



Assessment of Variation in Evaporation Rate as Evidences of Climate Change in Some Communities of Former Mega Chad, Borno State North East Nigeria

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Abstract

This study is to look at the assessment of variation in evaporation rate as evidences of climate change in some communities of former mega Chad, Borno state north-east Nigeria. The objectives were to: assess the evidences of climate changes in communities of former Mega-Chad, measure the variation rate of evaporation in those communities located at the shores of the former Mega-Chad, analyse the data collected from meteorology station to present outcome as evidences; The data used in this study were generated from secondary source only; the secondary data sourced from Meteorology station were analysed using trend analysis of time series to assessed the evidence of climate change in the study area, Journal articles, Conference proceedings and papers, Books, Photographs and other relevant sources were all consulted to have related information's on the variation in evaporation rate as evidences of climate change in some communities of former Mega Chad, Borno State North East Nigeria; Few Possible recommendations were also made for future studies.

Introduction

Climate change is here and will be with us for the long-term. The challenge facing water professionals is how to make decisions in the face of this new uncertainty. This paper outlines some aspects of local mitigation measures to the management approach that moves beyond technical quick fixes towards a more adaptive style that is inclusive and innovative. Only by thinking, working and learning together we can collectively tackle the impacts and uncertainties on wetland water resources induced by climate change (IUCN, 2003). Climate change is a key concern within African continent. Mean annual temperatures have increased by at least 1.5 times the observed global average of 0.65 °C over the past five decades and extreme rainfall events have increased in frequency. These changes are likely to continue, in 2013 according to South African Long Term Adaptation Scenarios and the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5) for Representative Concentration Pathway (RCP) 8.5 suggest warming relative to 1986-2005 of 3-6 °C by 2081-2100 in the interior, yet less certain precipitation changes in terms of both direction and magnitude. Climate change poses a significant threat to most of the Africa's water resources, food security, health, infrastructure, as well as its ecosystem services and biodiversity. Considering the Africa's high levels of poverty and inequality, these impacts pose critical challenges for most national development in the continent.

Climate change is having far reaching impacts across the globe with significant spatial variations. The world is warming, and it is becoming an increasing imperative for cities to prepare for the impacts of climate change. Each city will have different climate change impacts to prepare for based on their geographical location and their unique mix of local sensitivity, resilience and response capacity (IPCC 2007, CSIRO 2007). Cities responding early to climate change are most likely to better withstand its impacts and maintain a platform for health and prosperity (IPCC 2007). Cities are likely to be affected by climate change in three key ways: Adaptation' encompasses measures that are taken in response to the actual or expected changes in climate to negate or mitigate their impact. These measures reduce the vulnerability of the local natural or human systems to the effects of climate change by increasing the system's resilience to it. Adaptation response measures generally have four categories.

Aim and Objectives of the study

The aim of this study is to assess the local adaptation measures to the effects of Climate Change to wetland water resources in the communities located along the shores of the Lake Chad Basin Borno State Nigeria. The specific objectives are to:

- i. Asses the evidences of climate changes in communities of former Mega-Chad Borno state Nigeria.
- ii. Measure the variation rate of evaporation in those communities
- iii. located at the shores of the former Mega-Chad.

iv. Analyse the data collected to present outcome as evidences.

Study Area

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 29.4°C and 35°C. There is a sudden rise in temperature during the day around April, May and June, occasionally exceeding 40°C, 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.

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 engaged in other activities.

