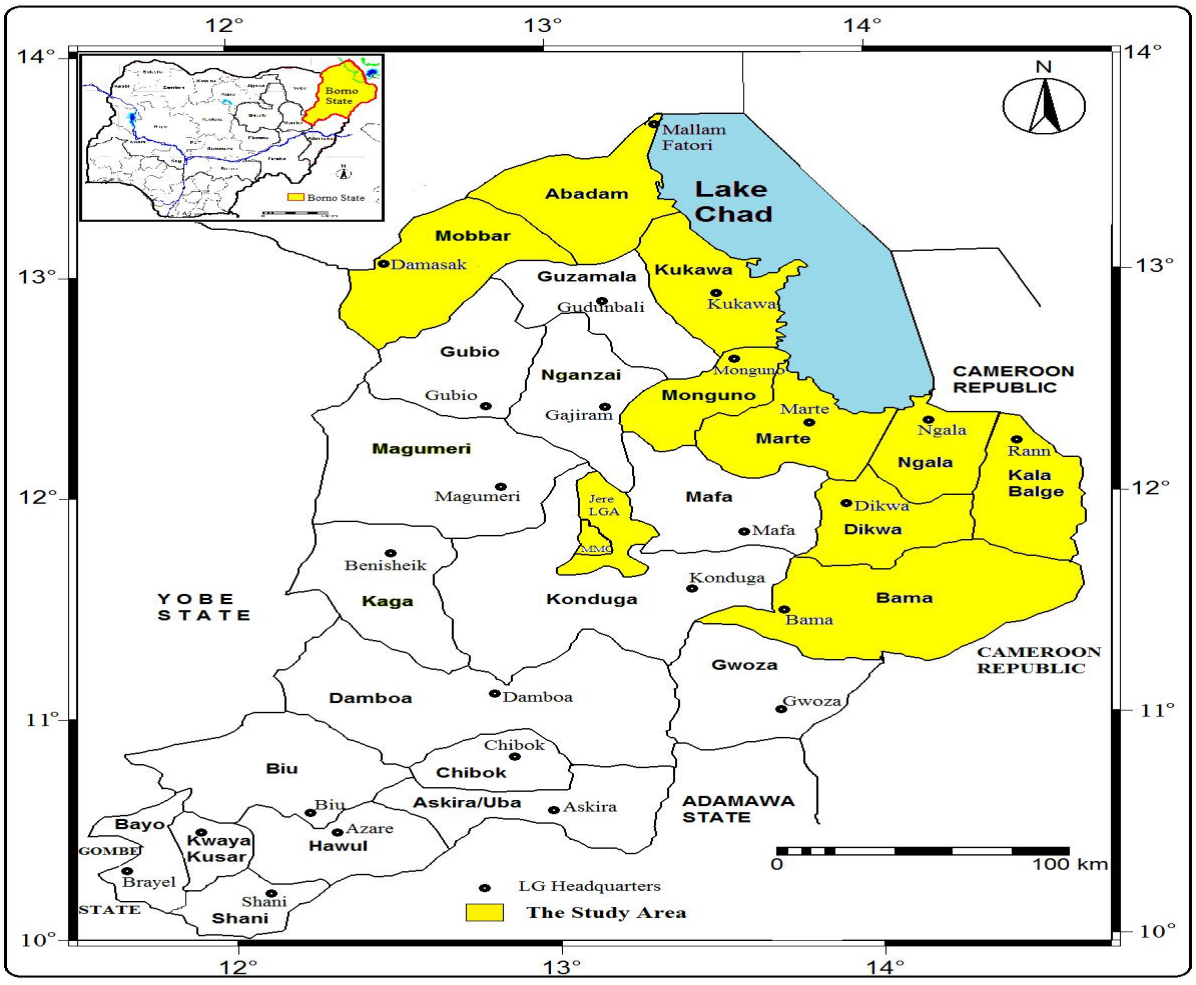


Fig: 1 BORNO STATE SHOWING SAMPLE SETTLEMENTS AND STUDY AREA THAT CONSTITUTED THE FORMER (MEGA LAKE CHAD)
Source: GEONETCast Unit, Department of Geography, University of Maiduguri, 2018

The economy of the state is anchored on natural resources such as clay, salt, nitron, limestone and kaolin. Iron ore and uranium and micas petroleum is prospected intensively on the shore of the Lake Chad in the state. There are only few industries in the state. These are flour mills, shoe factory, ginnery, dairy products, and corn milling just to mention a few (Waziri, 2009).

