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The Potentials and Challenges of The Lake Chad River Basin

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ABSTRACT

Lake Chad is yearning for a savoir! Being one of the greatest lakes of the earth is now once an attribute the lake had. Not only was it among the largest, but its then size (around 10,000BC) can only be compared to seas such as the Caribbean. Around 5000BC, it had covered over a million square kilometers, that was roughly half the size of the present day Mediterranean sea and one-third of the celebrated south china sea. Imagine a nation like Nigeria as an ocean, how big it will appear! With Nigeria having a total land area of 923,768km^2; paleo Lake Chad was bigger than Nigeria. As late as the 1960s, it had a surface area of about 28,000km^2 (almost as large as Belgium). According to the Global Resource Information Database of the United Nations Environment Program, it shrank by as much as 95% from about 1963 to 1998. Regrettable, it current surface area is estimated to be 1,350km^2. All that is left is a shadow of its former self –courtesy of both climatic and anthropogenic factors. Perhaps, more worry some is the fact that this lake which is tagged as one of the world's most neglected environmental disaster by the UN situated in a region also tagged as one of the most impoverish of the world is bound to varnish on the surface of the earth in less than twenty years to come. As the lake yearns for a savior, so also are the 68,000,000 million Africans from across Nigeria, Chad, Cameroon and Niger who are depending on the lake for their socio economic well beings. Millions of fauna and flora are also affected. The situated has displayed millions of people; some have been rendered jobless while others are left with no choice than to emigrate. Others found themselves recruited to cults such as the Boko haram. Hunger, starvation and crisis over the limited water resources left have been the order of the day. The Nigerian sector of the Chad basin also known as the Borno basin (1/10th of the Chad river basin) alone is very vast and fertile enough to feed the whole of West Africa. However, all hope is not lost, the lake can be saved. All that is required is the mega transaqua project. That will also create an intercontinental canal linking CAR to the ocean while generating over 700 mega watts of electricity to the region. What's more, a green belt that will checkmate desert encroachment across the Sahel which will also serve as a wind breaker hence increasing the annual rainfall of the region can be established. If actualized, this poor region can prove to be Nigeria's economically most important spot and one of Africa's; a transformation that can best be described as from grass to grace!

Keywords **—Lake Chad, Climate Change, Transaqua Project, Environmental Crisis**

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The Lake Chad River Basin

Figure 1: Chad river basin

Situated between latitude 6° and 24° N and longitude 7° and 24° E with an area of about 2,434,000 square kilometers (940,000 sq mi) covering almost 8% of the African continent is the lake Chad river basin- one of the world's biggest basins. It is the largest endorheic basin in Africa; it has no outlet to the sea and contains large areas of desert or semi-arid savanna. Seven African countries namely Nigeria, Niger, Chad, Cameroon, Algeria, Central African Republic (CAR) and Sudan each have part of the basin under their territory. The Nigerian sector of the basin also known as the Borno basin is about 1/10th of the total area of the basin and 19.4% of Nigeria's total land area. It falls between latitudes 11◦N and 14◦N and longitudes 9◦E and 14◦E, covering Borno State and parts of Yobe and Jigawa States of Nigeria.

GEOLOGIC SETTING

The basin belongs to a series of Cretaceous and later rift basins in Central and West Africa whose origin is related to the opening of the South Atlantic (Obaje et al., 2004). In Nigeria, other inland basins of the same series include the Anambra Basin, the Benue Trough, the Mid-Niger (or Bida) Basin and the Sokoto Basin. At times, parts of the basin were below the sea. In the northeastern part of the Benue Trough where it enters the Chad Basin there are marine sediments from the Late Cretaceous (100.5–66 Ma). These sediments seem to be considerably thicker towards the northeast. Boreholes under Maiduguri have found marine sediments 400 metres (1,300 ft) deep, lying over continental sediments 600 metres (2,000 ft) deep. The sea seems to have retreated from the western part of the basin in the Turonian (93.5–89.3 Ma). In the Maastrichtian (72.1–66 Ma) the west was non-marine, but the southeast probably was still marine. Stratigraphically, the Chad basin consists of the Bima formation overlaying the basement complex. The Gongila formation is sand witched between the Bima and the above Fika formation. The Chad formation blankets the whole of the basin. The basin also has three aquifers and holds great prospect for petroleum among other resources.