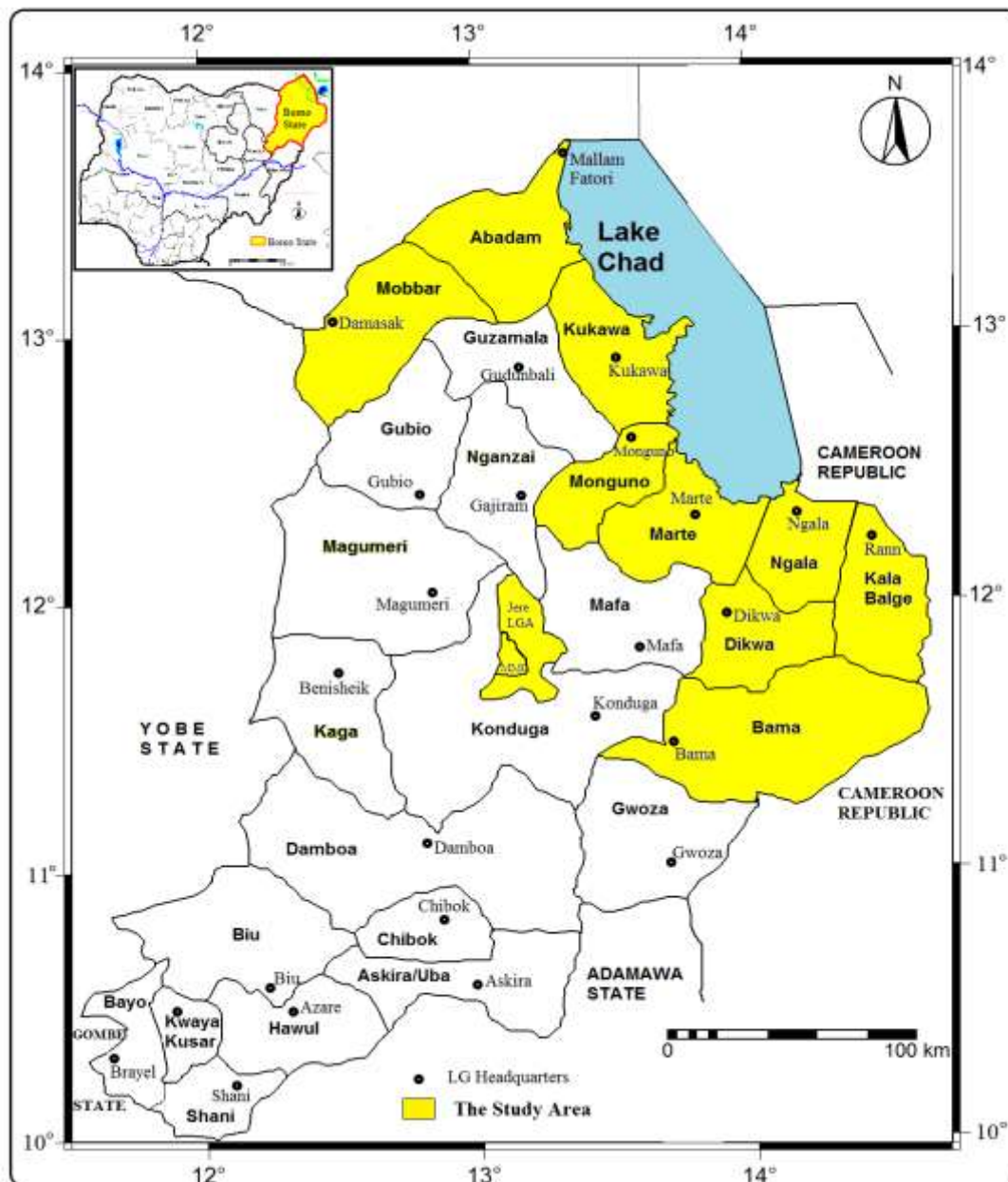


Fig: 1 BORNO STATE SHOWING SAMPLE SETTLEMENTS AND STUDY AREA THAT CONSTITUTED THE FORMER (MEGA LAKE CHAD)