Different kinds of land uses can be identified: such as settlements, agricultural, road, forestry, but the dominant type is the agricultural land use. Majority of the people in the area are peasant farmers although they may be engage in other activities.

Lake Chad Physical Information

Lake Chad basin is historically a large shallow endorheic lake in Africa, which has varied in size over the countries. According to the Global Resource Information Database of the United Nations Environmental Programme, it shrinks by as much as 95% from about 1963 to 1998, but the 2007 image shows significant improvement over previous years. Lake Chad is economically important, providing water to more than 68 million people living in the four countries surrounding it on the edge of the Sahara Desert. It is the largest lake in the Chad Basin (J. Allman, 2015).

i- Surface Area: 521.24 square kilometre, miles (1,350 kilometres square)

ii- Depth: 361'' (11 m)

iii- Surface Elevation: 938 feet (286 m)

iv- Shore Length: 404 miles (650 km)

v- Mean Depth: 4 '11'' (1.50 m)

vi- Inflow: Chari River

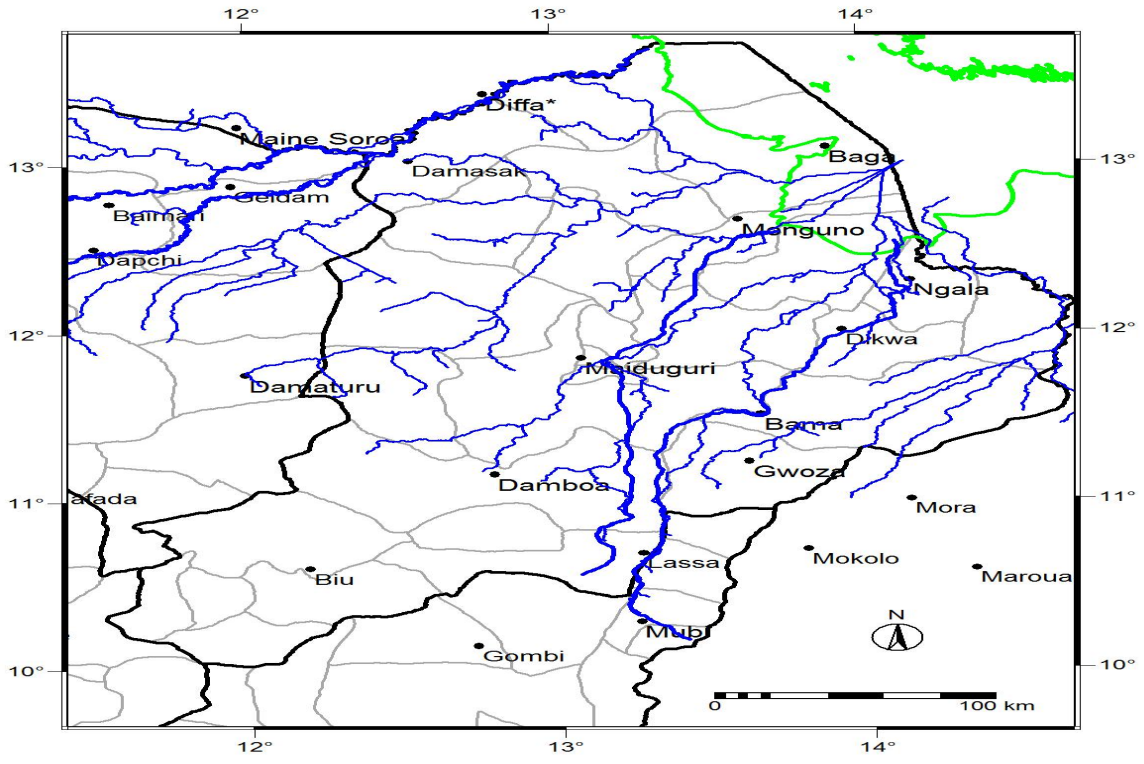


Fig: 2 BORNO STATE SHOWING THE RIVER SYSTEMS

Source: GEONETCast Unit, Department of Geography, University of Maiduguri, 2016

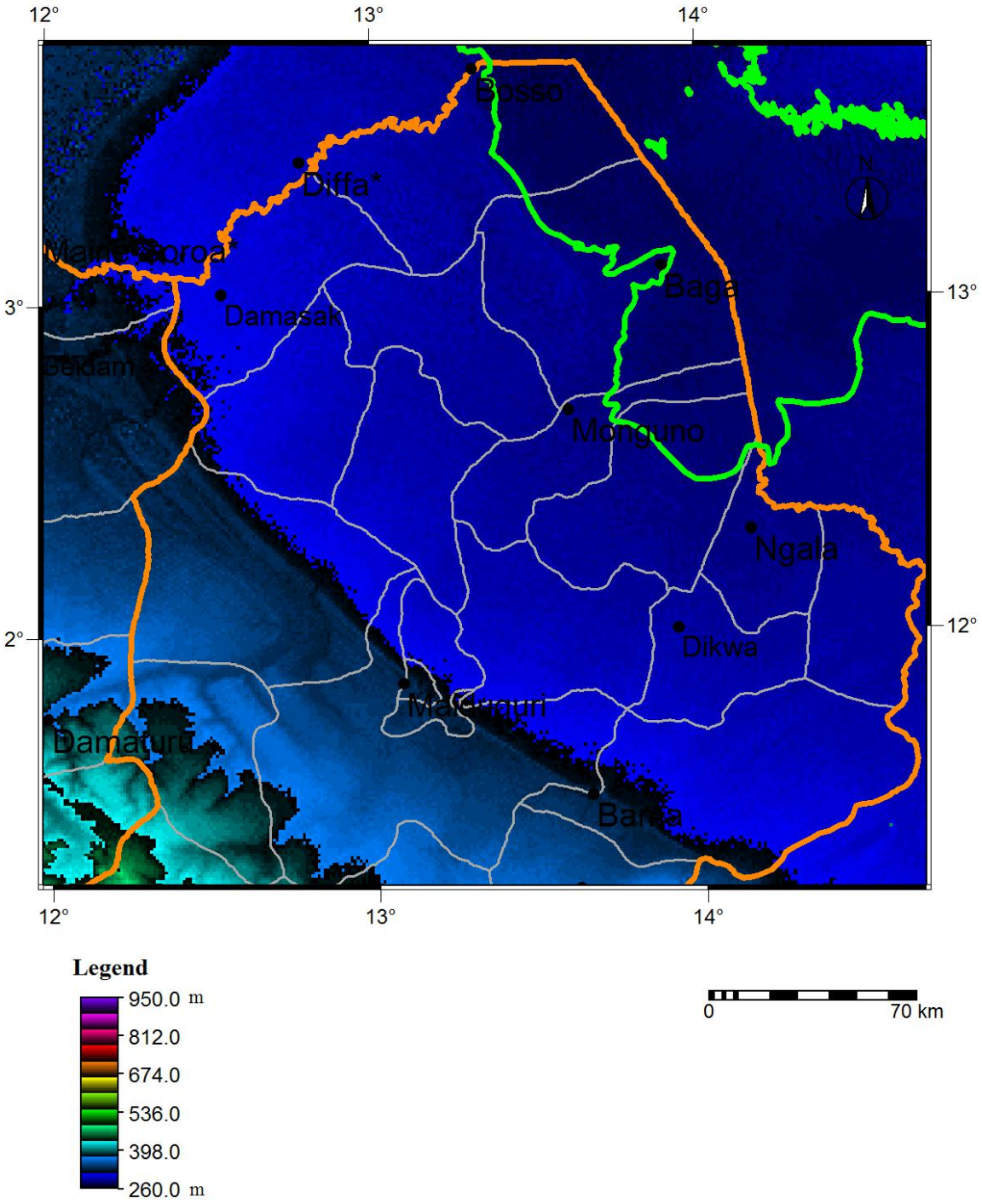


Fig: 3 BORNO STATE SHOWING THE RIVER SYSTEMS THE STUDY AREA AND DEM CLEARLY SHOWING BAMA RIDGE (MEGA LAKE CHAD)
Source: GEONETCast Unit, Department of Geography, University of Maiduguri, 2016

