EFFECTS OF CLIMATE CHANGES ON WETLAND WATER RESOURCES AND COMMUNITY ADAPTATION IN LAKE CHAD BASIN NIGERIA

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ABSTRACT

The purpose of the research was to determine the effects of climate change on wetland water resources. The survey has captured the research questions, objectives, types of data collected, procedure and analysis. Data from meteorology station that covers the period of thirty years from 1980-2010 was used. The objective of this study was to assess the evidences of climate change in the Lake Chad basin Borno state, measure the climate change effects on the seasonal variations, investigate and assess the local adaptation measures undertaken by communities to the effects of climate change on wetlands and identify the significant differences between adaptation approaches and respondent's gender, age and academic qualifications. Random sampling technique was conducted to select 252 respondents as 20% of the sample from a population of 1277. Descriptive statistics of percentages, bar charts were used to investigate and assessed the local adaptation measures undertaken by communities to the effects of climate change on wetland water resources. Trend analysis of time series technique was use to assess the evidences of climate change in the study area. For the analysis of trend by season minimum and maximum temperatures, rainfall, solar radiation, evaporation and relative humidity, the Mann-Kendall test, a nonparametric method was used and has shown gradual increase and decrease in most of the seasonal values recorded. A chi-square test of association statistics was performed to examine the relationship between climate change and seasonal variation. The relation between climate change and seasonal variation was significant χ^2 (12, N=252) =63.761, p=0.000. Climate change does have effect on seasonal variation. The survey results also indicated that dredging of water bodies around the community for the storage of water was one of the major approaches and was largely practiced by 38.9% of the respondents in the study area to cope with the challenges, while, findings further reveal that 29.0% of the respondents practice digging of dams for the storage of water as another form of mitigation measures. Further advance statistics of Kruskal-Wallis test, Kendall's tau-b test and ANOVA tests were all use to identify significant difference between respondents' gender, age and qualifications to adaptation approaches in the study area. The Kruskal-Wallis test statistic showed that there was statistically significant difference in the adaptation approaches between the male and female gender at different stages, $\chi^2(1, 252) = 114.959$, p=0.00, with a mean rank adaptation score of 104.94 and 228.41 for general adaptive measures undertaken by the communities, 104.80 and 229.09 for local mitigation measures against climate change, 105.50 and 225.75 for local coping measures against the effects of drying up of wetlands. Kendall's tau-b correlation coefficients statistic τ_b is 0.574 and that is statistically significant (p=0.000). Similarly, there was statistically significant difference between groups in relation to gender, age and qualification on general adaptive measures undertaken by the communities and local coping measures against the effects of drying up of wetlands by one-way ANOVA statistic (F (4, 247), =468.928, p=0.000). In conclusion, the main finding is that the existence of climate change and its significant effects on seasonal variation is observed. The implication of the findings revealed that dredging of water bodies around and digging of dams for the storage of water are necessary as well as sex, age and qualification of respondents as part of adaptation to curtail the situation if not the impacts will be unbearable in the near future.