CLIMATIC CONDITION

Northern portion of the basin is notably desert. Temperature is usually high during the day and low at night. The high temperature of the region is responsible for the evaporation of over 90% of the lake's water which under natural condition is restored by the tributaries of the lake and little contribution from rainfall. Riparian forests, flooding savannas and wetland areas are found in the region. In the far south there are dry forests. Rainfall varies widely from year to year. The amount of annual rainfall is very low in the north of the basin, rising to 1,200 mm (47 in) in the south.

FAUNA

Visitors to the medieval kingdom of Kanem in the Lake Chad region described an abundance of wildlife. Until the early 20th century, essentially the same faunal assemblages were reported. Since then, however, habitat loss, hunting, and direct competition from livestock have depleted wildlife populations. As with vegetation, the trend is toward decreased diversity and lower levels of biological productivity.

PISCES

The entire Lake Chad basin holds about 179 fish species, of which more than half are shared with the Niger River Basin, about half are shared with the Nile River Basin, and about a quarter are shared with the Congo River Basin. Lake Chad itself holds 85 fish species. The Chad basin remains an important fish producer with over 40 species of commercial importance. Also noteworthy are ancient species such as the lungfish and sailfin. During the wet season, fish move into the mineral-rich lake to breed and find food.

MAMMALS

There are many floating islands in the lake. It is home to a wide variety of wildlife mammals among which are giraffe, the striped hyena (*Hyaena hyaena*) and caracal (*Felis caracal*). Also present are antelopes such as the Addax and Dama Gazelle, and in the savannah there are korrigum and red-fronted gazelle. Large carnivores, including lions, Central African Cheater and leopards some of which are eliminated. Large animals such as rhinoceroses and hippopotamuses have been significantly reduced. Nocturnal species have been less affected by these changes; and some, particularly rodents, have benefited from them. The western black rhinoceros was once common but is now extinct. Elephants almost became extinct by the end of the nineteenth century due to European and American demand for ivory, but stocks have since recovered. Even in the 2000s, the region still remains host to large population of animals. The Nigerian sector of the Lake Chad Basin is one of Nigeria's national park.

AVES

Hundreds of species of birds reside permanently or seasonally in the Lake Chad region. Prominent among them are terrestrial birds—such secretary birds, Nubian bustards, ostriches and ground hornbills—and the water and shore birds for which the region is famous—such as the garganeys, shovelers, fulvous tree ducks, Egyptian geese, pink-backed pelicans, marabou storks, glossy ibises, wintering Ducks, Ruff (*Philomachus pugnax*) and other water fowl and shore birds. Near-endemic birds in the region include the River Prinia (*Prinia fluviatilis*) and the rusty lark (*Mirafra rufa*) and African spoonbills. The shrinking of the lake is threatening nesting sites of birds such as the black-crowned crane (*Balearica pavonina pavonina*).

FLORA

The lake Chad region has been found to be hosting some 44 species of algae. In particular it is one of the world's major producers of wild spirulina. The lake also has large areas of swamp and reed beds. The floodplains on the southern lakeshore are covered in wetland grasses. Research has shown that well-drained soils around Lake Chad once supported a relatively dense woodland, including species such as kapok and Ebony. Changing patterns of land use and progressive degradation coupled with desertification have reduced diversity and resulted in more open woodland increasingly composed of species adapted to reduced moisture. They include several acacias, baobab, desert date palms, African myrrh, and Indian jujube. The periodically inundated lands near the lake are more heavily vegetated. Annual grasses are increasing at the expense of the more economically valuable perennial species. Papyrus, ambatch, water lilies, and reeds dominate aquatic vegetation.

HYDROLOGY AND HYDROGEOLOGY

Chari river flowing from the Central African Republic (CAR) northwards into the lake is the largest source of water of the lake. The volume of water entering Lake Chad annually from the CAR has fallen from about 33 cubic kilometres (7.9 cu mi) before the 1970s to 17 cubic kilometres (4.1 cu mi) in the 1980s. A further 3 cubic kilometres (0.72 cu mi) to 7 cubic kilometres (1.7 cu mi) of water annually flows from Cameroon into Lake Chad via the Logone River. About 96% of the lake's water comes from the Chari -Logone system.

