

THE IMPACT OF MAGA DAM CONSTRUCTION ON THE DOWNSTREAM HYDROLOGICAL SYSTEM, ECONOMY AND SECURITY: A CASE FOR KALA-BALGE AND NGALA LGAs, N. E. BORNO STATE, NIGERIA.

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*Department of Geography, Federal University Kashere, Gombe-State, Nigeria.***ABSTRACT**

The role of water resources in the economic development of a nation cannot be overemphasized. It constitutes the most important necessities to man. This study looks at the consequences/effects of the Maga Dam construction in the Republic of Cameroon on the development of the downstream areas of Kala-Balge and Ngala Local Government Areas of Borno State Nigeria. The negative effects result from drying of one of the richest sources of Nigerian rivers draining into the Lake Chad. It is called River El-beid and locally known as Ebeji which also forms the larger part of the border between Nigeria and Republic of Cameroon (along the two LGAs) for more than 400 km until Lake Chad. To arrive at results showing the magnitude of the effects, a household survey was conducted in the area 0-5 kilometers away from the boundary. A total of 150 households were considered for the interview survey. Field observation and in-depth interviews were also conducted on some stake holders. The results indicate that,

Introduction:

Dams have been promoted as an important means of meeting perceived needs for water and energy and as long-term, strategic investments, which have many additional benefits. They are however, known to have both negative and positive impacts on their immediate and adjoining environment and capable of altering the harmonious interrelationship between the environment and human activities (James in Asiwaju & Adeniyi (eds.) (1989). Some of these additional benefits are typical of all large public infrastructure projects, while others are unique to dams and specific to particular projects. Regional development, job

economic activities such as farming, fishing, livestock, tourism, trade and transport/navigation, boat carving industries as well as problem of border porosity and security of the area and Nigeria at large have been affected, with resultant effect of poverty, forced out migration and social vices. It is recommended that, in order to restore the river to its normal state some of the waters of Surbewel should be channeled by construction of a navigable canal Oto River El-beid which could also be dyked through the assistance of Lake Chad Basin Commission and Chad Basin Development Authority (CBDA).

Keywords: Water resource, Boundary, Dam, Downstream, Poverty, Lake Chad

Creation, and fostering an industry base with export capability are most often cited as additional considerations for building large dams (Kader Asmal, 2000; Coe & Foley, 2001). The growing worldwide environmental awareness has increased attention on the impacts of dams on communities (Canter, 1985).

The Lake Chad Basin is drained by numerous rivers – the Chari-Logone, Komadugu-Gana or Lesser Yobe Ebeji, Ebeji Mbuli, Botha El Beid, the Yedserdam, Ngadolu, Ngadda, Komadugu-Yobe, Taf-taf and Serbewel. Of the above rivers, the river Chari – along with its tributary, the Logone – provides 90 per cent of the inflow to the lake, while the remaining 10 per cent comes from the Komadugu-Yobe river system. Three-quarters of the water entering the lake north of N'Djamena originate from headwaters in the Central African Republic and, to a lesser extent, Cameroon (Bliya, 2018). The Yaeres flood plain of Cameroon, getting its runoff from the Mandara Mountains. Maga Dam was constructed in 1979. It is a dam located south of Lake Chad near the border of Chad and Cameroon. The outcome of the dam diverting vast amounts of water has negatively impacted communities downstream. Maga Dam is the subject of ongoing environmental studies which implicate the diversion of water, which served as natural inflow to downstream regions, as the primary cause of Lake Chad shrinkage. The Dam has had very disruptive effect on the ecology and economy of the Grand Yaeres and the Waza National Park. The Maga Dam has created a permanent downstream hydrological drought.

Thus, any water impoundment has the tendency to create both negative and positive effects on the environment, ranging from the resettlement problems to

perennial flooding, destruction of flora, fauna, loss of farm lands and fish species, displacement from ancestral heritage and exposure to alien diseases. The resources of Ebeji River provide subsistence for the livelihood of millions of people, most of whom are farmers, fishermen and livestock breeders. But today the resources are no more or relatively low as a result of the aforementioned factors. Coe and Foley (2001) contend that the competing demands for fresh water by the four riparian states of Lake Chad, mostly through massive irrigation projects, account for almost 30 percent of the observed decrease in lake area since the early 1960s. Until about 1979, irrigation had a modest impact on the hydrology of the region. But between 1983 and 1994, the amount of water diverted for irrigation quadrupled over water used for the previous 25 years, accounting for 50 percent of the additional decrease in the size of the lake. In addition to the radically reduced lake surface area, the flow of water from the primary river system that feeds it has decreased by almost 75 percent over the past 40 years (Coe & Foley, 2001).