KESAN PERUBAHAN IKLIM TERHADAP SUMBER AIR WETLAND DAN ADAPAN MASYARAKAT DI LAUT CHAD BASIN NIGERIA

ABSTRAK

Tujuan penyelidikan adalah untuk mengetahui kesan perubahan iklim terhadap sumber air tanah basah. Tinjauan ini merangkumi persoalan, objektif, jenis data yang dikumpulkan, prosedur dan analisis. Data dari stesen meteorologi yang meliputi tempoh tiga puluh tahun dari tahun 1980-2010 digunakan. Objektif kajian ini adalah untuk menilai bukti perubahan iklim di Tasik Chad Basin wilayah Borno, mengukur kesan perubahan iklim pada variasi musim, menyiasat dan menilai langkah-langkah penyesuaian tempatan yang dilakukan ol eh masyarakat terhadap kesan perubahan iklim di tanah lembap dan mengenal pasti perbezaan yang signifikan antara pendekatan penyesuaian dan jantina, umur dan kelayakan akademik responden. Teknik persampelan rawak dilakukan untuk memilih 252 responden sebagai 20% sampel dari populasi 1277. Statistik peratusan deskriptif, carta palang digunakan untuk menyiasat dan menilai langkah-langkah penyesuaian tempatan yang dilakukan oleh masyarakat terhadap kesan perubahan iklim pada air tanah basah sumber. Analisis trend teknik siri masa digunakan untuk menilai bukti perubahan iklim di kawasan kajian. Untuk analisis trend mengikut suhu minimum dan maksimum musim, hujan, sinaran matahari, penyejatan dan kelembapan relatif, ujian Man Kendall, kaedah nonparametric digunakan dan telah menunjukkan peningkatan dan penurunan secara beransur-ansur dalam kebanyakan nilai musim yang dicatatkan. Ujian chi-square statistik persatuan dilakukan untuk memeriksa hubungan antara perubahan iklim dan variasi musim. Hubungan antara perubahan iklim dan variasi musim adalah signifikan χ^2 (12, N=252) =63.761, p=0.000. Perubahan iklim memang mempengaruhi variasi musim. Hasil tinjauan juga menunjukkan bahawa pengerukan badan air di sekitar masyarakat untuk penyimpanan air adalah salah satu pendekatan utama dan sebahagian besarnya dilakukan oleh 38.9% responden di kawasan kajian untuk menghadapi cabaran, sementara, penemuan selanjutnya menunjukkan bahawa 29.0% responden mengamalkan penggalian empangan untuk penyimpanan air sebagai bentuk langkah pengurangan yang lain. Statistik pendahuluan lebih lanjut daripada ujian Kruskal-Wallis, ujian Kendall's tau-b and ujian ANOVA. semuanya digunakan untuk mengenal pasti perbezaan yang signifikan antara jantina, umur dan kelayakan responden terhadap pendekatan penyesuaian di kawasan kajian. Stastiski kajian Kruskal-Wallis menunjukkan bahawa terdapat perbezaan yang signifikan secara statistik dalam pendekatan penyesuaian antara jantina lelaki dan wanita pada tahap yang berbeza, $\chi 2$ (1, 252) = 114.959, p = 0.00, dengan skor adaptasi peringkat rata-rata 104.94 dan 228.41 untuk langkah-langkah penyesuaian umum yang dilakukan oleh masyarakat, 104.80 dan 229.09 untuk langkah-langkah mitigasi tempatan terhadap perubahan iklim, 105.50 dan 225.75 untuk langkah-langkah mengatasi tempatan terhadap kesan pengeringan tanah lembap. Statistik keberkesanan korelasi tau-b Kendall 0.5b adalah 0,574 dan itu signifikan secara statistik (p = 0,000). Begitu juga, terdapat perbezaan yang signifikan secara statistik antara kumpulan dalam hubungan dengan jantina, usia dan kelayakan pada langkah-langkah penyesuaian umum yang dilakukan oleh masyarakat dan langkah-langkah mengatasi tempatan terhadap kesan pengeringan tanah basah oleh statistik ANOVA sehala (F (4, 247), = 468.928, p = 0.000). Sebagai kesimpulan, penemuan utama adalah bahawa

keberadaan perubahan iklim dan kesannya yang signifikan terhadap variasi musim diperhatikan. Implikasi dari penemuan tersebut menunjukkan bahawa pengerukan badan air di sekitar dan penggalian empangan untuk penyimpanan air adalah perlu serta jantina, umur dan kelayakan responden sebagai sebahagian penyesuaian untuk membendung keadaan jika tidak kesannya tidak akan dapat ditanggung dalam masa terdekat.

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CHAPTER ONE

INTRODUCTION TO CLIMATE CHANGE

1.1 Overview

Climate change as the earth's climate keeps changing all the time. Previously there was often a time when earth's climate is being warmer than what it is presently and of course will be different in some time to come. Climate change as a change in the earth's climate has the following contributory factors that trigger changes; these include variations in the sun's output, milankovitch cycles, volcanic pollution, El Nino and La Nino and the greenhouse effect. The resilience of many ecosystems could be harmed by an unprecedented combination of climate change associated disturbances that includes flooding, drought, wildfire, etc. And other global change drivers such as land use change, pollution, fragmentation of natural systems, and over exploitation of resources (IPCC, 2007; CBD 2009).

The United Nations Framework Convention on Climate Change (UNFCCC) one of its prime mandates includes "the stabilization of greenhouse gas concentrations in the atmosphere at a level which is not dangerous to the climate system" an objective is basically stands to as "mitigation." Measures of reducing risk to natural hazards. Perhaps the degrading of greenhouse gas emissions seems to be a great task; which is manifesting ever clearer, reducing the level of emission only cannot be adequate to save extended social groups from the effects due to changing of climate. It is recently being acknowledged adaptation is a principal actor in curbing risks of

climate change on environment, businesses, society and the entire human and animal life (UNFCCC COP-1, 1995).