Figure 2: Chari and Logone rivers flowing down to the lake.

Hadejia - Jama'are - Yobe sub-basin this is one of the two sub basins that drain into the Lake from Nigeria. This sub basin is responsible for the supply of some 6,000 square kilometres (2,300 sq mi) Hadejia-Nguru wetlands. They converge to form the Yobe, which defines the border between Niger and Nigeria for 300 kilometres (190 mi), flowing into Lake Chad. Constructions of upstream dams and growth in irrigation have reduced water flow resulting to rapid drying of the flood plains.

***The Yedseram - Ngadda sub-basin*:** The Yedseram River and its tributaries rise in the Mandara hills and it 'loses' most of its water while flowing northwards through a 7-km-wide flood plain. Further downstream, together with the Ngadda River, it forms an 80km^2 swamp and does not maintain a definable water course to the lake. The basin consists of three aquifers namely; lower, middle and upper.

Management and the LCBC

About 20% of the total area of the Lake Chad basin covering an area of 427,500 km^2 is called the Conventional Basin (42% in Chad, 28% in Niger, 21% in Nigeria and 9% in Cameroon), which is under the mandate of the Lake Chad Basin Commission. Shortly after attaining independence, the four countries sharing the conventional basin came up with an idea to establish the Lake Chad Basin Commission (LCBC) in the year 1964. CAR and Sudan later joined the commission.The LCBC later met in Central Africa Republic in 1994 — and its partners continue to make efforts to save the lake or at least mitigate the impact of its shrinkage on people's lives. Plans to divert the Ubangi River into Lake Chad were proposed in 1929 by Herman Sörgel in his Atlantropa project and again in the 1960s. The copious amount of water from the Ubangi would revitalize the dying Lake Chad and provide livelihood in fishing and enhanced agriculture to tens of millions of central Africans and

Sahelians. Interbasin water transfer schemes were proposed in the 1980s and 1990s by Nigerian engineer J. Umolu (ZCN scheme) and Italian firm Bonifica (the Transaqua canal scheme). In 1994, the Lake Chad Basin Commission (LCBC) proposed a similar project, and at a March 2008 summit, the heads of state of the LCBC member countries were committed to the diversion project. In April 2008, the LCBC advertised a request for proposals for a World Bank-funded feasibility study. Neighboring countries have agreed to commit resources to restore the lake, notably Nigeria among others.

HISTORY, PEOPLE AND ECONOMY.

Kanem Borno, one of Africa's longest documented kingdom has been the host of the Lake chad in particular. Within the Chad basin however, were other kingdoms including the Wadai and the Hausa city states. Humans have lived in the inner Chad Basin from at least eight thousand years ago, and were engaging in agriculture and livestock management around the Lake by 1000 BC. Permanent villages were established to the south of the lake by 500 BC at the start of the Iron Age. The Chad Basin contained important trade routes to the east and to the north across the Sahara. By the 5th century AD camels were being used for trans-Saharan trade via the Fezzan, former capital of the kanem Borno empire which is now situated in present day Libya or to the east via Darfur, where slaves and ivory were exchanged for salt, horses, glass beads, and firearms.

With its rapid population, reaching up 68,000,000 people, the Chad basin mainly comprises of ethnic groups including the Kanuris, Maba, Buduma, Hausa, Kanembu, Kotoko, Bagger, Haddad, Kuri, Fulani and Manga. Major cities in the basin include Maiduguri and Kano in Nigeria; Maroua in Cameroon, N'Djamena in Chad and Diffa in Niger.Farming, herding and fishing are the main economic activities of the region. At least 40% of the rural population of the basin live in poverty and routinely face chronic food shortages. Crop production based on rain is possible only in the southern belt. Flood recession agriculture is practiced around Lake Chad and in the riverine wetlands. With a harvest of about 70,000 tons of fish between 2000-01 for example, fisheries in the Lake Chad basin provided food and income to more than 10 million people as at that time.