The impact of this depletion is being felt by the Lake Chad basin population who depend on the lake for their livelihood. Particularly worrisome is the rising incidence of conflict between and among fishermen, pastoralists, farmers and sometimes also state security agents, and the tendency of the conflicts to degenerate into large scale intra-ethnic, intra-state and inter-state conflicts (Michel Tchotsoua, Aboubakar Moussa & Jean-Marie Fotsing, 2008)

According to Masari (2006) combination of dams, increased irrigation, [climate change](#), and reduced rainfall are causing water shortages, contributing to [terrorism](#) and the rise of [Boko Haram](#) in the region. Lake Chad continues to shrink. This scenario has affected the socio-economic and livelihood of the riparian population. And even though there are series of studies on the negative impacts of dams, there is still scanty if any, empirical research/study on the socio-economic and livelihood analysis of dams on the environment of Ngala and Kala-Balge LGAs of Borno States, Nigeria. Some of the few studies undertaken include: Michel Tchotsoua, Aboubakar Moussa & Jean-Marie Fotsing (2008)'s work on the Socio-Economic Downstream Impact of Large Dams: A Case Study from an Evaluation of Flooding Risks in the Benue River Basin Downstream of the Lagdo Dam (Cameroon) and the study of evaluation of the impact of Mattani Aza Khel Dam on the crop revenues, agriculture practices and overall socio-economic conditions of the area by Abdul Wajid, Abid Usman, Muhammad Kashif Khan &

Amjad Ali Chaudhry (2013). There is therefore strong need for these types of studies.

Against this backdrop, this paper addresses the following questions. (i) How does the Maga dam affect the hydrological system and resources of the down stream areas? What are the nature and to what extent the socio-economic conditions and other means of livelihood of the farmers in the study area affected? And what are the implications of the diminishing water resources as a result of the dam on the security of life and property in the area under study?

An attempt is hence made in this study to investigate the impact of Maga dam on the agriculture production, security and overall hydrological and socio economic conditions of the area. The study therefore documents (i) The hydrological system of the study area; (ii) the socio-economic and security conditions of the inhabitants; (iii) compare the crop yield, cropping pattern and crop revenues before and after dam construction & (iv) highlight issues on security situation.

Significance of the Study

The diminishing water resources of the lake will compound the problem of water security/scarcity in the region. Water scarcity occurs when the amount of water withdrawn from lakes, rivers or groundwater is so great that water supplies are no longer adequate to satisfy all human or ecosystem requirements, resulting in increased competition between users and demands (UNEP 2002). Interestingly, Nigeria has been fingered as one of the African countries likely to suffer water stress in 2025 (UNEP 2002) and the study area study area is currently seriously confronted with the problem. Hence, a study of the impact of Maga dam is desirable as that would contribute to knowledge and decision making more especially at the time when solutions are being sought for the revitalization of the diminishing Lake Chad.

Water is life as it is commonly referred to. It is one of the 17 goals for the Sustainable Development Goals (SDGs) as a medium of eradicating poverty. The study of water and any other related study is therefore essential.

The Study Area

Ngala and Kala-Balge LGAs are located at extreme North-eastern part of the Borno State, Nigeria (figure 2). They have the land masses of 1,519.82 km² and 1,962.13 km² and populations of 236,498 and 60,834 respectively (Borno State

LGA's Baseline information for planners June, 2017). . With their total land area of 3481.95 km², they form (0.163%) part of the Lake Chad basin's total land area of 2,137.500km². The two LGAs are both bordering Cameroon republic and are in Dikwa Emirate.

The El Beid River is a true floodplain river, locally known as the Ebeji, forms a long part of the border between Nigeria and the Republic of Cameroon for more than 400 Kilometers (250 mi) until Lake Chad. The river has a catchment area of approximately 22,640 square kilometers (8,740 sq mi) in length. This stream flows during the rainy season followed by a flood after the rainy season from October to December. Peak discharge occurs in November or December, when the Yaeres floodplain filled up (Michel Tchotsoua, Aboubakar Moussa, Jean-Marie Fotsing, 2008).

The El-Beid is by far the water richest Nigerian river drains into Lake Chad (Connah, 1981). The river has been traditional sources of freshwater for domestic consumption and agricultural production throughout the centuries, the river has three main sources of water: direct runoff from the Mandara Mountains, flood overspill from the Logone River into Yaeres and relatively small overspills from the Serbewel River.

The Serbewel emanates from the Chari delta proper begins immediately downstream of Ndjamena, 140 Km from the Lake Chad, where the river branches off from the left bank and follows its own course to the Lake Chad. The annual runoff of Serbewel River varies from 1.3 to 3.9 x 10⁹ m³ (Coe & Foley, 2001).