Adaptation has several definitions by many scholars and agencies, but when relating it to fluctuations, variability, and changes in state of climate is delimited by Inter Governmental Panel on Climate Change (IPCC) as "the adjustment in natural or human systems in response to actual or expected climate stimuli or their effects as it may be which moderates harm or exploits opportunities." Adaptation is being classified differently as regard to designed and spontaneous adaptation. Designed adaptation is a course of public plan of action making and a preparation which is targeted on the available knowledge of current situations at hand and susceptibility, the qualities will differ and actions need to curtail loss or maximise income.

According to (IPCC, 2001) spontaneous or autonomous adaptation is also referring to in the context of businesses adapting to any change that happen or may happen, most at times motivated by markets or welfare changes and the general social institutional needs. Designed adaptation therefore means principally to authorities working in a more pro-active manner, while spontaneous adaptation emphasises on what private sector does, of course to be of reactive approach. Those who favour deploying "concrete" adaptation measures, such as the constructions of reservoirs or development of irrigation systems, have sometimes been reluctant to embrace "softer" adaptation approaches such as education, extension services, policies, penalties and other incentives. In fact, either of this have their advantages. Given the pervasiveness of climate change, adaptation has a lot to play at all strata of social organization, from international, federal, state, local councils so also to the privately owned sectors, faith

based organizations and community based organizations, individuals and of course households. Perhaps is a situation change and adjustment to any condition.

1.2 Background of the Study

Changing climate should be act related with arrays of other forces, number of which, determine by the area, and may have far higher extent and immediate concern for the general water resources and wetlands around in both limited to middle duration. Wetland systems appear to be more susceptible and prone to changes in both the amount and content of water amount. It is obvious that climate change may have more impacts on saturated areas via alterations in hydrological tenures, particularly, the nature and the variability of hydro-period, and the quantity and severe nature of extreme events. Moreover, other variables linked with climate may also have some vital functions in ascertaining regional and local effects, which include high in temperature and changed evapo transpiration, changed bio-geochemistry, changed quantity and structures of un-dissolved sediments loadings, Fire, oxidation of organic sediments and the physical effects of wave energy, (IPCC, 1998; Burkett and Kusler 2000; USGCRP 2000).

The major atmospheric aspects which have significant impact on the climate of a region include temperature, humidity, and precipitation. The tragic associated with climate change on rainfall and wetland has become an issue of concern in several scientific findings (Lima, et al., 2010). Rainfall and temperature findings are of greatest usable for understanding nature and further characteristics of climate changes

(Maragatham, 2012). The global ecological system seems to collapse and die most often as human population grows rapidly and over stress the natural ecosystems and climate.

Declaring of climate peace based upon conserving and restoring natural ecosystems including the atmosphere can save us now. It is the best hope to declare peace with the natural universe starting with climate and old-growth water bodies and forest all merging together as peace-advocates of the rainbow for truth, love, justice, equity, and ecology. Making peace with ecology will allow the generations after us to live forever, rather than suffer and die miserably in ecologically apocalyptic West lands (Barry, 2016).

Any narrations about its complexity that involves in its process most begin with the ways in which the energy into earth's atmosphere can fluctuate. The receipt of that radiation most surely is been influenced by the earth's position as it relates to the solar system and by such parameters as the quantum of occurring dust between stars. Perhaps, once the ray's transmission hit the envelope of gasses in the sky, it will then pass it to the earth's surrounding which is controlled by the atmosphere that including (water vapour) and discrete mass of substance quality or liquid matter (e.g. aerosols) in the air (Anderson, 2007).

The absorption or reflectance of the incoming radiation largely depends on the reflectivity of the surface. These materials could be natural or man-made in nature. Effects of the felt radiation on climate also proportionally depend on how it is being dispense and the altitude level of land masses and oceans in a given location

(Anderson, 2007). A continent or continents may be moving to or in places where ice-caps most have accumulated, mountain belts may grow or subsides and directly impact on the world's wind-belts and local climates, and arrangement of climatically important composed of organic compounds deposit may be restrain by changes in the depths of volume of water and air that can be held in soil dividing basins from one another and by the width of the seas, oceans, and channels. The situation is difficult by feedback loops within and between the ocean, atmosphere, and land system (Anderson, 2007).