LAKE CHAD

Figure 3: Lake Chad showing the major settlements surrounding it

Chad as a country got it's name from the lake. "*Chad"* is a local word meaning "large expanse of water" - a lake if you like. Lake Chad is the remnant of a former inland sea, paleolake also referred to as the Mega-Chad. At its largest, sometime before 5000 BC, Lake Mega-Chad was the largest of four Saharan paleolakes, and it was estimated to have covered an area of 1,000,000 km^2 (390,000 sq mi), larger than the Caspian Sea is today, and may have extended as far northeast as within 100 km (62 mi) of Faya-Largeau. At its largest extent the river Mayo Kébbi represented the outlet of the paleo lake Mega-Chad, connecting it to the Niger River and the Atlantic. The presence of African manatees in the inflows of Lake Chad is an evidence of that history. In the 1960s, the lake had a surface area of about 28,000km^2, about the size of the US state of Maryland or Belgium and bigger than Israel or Kuwait.

Lake Chad was first surveyed from shore by Europeans in 1823, and it was considered to be one of the largest lakes in the world then. In 1851, a party including the German explorer Heinrich Barth carried a boat overland from Tripoli across the Sahara Desert by camel and made the first European waterborne survey. Lake Chad has shrunk considerably since the 1960s, when its shoreline had an elevation of about 286 metres (938 ft) above sea level and it had an area of more than 26,000 square kilometres (10,000 sq mi), making its surface the fourth largest in Africa. An increased demand on the lake's water from the local population has likely accelerated its shrinkage over the past 40 years. The traditional staples of livelihood for the Lake Chad community dwellers, are vanishing. Vultures feast on dead cows as drought and desertification take their toll. The UN Food and Agriculture Organization (FAO) have called the situation an ***"ecological catastrophe"*** predicting that the lake could disappear this century.

By 2001 the lake covered less than 1/18th of the area it covered during the 1960s. "It may even be worse now," says Abbas Mohammed, a climatologist at the University of Maiduguri, Nigeria.

Figure 4: Kanuri tribal fishermen in 1970s harvesting fish in the Lake Chad

The size of Lake Chad greatly varies seasonally with the flooding of the wetlands areas. In 1983, Lake Chad was reported to have covered 10,000 to 25,000 km^2 (3,900 to 9,700 sq mi), had a maximum depth of 11 metres (36 ft), and a volume of 72 km^3 (17 cu mi). By 2000, its extent had fallen to less than 1,500 km^2 (580 sq mi). As late as December 2014, Lake Chad was still sufficient in size and volume such that boats could capsize or sink. The European Space Agency has recently presented data showing an actual increase in lake extent of Lake Chad between the years of 1985 to 2011. Currently however, the total surface area of the lake is estimated to be 1,350km^2. Less than half of Lake Chad is covered by water through an entire year. The remaining sections are wetlands. Lake Chad's volume of 72 km^3 (17 cu mi) is very small relative to that of Lake Tanganyika (18,900 km^3 (4,500 cu mi)) and Lake Victoria (2,750 km^3 (660 cu mi) other African lakes with similar surface areas, this owes to the shallow depth of the lake.

POTENTIALS OF THE LAKE CHAD

FISHERY

As at 2001, Nigeria with an estimated population of about 120 million people requires about 2.3 million metric tons of fish and fisheries product for good health at the

recommended 19 kg/caput/year by FAO. Lake Chad fisheries resource of Borno State is a blessing in disguise to the Nigerian economy. It has potential to produce over ***300,000 metric tons*** of fish protein annually, representing about ***12.2% of the total fish demand of Nigerians*** *(FISON, 2001).* In 1990 for example, of the 596,600 (MT) of both fresh water and marine fish produced in Nigeria, Lake Chad alone produced 71,639 (MT) amounting to about 12% of the total national fish produced. In spite of this laudable potential Lake Chad fisheries resources of Borno State declined in the past two decades due, largely, to lack of/or inadequate attention by the government, private and commercial organization. Moreover, lack of social economics and infra-structural facilities for rational exploitations and management of its resources also contributed. Nigeria can derive a substantial proportion of its fish demand from Lake Chad fisheries of Borno State alone just with the adoption of some proffered strategies including combined efforts of the private and public sectors in the rational management of fishery resource of Lake. The shrinkage of the lake may turn to give and entirely different complexion to this potential. The table below provides details of Nigeria's fresh water fish produced in the inland states from 1985-1994

TABLE 1: INLAND STATES FISH PRODUCTION IN RELATION TO LAKE CHAD CONTRIBUTION

YEAR	INLAND STATES TOTAL PRODUCTION (MT)	LAKE CHAD CONRIBUTION (MT)	ANNUAL % CONTRIBUTION (MT)
1985	60,510	22,878	38
1986	106,967	31,352	29
1987	103,232	34,141	33
1988	112,443	53,070	47
1989	132,168	68,424	**52**
1990	113,075	71,639	**63**
1991	123,075	71,832	**58**
1992	99,536	46,398	47
1993	94,900	47,266	**50**
1994	110,484	34,657	31
TOTAL	**1,056,390**	**481,657**	**46**

SOURCE: Fisheries statistics of Nigeria (FDF) 1994.