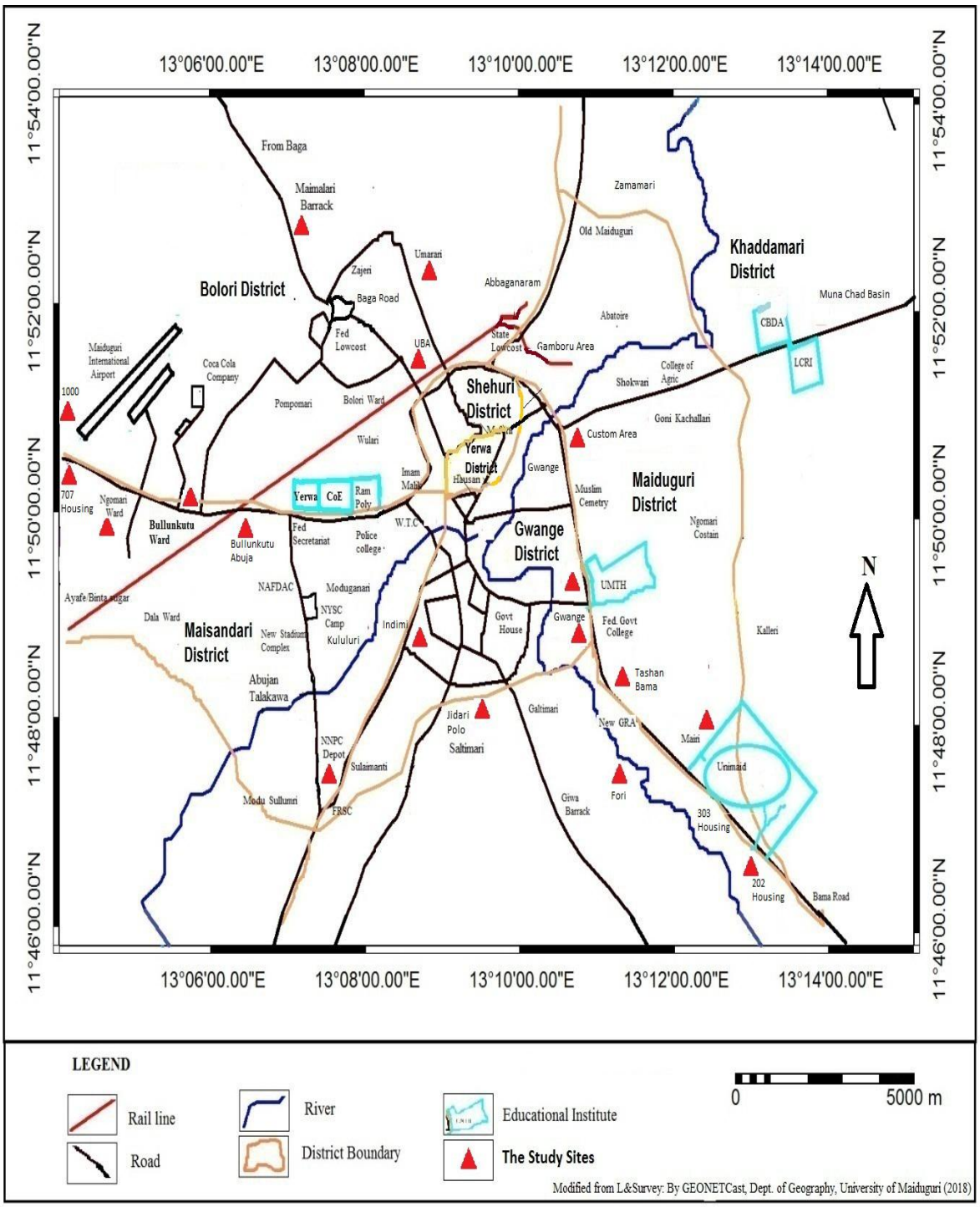


Fig: 4 Maiduguri Township Showing Settlements where Study Areas were Located
Source: GEONETCast Unit, Department of Geography, University of Maiduguri, 2018