The Earth and the energy system were said to have been makes about 4.6 billion years ago, and ever from that time the earth has undergone via series of cycles of warmer and cooler in its history. During the past several decades ago, it has been recurrent glacial time after time on a cycle of between 40,000 and 100,000 years, and the closest glacial time experienced is at virtually 15,000 years ago (Anderson, 2007).

1.3 Rational of the Research

The Lake Chad Basin was found out to have closely filled the whole of its drainage basins in the past 100 years. Since then, the lake has experienced dwindling conditions which has led to drying of most part of the lake. Between 1400 and 1910, the Lake Chad was estimated to cover 25,000 sq km in 1963 comparable to just 1,350 sq km in the recent time (Odada, et at 2000). More so, the vegetation particularly of the northern part of the lake is drying, and also sand dune has form on the dry lake area. The drying of the lake is said to have been responsible to several factors, which climate change is the principal factor that also led to high demand for water.

Historically, the lake has a lot of impact on the life of many people, looking critically the Boko Haram insurgency that engulfs Borno state in north eastern region of Nigeria since 2008. Some people are even trying to make reference to the drying off of the Lake Chad Basin due to risks that associated with changing climate seems to be one of the factors that triggered the insurgency in the region. Thousands of people were rendered jobless, fishing and irrigation activities were seriously affected which in turn has resulted in several challenges in the area.

The world is being faced by various challenges today owing to the fact of changing climate. Climate change is one among the global issues of the universe today that been faced by human kind. Unlike other crises, it is global in nature and threatens the very survival of civilization. The variability and change in climate over the world may largely be attributed to human activities in forms of fossil burning leading to emission of greenhouse gases, mineral exploration and exploitation; transport systems, business activities, residential building and industrialization altogether contribute in a no small way to greenhouse gases. Other natural factors and phenomena that induce climate change which results in water scarcity may include radioactive forcing (a change in relatively short and temporary period of warming during a glacial) and internal relations in between parts of the climate system of the earth's spheres (IPCC, 2011).

Water with other resources is much affected due to the changing climate that is triggered by global warming. Burning of fuel from the remnant of organisms found in rock with high content of carbon and hydrogen like oil and coal by some

agricultural with industrialist leads to global warming. Generally, activities like that contribute higher temperature which in turn results in raising amounts of greenhouse gases (where sun's heat is stored) by the atmosphere. Climatic changes play a very vital function regarding agricultural outputs with an important result in crop growth, development and yield, leading agricultural exercise one of the most sensitive and susceptible areas out of the environmental activities (Ventrella, et.al. 2012).

In 2006, Mr Kiochiro Matsuura, the Director General of UNESCO affirmed that Climate changes are induced on all spheres of human and natural systems that include both cultural and natural world heritage properties. The conservation to ensure sustainable management of these sites has indeed turned to be an intergovernmental priority of the esteem order'' water is basically use for three basic need by humans; these include home and municipal purpose (drinking, cooking, cleaning, and etc), agriculture, and industry. Humans generally in the mid-1990s opted to withdraw (taken away in rivers, lakes, and aquifers) 3,750 cu km (900 cu mi) of water annually for such purposes, according to the United Nations (UN). About 2,270 cu km (540 cu km) of such was used before (now is nowhere to be any more for immediate use). There are arrays of factors that contribute to how water is been use largely. Among which include evaporation of water from irrigated lands also considered as finished industrial products, or is been directly engrossed by either plant or animal (United Nation, 2015).

Climate change disaster would be increasingly high across the world. The adverse effects would also be intense in most nations that are highly responsive to distress of climate. Since huge of African livelihoods depend largely on rain-fed

agriculture and this makes them extremely susceptible and prone to climate variability and change. Climate variability is most habitually happening of climatic undulation affecting the natural climate aspects, Christensen et.al, 2007).

The world is at a risk of witnessing the possibility of water challenges triggered by the rapid increasing population increase, unequal water supplies, pollution, and as well other parameters. The United Nations (UN) forecast that water crises can result in retarding the economic development of some states around the world and could result in food crises, perhaps to international crises. Very small water is being sourced or totally missing in previous billions of years. In place the same water has been cycled countries times by the water cycle (UN, 2015).