CROP PRODUCTION

The region is the largest producer of millet in Nigeria. At the shores of the lake, almost all crops grown in Nigeria are produced. The land is very fertile owing to the fact that deposits of all kinds from across the basin are transported down to it by its tributaries. Roughly, half of the lake is wetland, as the water recesses; it leaves behind large area of land that can be used to grow rice and wheat. Farm yields are very commendable, "a farmer can harvest up to 5,000 bags of rice every year" says Goni Ibrahim Gamboru, an indigene of Ngala Local Government Area of Borno state. Others include sorghum, corn (maize), groundnut and beans. In fact, the region is the largest producer of red pepper in Nigeria and substantial amount of onions, tomatoes, potatoes among others are produced. Crops are mostly grown with no or little fertilizer requirements along the shores. The quality of the food produced in the region always tends to stand out among others. Fadama farming is widely practiced in the region. The region was the producer of wheat to the Maiduguri flour mills when it was very active.

FORESTRY

The exploitation of such forest products as gum arabic, honey, bee wax, and firewood is of considerable importance in the region. Production of these, however, has been adversely affected by the decline of the forested areas, aggravated by the explosive growth of cattle populations and increasing human demand for fire woods as domestic fuels.

CATTLES

The environs of the Lake is one of the largest producers of cattle in the continent. It provides cattle to the four countries surrounding it. Nigeria being a populous nation is the largest consumer of the cattle reared here. Kuri cattle breed is found on the shores and islands of Lake Chad. Its main habitat is in southern Chad and north-eastern Nigeria but the breed is also found in northern Cameroon, in Niger

and, to a limited extent, in the Central African Republic. The Kuri are also known as the Baharie, Bare, Borrie, Boudouma, Dongolé, Koubouri, Buduma or White Lake Chad. The importance of the Kuri lies not only in its unique physical characteristics but also in its meat and milk production potentials. The breed is so acclimatized to the environs of Lake Chad that it is unable to survive elsewhere. This unique African breed is being threatened by extinction. Other varieties found in the region include Zebu (Brahman). Milk is a major component of local diets, and cattle are an important export to the tsetse-infested regions to the south. Poultry, goats, sheep, camels, horses and donkeys are also kept in addition.

***PETROLEUM RESOURCES*:**

Petroleum reserves have been discovered in Chad and Niger. The Nigerian sector of the basin is also undergoing exploration. This may bring industrialization to the region. The question is whether the revenue generated from the petroleum will be used to restore the lake or further degradation and extinct of plants and animals will be witnessed. The exploration has been a controversial issue among climate change activists, agriculturalist and the petroleum industry.

***NATRON*:**

Figure 5: natron; an economic commodity in Lake Chad

Natron also known as hydrated sodium carbonate, found in depressions along the northeastern shore of the lake has long been economically important. Traditionally, it is excavated in blocks and shipped across the lake where it enters Nigerian commerce and the other surrounding countries.

IRRIGATION POTENTIAL AND WATER REQUIREMENTS

Lake Chad basin: Irrigation potential, water requirements and areas under irrigation

Country	Irrigation potential			Gross irrigation water requirement		
	within conventional basin (ha)	**outside conventional basin (ha)**	**within the whole basin (ha)**	**per ha (m^3/ha.year)**	**total (km^3/year)**	**Area under irrigation (ha)**
Nigeria	204000	100000	304000	10000	3.040	82821
Niger	3000	8000	11000	0.215	2000	2000
Algeria	-	0	18000	0.000	0	0
Sudan	-	4000	4000	7500	0.030	500
Centr. Afr. Rep.	-	500000	16500	16500	8.250	135
Chad	142500	135000	277500	15000	4.163	14020
Cameroon	46700	20000	66700	12500	0.834	13820
Total	396200	767000	1163200		16.531	113296

Source: FAO

At present, out of a potential of over 1.1 million hectares in the basin, fewer than 100,000 ha are actually irrigated. However, due to the lowering level of the Lake in recent times, every new irrigation development has to be studied very carefully. Already in 1980 the maximum development was estimated at fewer than 400,000 ha by a UNDP-financed study. The recently prepared master plan for the Conventional Basin proposes to concentrate future developments on small-scale projects.