Methodology

The data used in this study were generated from both primary and secondary sources; data from primary source was the administration of questionnaire to 552 respondents in different communities within the study area. While, the secondary data on different variables of weather and climate were collected from Meteorology department for the period of 30 years and analyzed establishing the fact on climate fluctuations and changes in the study area over the period. Furthermore, other secondary sources include Journal articles, Conference proceedings and papers, Books,

Photographs and other relevant sources were all consulted to have related information's about the shrinking of the Lake and its effects to wetland water resources in communities located along the shores of the Lake Chad Basin Borno state North East Nigeria.

Results and Discussions of Findings

Lake Chad has been subject to the same extended drought as the Niger Basin. The area of the lake was reduced to 1,350 km2, over 90 % smaller than during the mid- 102 S. A. Mitchell twentieth century. The mean annual river inflow decreased by approximately 50 % from a pre-drought volume of 39.8 km3 (Brown 2005; Odada *et al*, 2006). The history of Lake Chad indicates the existence of a much longer climatic cycle. During the Holocene, the Sahara received regular monsoon rains and was well forested. There were several large lakes, of which Lake Mega Chad was the largest. It is estimated that approximately 7,000 years before present Lake Mega Chad covered 400,000 km2. During the period 20,000 12,500 BP the Sahel was arid and Lake Chad is thought to have been completely dry for at least part of this period (Thiemeyer 2000; Odada and Olago 2005; Brown 2005; Drake and Bristow 2006).

There is a single major factor behind the cause for the shrinking of the Lake: a natural fluctuation is a brain behind the long term cycle and as well as the uncontrolled used by human for the purpose of irrigation activities, and more so, deforestation has also contributed greatly. Change in climate is another principal factor for the gradual residing of the lake from the earlier 25,000 square kilometres in 1963 to as low as only 1,300 square kilometres in the recent time (P. Burnett, 2014).

The trend is clearly to tell or perhaps show the changes that exist whether it is appreciating of otherwise, it could either be an increase, decrease or constant observation over period of time, which the horizontal line is running from west to east direction on the graph. Like in the case of season one of monthly mean maximum temperature as it is shown in the figure 4.3.1, since from 1980 there was a gradual and continues increase in the seasonal values recorded until 2010, this is also an indication that there is a variation due to the changing climate in the area. On the average the value is around 30mm or cm, while where an extreme value above the average value that signifies the clear evidence of climate changes in the period, and as well if there is a drop value from the average it is also an indication or evidence of climate change (Odjugo et al*,* 2010, Koudahe et al*,* 2018).

Maximum Temperature Trend Equation & Coefficient of Determination

Season 1	**Season 2**	**Season 3**	**Season 4**
Dec y =0.0512*+34.8385	Mar y = 0.1681 *+ 36.2211	Jun y = 0.0294 * + 39.6333	Oct y =0.0441* +34.1809
r^2=0.1273	r^2= 0.0869	r^2 = 0.0231	r^2 = 0.0965
Jan y=0.0618* +31.1128	Apr y = 0.0398* + 40.2687	Jul y = 0.0001* + 36.4991	Nov y =0.0487* +37.0598
r^2=0.0641	r^2 =0.0693	r^2 = 0.	r^2 = 0.1374
Feb y=0.0984* +32.9675	May y =0.0642 * +31.4231	Aug y =0.0213* +33.5613	
r2=0.1247	r^2 = 0.1158	r^2 = 0.0324	
		Sep y = 0.573* +32.4507	
		r^2 = 0.1609	

Table 1 below reveals that 38.9% of the respondents suggested dredging of all water bodies around the communities in the study area as a major means of adaptation against climate change. While, 6.3% of the respondents suggested other means such as water harvesting during rainy season, routine monitoring of grazing animals and nomadic farming uses the water bodies around the communities. There are also other salient measures that were reserved by the respondents.