The world's inhabitant rises extremely in the last century, the population was estimated and put at 1.65 billion persons survived on earth in 1900 according to UN. While, by 1999 the world's population was more than 6 billion persons, and now it is rate at about 7 billion. And the UN projects that world's population will be up to 9 billion persons by 2050. However, annual indefinite quantity of renewable fresh water seems to be still intact as it is. UN Commission on Sustainable Development affirms, that volume of water obtainable for an individual decline, and as the number of people goes up day by day, raising the prospect of water scarcity in the world (UN, 2015).

Natural water shortage pushed many states increase their supply by constructing more facilities to dam and harvest water that if not, flight to the seas, lakes, oceans and other forms of water bodies, or by embarking on sinking many and deep wells, because these efforts in turn may result in negative way that can as well

lead to water scarcity in the other parts. Scientists disputed on the rate global warming might change the earth's climate and how speedily could happen. However, most experts are of the opinion that risen global temperatures generally modify the world's rainfall patterns. Modification can result in worsening water issues in some regions and as well possibly alleviating it in others.

Issues on water can perhaps result in international crises as nations compete to survive for scarce water resources. In 1995 Ismail Seragaldin, senior Personnel at the World Bank, affirms, (next century's conflict in the world is about water). Political pressures on water continue escalating when different governments said to have made assertion or averment particular same river, lake, or aquifer. Well over than 300 river basins and aquifers worldwide cross national boundaries triggering the tendencies for international crises (UN, 2013).

There were some water resources related major implications noticed by Zimbabwe's water resources management. Water available to cities and village areas particularly in the south and west part of the country seems to be severely injured. Given the dependence of greater Zimbabweans in rural areas on groundwater, this implies that climate change could also have adverse consequences on village inhabitants. A Southern African Development Community (SADC) study supported this conclusion. It was found out that the population was at very high risk from ground water drought in Zimbabwe can raise from 32% to 86% by 2100 rather prompt attention is paid and serious interventions considered to adapt to effects of changing climate.

Decline in runoff and groundwater recharge is coupled with possible scenarios of population increase, nations GDP per capita and water availability decreases significantly. Even under the best case greenhouse gas emissions scenario and a low population growth scenario, national GDP per capita and water availability declines by 38% from 2.45 Ml per capita per income in year 2012 to 1.52 Ml per capita per year income by 2050. Under medium or high population growth scenarios, national per capita income water obtainable continues to decline to 2080 to the point where Zimbabwe would move from the UNs “water stress” to “absolute water scarcity” category (World Bank, 2014).

There are several entailments to water resources investments and management. Existing dams built for water supply and irrigation may seem to have been no more reliable. There was no consideration for climate change in the ongoing plans to rehabilitate country's water resources infrastructure. Hence, reduced precipitation and increased evaporation in southern and western parts of Zimbabwe could have significant entailments when selecting dams for reconstruction or when designing new ones. Increasing investment in infrastructure, by its own self, is not likely to be strong enough in response to reduced water availability. Instead a multi-pronged strategy including better governance and reform management to ameliorate existing water resources go distant in a more economical manner (Davis, R. & Hirji, R. World Bank, 2014). This has clearly shown that there is a need to embark on a serious Environmental Impact Assessment (EIA). Most advance countries of the world today are what they do to mitigate climate and other natural and manmade environmental induce stress.

The implementation of Environmental Water Requirement (EWR) is put in place to guarantee the running of ecosystem services that people will be provided by wetlands and rivers sustainably. In South Africa's National Water Act (NWA), the reserve (water necessary to attend basic human needs and maintain environmental sustainability) is the only water share assured as a right. The future of wetlands is quite closely linked to human survival, and so the climate changes effects is not independent from man's specific general behaviour that takes place in and around wetlands. Widely circulated poverty pushes and led the people to exhaust whole benefits tapped from ecosystem services and compels individuals more prone about climate changes effects. It resulted to a circumstance which the menaces to wetlands are from a complex several reasons than from just a particular source as one may simply think (King and Pienaar, 2011).