SHRINKAGE AND ITS EFFECTS

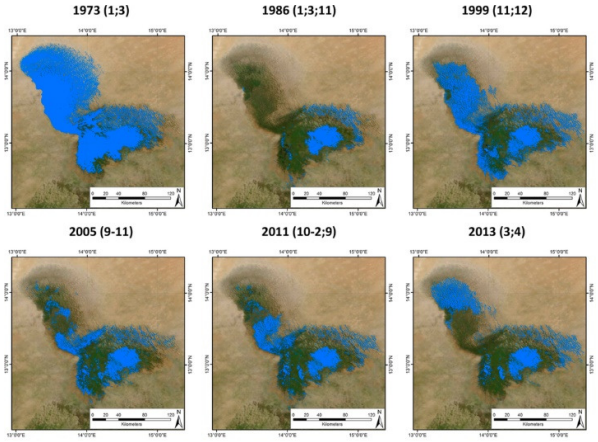

Figure 6: Showing Lake Chad from 1973 to 2013

As over 68,000,000 are dependent on the lake, the effects of its shrinkage cannot be expected to be light. Being the most important resource in a region tagged as one of the world's poorest, already, it depletion has left millions displaced. It does not take much effort for one to notice hunger, starvation and disease in the region. Not only humans are affected, livestock, wildlife and forestry are all under attack. Furthermore, desert encroachment is becoming prevalent in the region. Human population expansion and unsustainable human water extraction from Lake Chad have caused several natural species to be stressed and threatened by declining lake levels. For example, the decline or disappearance of the endangeredpainted hunting dog has been noted in the Lake Chad area. The Lake Chad basin national park may be found to be empty in few decades to come if this trend continues.

There is also a link between the lake and the three aquifers in the basin; the possibility is that, the water from the lake feeds these aquifers to some extent. The wells dug across the basin may be indirectly consuming water from the lake. If this is true, then as the lake gets drier, the level of the water table will also drop. In the long run, cities such as Maiduguri, one of west Africa's fastest growing cities until the coming of the boko haram crisis, N'djamena , Diffa and over hundreds of other towns and villages in the region will be experiencing difficulties in obtaining ground water. As parts of the lake dry up, most farmers and cattle herders have moved towards greener areas, where they compete for land resources with host communities. Others have gone to Kano, Abuja, Lagos and other big cities for menial jobs or to roam the streets as beggars. Some have migrated out of the continent through the Mediterranean sea to Europe. Some were recruited into the boko haram sect. Those who remain in Lake Chad shoreline communities such as Doron Baga are haunted by the speed with which the lake is vanishing. The Doron Baga settlement, which used to be by the lakeside, is now 20 kilometers from its edge. The situation is quite worry some, "when I was a child, the water was at our door step, but now, one has to travel some 30km from here to reach the water" Goni Ibrahim Gamboru added. The impact of the drying lake is causing tensions among communities around Lake Chad. There are repeated conflicts among nationals of different countries over control of the remaining water. Cameroonians and Nigerians in Darak village, for example, constantly fight over the water. Nigerians claim to be the first settlers in the village, while Cameroonians invoke nationalistic sentiments, since the village is within Cameroonian territory. Fishermen also want farmers and herdsmen to cease diverting lake water to their farmlands and livestock.