Table 1 Local Mitigation Measures against Climate Change

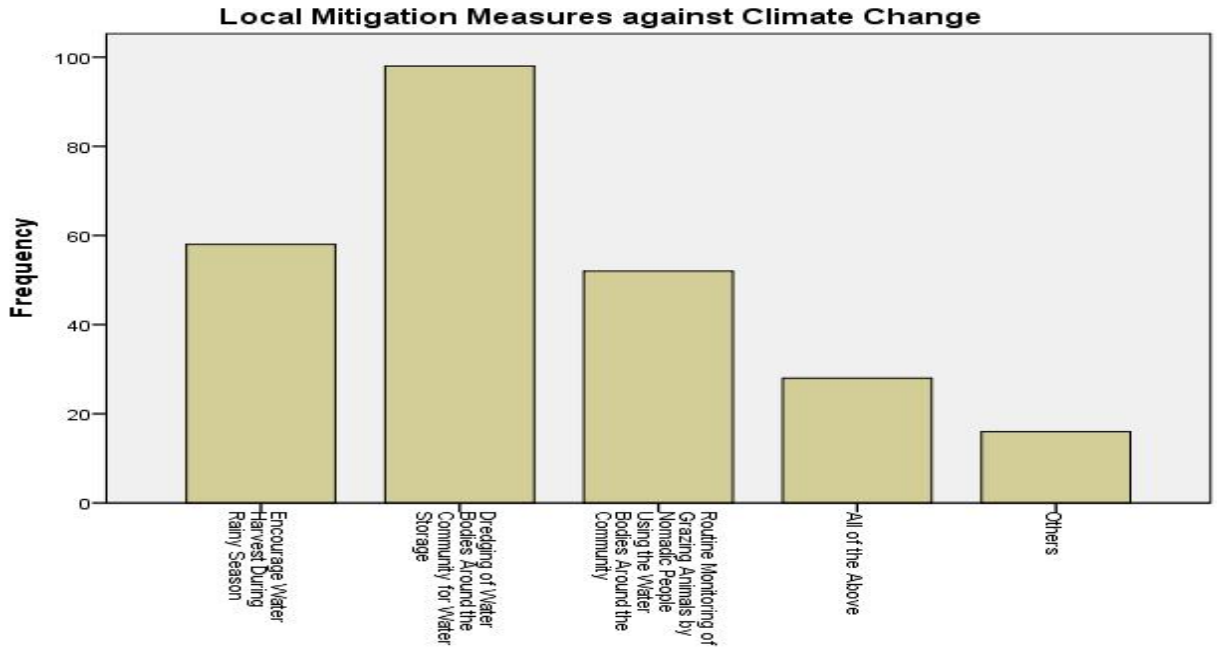
	Frequency	Percentage
Encourage Water Harvest During Rainy Season	58	23.0
Dredging of Water Bodies Around the Community for Water	98	38.9

Storage		
Routine Monitoring of Grazing Animals by Nomadic People Using the Water Bodies Around the Community	52	20.6
All of the Above	28	11.1
Others	16	6.3
Total	252	100.0