1.4 Statement of Problem

In the recent time, change in climate has become the world's major issue of concern. Climate change stands as famous environmental, social and economic menace surrounding the entire planet. In African countries, climate change is prime venom to sustainable development and to food security (Christensen et.al. 2007). It is very common for those communities who live in the dry lands of Africa and also rely solely on rain fed agriculture for their livelihoods. These communities who practice

irrigation farming system may also be seriously injured by climate change due to declining trend of sustainable water resources and consequently the high demand for water due to shutting of population. Nigeria is an (agrarian) state which relays largely on rain fed farming; perhaps the sector is extremely vulnerable to climate variability and climate change (Peter, et al 2010).

Changing climate is being globally tagged as a greater danger to the existence of number of different species, and as well wholeness of communities or organisms world over (Hulme, 2005). The several bodies of knowledge written by many scholars on ecological and hydrological stress as an outcome of changing climate result have grown larger in the recent decade, forces of tension to wetlands is likely to be mediated via changes in hydrology. Direct and indirect effects of changes in temperatures and land use changes, (Ferrati et al. 2005).

Wetlands serve as larger sources of water that comes from rainfall, runoff, and ground water blow up, and increase high or overbank stream flows. Evaporation, transpiration, seepage to ground water, and overflow result in escape of water in wetlands across Victoria, balance of water intake and outputs determines the hydrology of wetlands. Continues change in climate result in decreasing the amount of rainfall, and water shortage that severely persist (DSE 2009).

Human beings adapt in several to the numerous changes come along with climate which will also seriously affect the future position of wetlands. Human population is the known paramount driver of determining water use and economic development, and so also the changes in societal general perception and

understanding the worthy of water and waterways. Water use in specific irrigation, wholly upward with temperature downward in rain (Kundzewicz et al. 2007). Irrigation water demand as a result of climate change is likely if conditions become drier, the human demand for ground water is also likely to be increased, which can harmfully affect the groundwater dominated wetlands. In arrays of wetlands that are reduced primarily as to man's water use and drainage, climate change is perhaps to aggravate reduction by size if it reflects in reducing the net water accessibility (Kundzewicz et al, 2007).

Ecosystems and global climate change degrade the wetlands when bird's species and other wildlife have been influenced (USFWS, 2011). Shortage of rainfall and floods will lead to unpredictable due to rising temperatures and more storms, in some cases, irreversible ranges in hydrology, plant groups, and prey abundance. Projected temperature goes up without comparison addition in rainfall will have serious effects in wetland ecosystems, commonly linked to loss of water inputs, limiting storage capability, timing of wetland recharge, and persistence of drought. Increase in evaporation may shorten the degree of semi-permanent and seasonal wetlands, and as well lowering summer soil moisture, with specific reference to places like the prairie regions of the United States. There will be probably high impacts on mountainous wetlands where temperature-sensitive plants and animals will be unable to move further. It has also been stated that wetlands that depend on snowmelt will reduce or even get dry (NABCI, 2010). Changing climate is a threat which can trigger to cause a transformation in ecosystems and several resource and service they provide to one another and the society in general. Climate change has

already altered some elevations and high latitude ecosystems in many regions across the world.

Several communities located at the shores of the Lake Chad Basin are prone to many environmental challenges looking at their locations on the fringes of fragile semi-arid region of Nigeria. Couple with climate semi-arid type with long dry season followed by short rainy season (Hayward and Oguntoyinbo, 1987). This will definitely result in making the areas to experience some challenges like deforestation, high increase in temperature, excessive heat, drought, and death of both plants and animals in large number, desertification and many other several problems that may result in making the water bodies around to be used as an alternative sources of water supply.

Drought seems to be a serious problem, and a major environmental challenge of Borno State for quite sometimes dated back to 1983/84. The magnitude of the challenge when happened goes up in north-ward direction towards Sahara. Drought clearly revels in wilting of crops due to lack of rain which results in wide-range of crop failure, drying up of rivers, wetlands, lakes and ponds around, falling ground water table, and general absence of water for domestic and other needs. Other challenges that come along with drought include; livestock loss, frequent occurrence of diseases, famine, rural-urban migration, insecurity, general crime rate, other hardships and even death as the case may be. Drought years of 1972/73, 1983/84 some stations in Borno like Monguno, Kukawa, Damboa, and Mallam Fatori in the present Abadam LGA below 250mm of rainfall, and this is a serious call for cry to agriculturist, meteorologists, hydrologists, and environmentalist as well.