CAUSES OF ITS SHRINKAGE

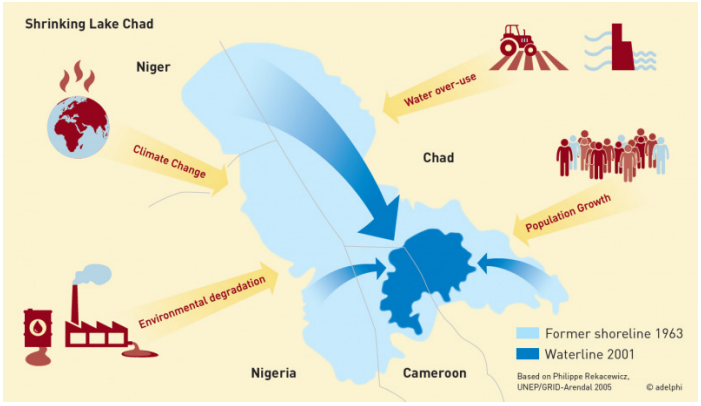

Figure 7: factors responsible for the shrinkage of the Lake Chad.

The factors that lead to the shrinkage of the lake can best be classified as climatic and anthropogenic.

***Climatic factors*:**

Evaporation rate of the lake stands at about 90%. Shifting in rainfall pattern resulting from climate change has made recharge from precipitation very poor over the last 40 years. The Sahara desert is also encroaching at an alarming rate. The Lake Chad drainage basin depends on monsoon rains to replenish its water, and this rainfall has dropped dramatically since the early 1960s. The United Nations Environment Program and the Lake Chad Basin Commission concur that at least half of the lake's decrease is attributable to shifting climate patterns

***Anthropogenic factors*:**

According to the UN, the number one factor that leads the shrinkage of the lake is the unsustainable usage of the lake by both governments and local communities resulting in over use. Recently, however, an additional theory is gaining traction. This states that European air pollution had shifted rainfall patterns farther south, thereby making the region drier and not allowing the lake to replenish. Since the implementation of new regulations in the EU concerning air pollutants, much of this rainfall is now beginning to return, thereby explaining the small improvements observed since 2007. A 2001 study published in the *Journal of Geophysical Research* blamed the lake's retreat largely on overgrazing in the area surrounding the lake, causing desertification and a decline in vegetation. The World Wildlife Fund (WWF), an organization

devoted to wildlife conservation, points to the diversion of water from the Chari River to irrigation projects and dams along the Jama'are and Hadejia Rivers in northeastern Nigeria as the main causes. The UN Environment Programme (UNEP) and the Lake Chad Basin Commission (LCBC) maintain that inefficient damming and irrigation methods on the part of the countries bordering the lake are partly responsible for its shrinkage.

Although, the only protected area is the Lake Chad Game Reserve, which covers half of the area next to the lake that belongs to Nigeria, the regional effect of the lake's shrinkage can also be felt by the reserve. The whole lake has been declared a Ramsar site (*The Ramsar Conventionon Wetlands of International Importance is an international treaty for conservation and sustainable use of wetlands. It is also known as the Convention on Wetlands. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971*)

WAY FORWARD/ RESCUE MISSION- ALL HOPE NOT LOST!

The **Lake Chad replenishment project**, or **Transaqua**, is a proposed major water diversion scheme that would involve damming the Ubangi River at Palambo in Central African Republic and channeling some of the water to Lake Chad through a navigable canal. Since 2003, the LCBC has been trying to get international attention in a bid to rescue the lake. Some $14.5 billion is required according to the LCBC in 2009 to salvage the lake alongside the millions of people in addition to plants and animal potentials in its surroundings.

This water transfer will require diversion of water from the Ubangui river a tributary of the Congo river that lies hundreds of kilometers from the lake to river Chari. A dam will be constructed at Ubangui along side with hydro power generation station from where water will be pumped to a distance of 277km out of the Congo basin to the lake Chad basin. Within the Lake Chad basin, the river flows through a distance of 1,100km down to lake with the aid of gravity.

***PROSPECTS OF THE PROJECT*:**

The project if executed will be quite promising. Stated below are the objectives of the project as stipulated by the LCBC in 2008.

- To generate 700MW of electricity via Palambo Dam in Ubangui
- To increase the navigability of the Ubangui river upstream of Ubangui
- To provide transportation of goods from central Africa to the sea through river Benue linking the landlocked region to international commerce
- Improve the regional economic integration
- Re establish fisheries and agricultural irrigation
- Promote poverty alleviation through drought mitigation and control of desertification

Once the project is completed, there will be enough water to establish a new green belt, if that is done, desert encroachment can be checked. The forest can also serve as a windbreaker thereby intercepting cloud leading to increase in rainfall amount in the region.