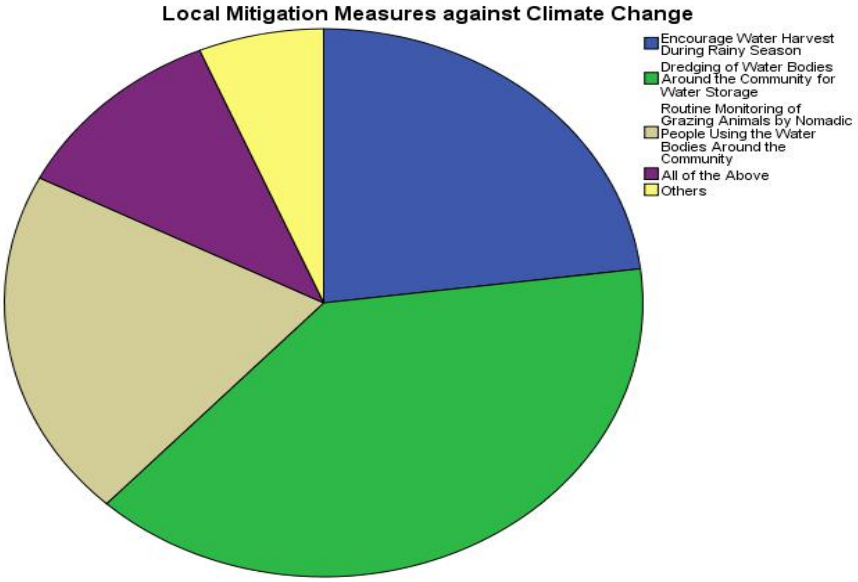
Source: Field Work

Both the above histogram and the Pie Chart are showing different adaptation measures been practiced by individuals in different communities located at the study area. Most of the respondents confirm that they prefer to practice tree planting campaign widely as an adaptation measures with virtually 80%. While, supporting water resource management was the least with only 20%.

As a symbol of global warming, however, the gradual receding of the Lake Chad Basin is linked with the consideration of its location in Sudan and Sahel region of Africa which makes it to be prone and more vulnerability to several other physical challenges and as well to climate change, facing rising of temperatures and great increased in drought. Despite all odds, Africa is the least responsible for global greenhouse emissions that cause global warming. Nevertheless, the effects of the Lake Chad Basin drying up is innermost, because the Lake was earlier estimated to provide life to almost 30 million people in Nigeria, Cameroon, Chad and Niger. Now has greatly resided, and resulted in massive reduction in fishing activity, which large number of people solely depend on for income. This in returned has caused tensions at different community levels between several lands and water users, and regionally even between countries competing for the resources of the Lake. The shrinking of the Lake has negative impacts on many other things also, large scale irrigation schemes in Nigeria. The lake served as a critical strategic point for biodiversity globally, home to different 120 species of fish, as well as supporting 372 species of birds. The countries within the region of the Lake are ranked as the poorest countries in the world. Based on the 2007/08 United Nations Development Programme (UNDP) Human Development Index (HDI) for 177 countries, the Lake Chad Basin Commission (LCBC) countries ranked amongst the lowest globally (P. Burnett, 2014).



Pie Chart



Conclusion

Lake Chad Basin will continue to be shrinking due to effects associated with climate changes on wetland water resources and the general environment of the communities located along the shores of Lake Chad Basin Borno state. People living along the shores of the lake should learnt to practice local adaptation measures to counter the effects associated with the changes and fluctuations experienced over time. Most water bodies and green areas around seem to be deserted and drying up of wetlands and deforestation of the area could bring severe impacts on all communities in such a way as to improvise on human wellbeing. There is a need to improve the understanding of communities on the changes, risks and hazards associated with the effects of climate change. Adaptation measures alone may not be sufficient to meet the challenges of current environmental degradation due to the climate change.

Table 2.1:

Hierarchical of Forcing or Pulsing Events Affecting the Formation and Sustainability of Coastal Wetlands Ecosystems

Events	Time Scale	Impacts
Major Changes in River Channels	500-1000 Years	New Delta lobe formation, Major Sediments Deposition
Major River Floods	50-100 Years	Avulsion Enhancement, Major Sediments Deposition, Enhancement Of Crevasse Formation & Growth
Major Storms	20-25 Years	Major Sediments Deposition, Enhanced Production
Average River Floods	Annual	Enhanced Sediments Deposition, Freshening (Lower Salinity), Nutrient Input, Enhanced 1 and 2 Production

Normal Storm Events (Frontal Passage)	Weekly	Enhanced Sediments Deposition, Enhanced Organism Transport Higher Net Materials Transport
Tides	Daily	Marsh Drainage, Stimulated Marsh Production, Low Net Transport of Water and Materials

Source: Modified from Day et al, 1997

2.6 Effects of Climate Change in Africa

Wetland managers face a new set of challenge when addressing the impacts from global climate change. Wetlands are at risk of rapidly declining in quantity and quality due to impacts associated with climate change. However, wetlands also provide all effective strategy for mitigating and adapting to the impacts of climate change. Sea level rise, carbon sequestration, and invasive species are all among the many topics in recent discussions about wetlands and climate change. There is a growing interest among local, state and federal agencies and organizations in regards to the science and development of climate change adaptations plans that incorporate natural resources, including Wetlands. It is ASWMs goal to facilitate a working dialogue and to develop all information resource on this increasingly important issue (ASWMs, 2015).

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