Desertification is also another problem, and Borno's rate in varies from medium to severe as one goes towards the northward. Symptoms and consequences of desertification is widely perceived to be seen as in low productivity and in the progressive reduction of natural resources in the vegetation cover such that the land seems not capable of supporting any given population. Gradual fading away of fuel wood, ground water, resources reduction, high rate of evaporation, accumulation of toxic salts in the soil, malnutrition, south-ward migration, and also man and geomorphologic responses such as the gradual shifting of the sand dunes in all the local government areas located in Borno north are highly vulnerable, and have a sign or the other in respect to desertification.

Water Resources loss, receding of Lake Chad is generally agreed by many to relate it with continues drought in the entire Sudan-Sahelian region other than all droughts. The abstraction of the flow of rivers Lagone and Shari, Yobe and Yedzaram have also contributed to greater degree by which it has affected the lakes status. The loss of ideal water in the Lake has direct linked to agriculture, fishing and arrays of other socio-economic activities since the bare is a delicate land in nature, and highly susceptible to drought. Other recession of the lake therefore has terribly injured the livestock sector. Herds often follow the old lake water as it recedes or emigrate from the state. The net result of water loss is the abandonment of some settlements, waste of time and energy in search of water for both man and livestock over of long distances and loss of vegetation cover.

Many of these communities under the research have known to be using entire resource from Lake Chad Basin for fishing, irrigation farming and all sorts of economic life for time immemorial, but today the whole activity turned to be something else. Lake Chad Basin that was estimated to 25,800 square kilometres in 1963, and has been in used as far back as that time with the capacity of sustaining lives of about 30 million people in Nigeria and other neighbouring countries has now become as low as 1300 square kilometres in the recent time (P. Burnett, 2014).

Furthermore, with this, it is obvious that millions of water resources and ecosystems must have been affected in many several ways either directly or indirectly. Some experienced discomfort, injury, extinct or even death. Change in climate could be a major factor that triggered this universal challenged with particular reference to the social and economic life of the people living around the shores of the former Mega Chad. Therefore, this research is to assess the effects of climate changes to wetland water resources and community adaptation in Lake Chad Basin Borno State North-East Nigeria.

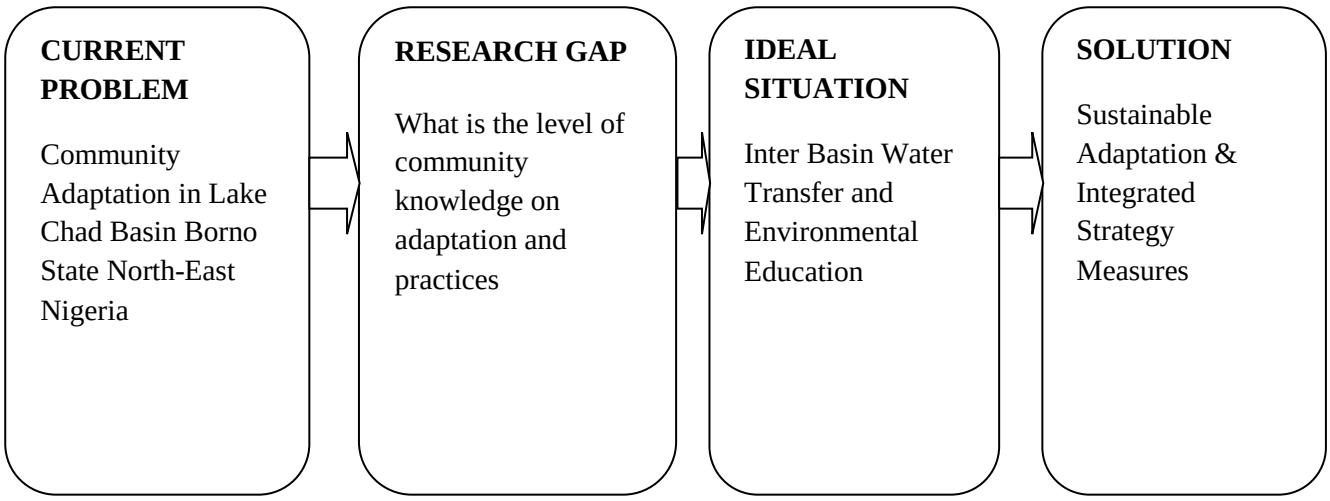

Figure 1.1. Research Gap

Research could simply be putting together to establish new findings, that may either be a developing a new concept, testing approach or adoption and extension of concept (concept building approach). By means of a concept testing or a concept extension approaches latest findings are made and also research is not all about collecting, classifying, and arranging and analysing ordinary data and information, but it is all about interpretation of collected data and information in one's journey of research work (Uyangoda, 2011).