Source: GEONETCast Unit, Department of Geography, University of Maiduguri, 2018

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

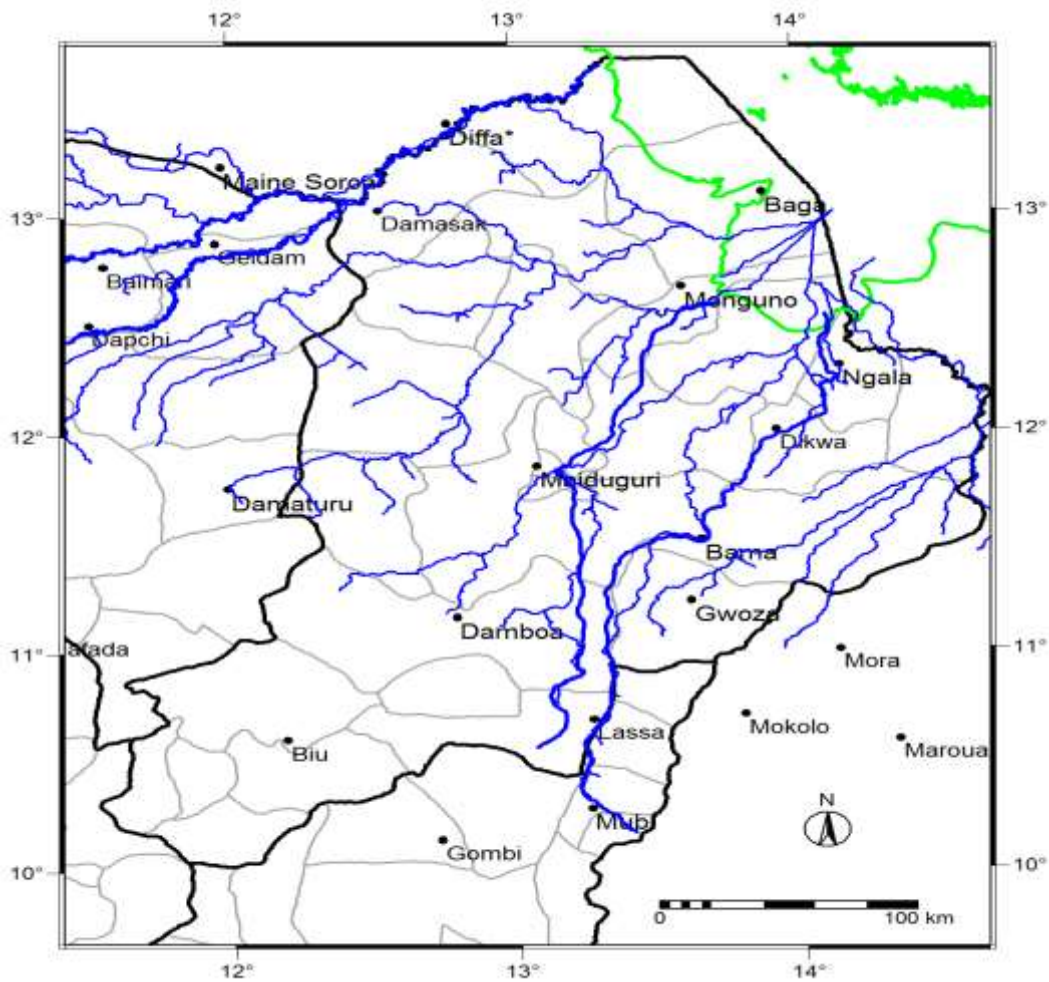


Fig. 2 BORNO STATE SHOWING THE RIVER SYSTEMS

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

Methodology

The data used in this study were generated from secondary source only; the secondary data sourced from Meteorology station, Journal articles, Conference proceedings and papers, Books, Photographs and other relevant sources were all consulted to have related

information's on the variation in evaporation rate as evidences of climate change in some communities of former Mega Chad, 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).

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).

Evaporation Trend Equation & Coefficient of Determination

FacSeason 1	Season 2	Season 3	Season 4
Dec $y = 0.1322^* + 13.4497$ $r^2 = 0.4399$	Mar $y = -0.0125^* + 17.6389$ $r^2 = 0.0054$	Jun $y = 0.0026^* + 10.6554$ $r^2 = 0.0001$	Oct $y = 0.1049^* + 10.2645$ $r^2 = 0.1038$
Jan $y = 0.0152^* + 12.3389$ $r^2 = 0.0074$	Apr $y = 0.0288^* + 18.4632$ $r^2 = 0.0116$	Jul $y = 0.0455^* + 7.0944$ $r^2 = 0.045$	Nov $y = 0.0718^* + 12.894$ $r^2 = 0.1044$
Feb $y = 0.0278^* + 14.046$ $r^2 = 0.0137$	May $y = 0.0401^* + 12.732$ $r^2 = 0.0158$	Aug $y = 0.319^* + 4.204$ $r^2 = 0.0523$	
		Sep $y = 0.0457^* + 5.5042$ $r^2 = 0.0439$	

Conclusion

Climate change will continue to have effects on the 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 of changes and fluctuations occur, most water bodies and green areas around start to be deserted. Drying up of wetlands and deforestation could bring severe impacts on 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.

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