CONCLUSION

How imperative is the Lake Chad cannot be over emphasized, especially when the lives of tens of millions of people are concerned. The lake if restored can make the region a hub of economic significance in the whole of the world. As Nigeria tends to diversify its mono dependent economy to agriculture and other sectors, it requires it's on portion of the Lake Chad basin to feed it over growing population targeting about quarter of a billion in few decades to come. But even the Nigerian sector when fully exploited is capable of feeding the whole of West Africa, therefore, the whole of the basin can carter for a bigger population. What's more, the impoverished region can also be alleviated of its poverty in addition to restoring the endangered wildlife and the livestock potentials. However, all of this depends on the actualization of the transaqua project. Major constraint is finance, $14.5 billion is no little money to be generated by the member countries. The AU, EU, UN and other organization in the world have to come to the rescue of this region

As ambitious as it the project may sound, it has not been embarked upon. What African countries and the global world should know is the fact that, there is no much time. A year old baby today may grow to know Lake Chad as a dry area of land once occupied by water on his 20th birthday!

Recommendation:

1. Advocate for the actualization of the transaqua inter-basin water transfer from Congo river basin to the Lake Chad basin as a matter of urgency.
2. Integrate youth as part of the implementation process of the project as the issue affects youth and children the most.
3. Extensive afforestation as a boundary between the sahel and the sahara desert to combat desert encroachment.
4. Cut down greenhouse gas emissions especially in Europe which leads to the shifting of rainfall pattern in the region.
5. Livelihood schemes in a bid to alleviate poverty in the region. This should include turning the resource potentials of the region into finished products, example large deposits of kaolin, hide and skin, mechanized farming, and entrepreneurial skill acquisition programs.

REFERENCES

- *A. Alao (2007). "Natural resources and conflict in Africa: the tragedy of endowment" University Rochester Press. p. 323k. ISBN 1-58046-267-7.*
- Adeniji K.O**.** (1985). "Review of endangered cattle breeds of Africa" Organization of African Unity/Inter-African Bureau for Animal Resources, Nairobi, Kenya. pp. 20-32.
- *B. David (February 2010). "Lake Chad to be fully protected as international wetlands". National Geographic.*
- *Bunu, Mallam Zaji (1999). "Groundwater management perspectives for Borno and Yobe States, Nigeria" (PDF). Journal of Environmental Hydrology. **7** (19).*
- *Chapman, Graham; Baker, Kathleen M. (1992). The changing geography of Africa and the Middle East. Routledge.*
- *CNN (18 June 2007). "Climate change and diminishing desert resources". Retrieved 13 october 2017.*
- *Coe, Michael T.; Foley, Jonathan A. (2001). "Human and natural impacts on the water resources of the Lake Chad basin". Journal of Geophysical Research. **106** (D4): 3349–3356. Bibcode:2001JGR...106.3349C. doi:10.1029/2000JD900587.*
- D. ogogbo (2001) "re-emphasizing the importance of Lake Chad fisheries in Nigerian economy: borno state experience" FISON.
- *Drake, Nick; Bristow, Charlie (2006). "Shorelines in the Sahara: geomorphological evidence for an enhanced monsoon from palaeolake Megachad" (PDF). The Holocene. **16** (6): 901–911. doi:10.1191/0959683606hol981rr.*
- *Europa Publications Limited (2002). Africa South of the Sahara 2003. Rout ledge. p. 266. ISBN 1-85743-131-6*
- http://www.fao.org/docrep/W4347E/w4347e0j.htmRetrieved 11, September, 2017
- http://www.un.org/africarenewal/magazine/april-2012/africa%E2%80%99s-vanishing-lake-chadRetrieved 15, September, 2017
- http://www.un.org/africarenewal/magazine/april-2012/africa's-vanishing-lake-chad Retrieved 14, September, 2017.
- https://www.britannica.com/place/Lake-ChadRetrieved 12, September, 2017
- *Michele L. Thieme (2005). Freshwater eco regions of Africa and Madagascar: a conservation assessment. Island Press. p. 195. ISBN 1-55963-365-4.*
- N.G. Obaje (2009) "*Geology and Mineral Resources of Nigeria*"
  Published by Springer-Verlag Berlin Heidelberg. Pp 69-76