Well defined, structured and an articulated problem statement is the bedrock of any dissertation. While, a vague problem of statement is the cardinal point in any dissertation work, when a researcher is submitting a research proposal for any proposal presentation be it academic or otherwise, the assessors may wish to find out what are you actually trying to investigate. A good researcher should be in a better position to convince his or her examiner based on the research problem presented. Perhaps how best you can build your research problem (Uyangoda, 2011).

The study attempted to bridge the gap in challenges in wetland resources as phenomenon of danger of changing climate in the study area particularly as how they cope locally at communities located at the shores of the Lake Chad, and further to develop a sustainable adaptation integrated strategy model for adoption in all the affected communities. Furthermore, originality is very important in one's journey in any given research. That will indeed give the research's findings, confidence, authenticity, strength and of course reliability by those who may find themselves reading the outcome of the research.

1.5 Aim of the Study

The aim of this study is to assess the effects of climate changes to wetland water resources and community adaptation in some selected communities located around the shores of Lake Chad Basin Borno State North-East Nigeria.

1.6 Objectives of the Study

Specific objectives of this study are to:

(i) identify the effects of climate change in the Lake Chad Basin Borno state.

(ii) measure the climate change effects on the seasonal variations.

(**iii**) investigate and assess the local adaptation measures practice by communities to effects of climate change on wetlands;

(**iv**) assess significant differences between community adaptation and respondent's demography.

1.7 Research Questions

RQ1: Are there any evidences of effects of climate change in Lake Chad Basin Borno state?

RQ2: Does climate change has any effects on seasonal variations?

RQ3: What are the local adaptation measures practice by communities to effects of climate change to wetland water resources?

RQ4: What are the significant differences between community adaptation and respondent's demography?

1.8 Scope of the Study

This study covered some selected communities in the following LGAs of Mobbar, Abadam, Kukawa, Monguno, Marte, Dikwa, Ngala, Kala Balge, Bama, MMC and Jere located at the shore of Lake Chad Basin in Borno State North-East Nigeria. Emphasis was placed on assessing community adaptation due to climate changes effects to wetlands water resources in some selected communities in Borno State Nigeria.

1.9 Significance of the Study

The present concern about clean and abandoned water for human and animal use all around the world call for care and foresight in the use of environmental resource. Land, water and vegetation resources all have carrying-capacities. And it is of very great importance for all the communities to be fully aware through advocacy, sensitization, workshops, lectures, symposiums, conferences at both local and international level, research papers and inclusion of community people as stakeholders, that there is a need to achieve their current needs by not destroying the

capability of future generation to get their own needs too. This research will provide basic information's to government agencies, students, other researchers, scientist and as well as development partners in preparing framework for the management of environmental resources sustainably.

It will also help government in making policy formulation for sustainability of resources use as a whole. It is has also provided basic information's on how the affected communities will adapt and cope with the challenges of drying of wetlands and other sources of water that leads to the scarcity of most of the resources. It will help on how should the communities, national government and international communities to improve for a lasting solution in these affected areas. The research will serve as a baseline for future reference purposes particularly in respect to sustainable development. It is expected that the research will serve as a theoretical and empirical concept for students, teachers, parents and the society at large.

1.10 Summary

This work is on community adaptation due to climate changes effects on wetland water resources in Borno State Nigeria, the research discussed extensively on the general overview, the rationale, problem statement, research gap, expected outcome, summary finally conclusion.

It also went further to discuss that this is the driving force of the entire findings, first the intension of the work has been clearly stated by the introduction

which will a long way in guiding the reader, then followed by the rational of the thesis the purpose which the study is intended to be undertaken. Then the statement of problem meaning the reason behind the research work that is what triggered the research to be of interest which there were also various scholars who made same reason in other parts of the world, perhaps what actually triggers the researcher found out that yes this is an issue, a figure also showing the research gap was designed by the researcher which has clearly spelt out on how to bridge.

The research questions, scope specific area the research intended to cover, then significance of the research, of what benefit is the research going to be either to scholars, development partners or otherwise, and finally the expected outcome of the research, what the research expected to achieved at the end.