Maga Dam is a dam located south of Lake Chad near the border of Chad and Cameroon. It was constructed in 1979. In 1994 a pilot program was started to drain some water back into the floodplain. The outcome of the dam diverting vast amounts of water has negatively impacted communities downstream.

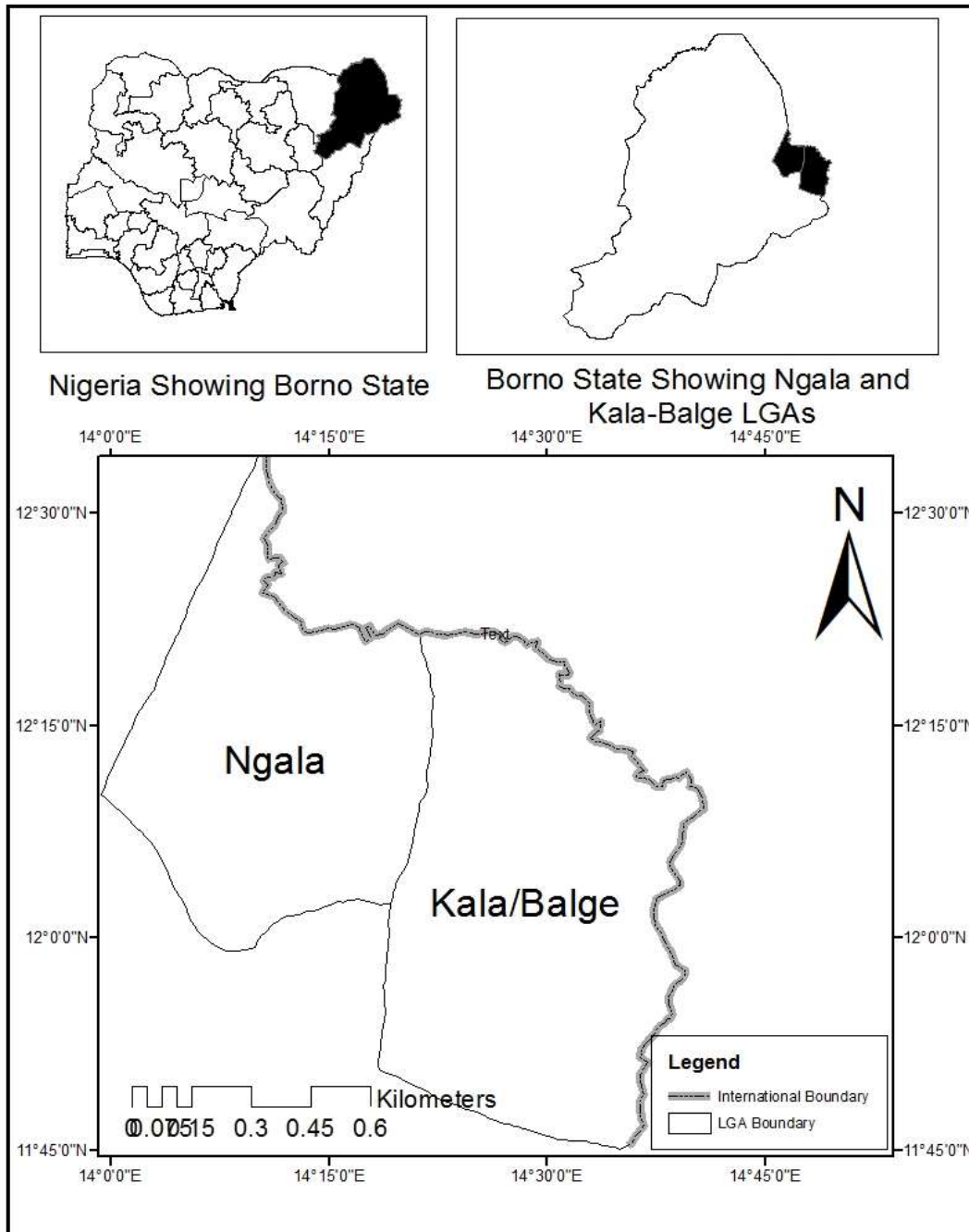
The lake which is located in the semi-arid region of the Sahara Desert is a vital source of fresh water and other resources for human, livestock and wildlife communities. The main economic livelihood in the basin includes fishing, agriculture and pastoralism. Fishing is one major occupation around the lake and all four riparian countries heavily depend on supplies from the lake. It is believed that over 150,000 fishermen live on the lake shores and its islands. At the peak of its production in the 1960s, the Lake Chad fisheries are said to have included fish of close to 80 species with an estimated annual fish catch of 130,000 to 141,000 tons up to the early 1970s. Recent estimates of annual fish production are said to be close to that of 1977, hovering within the range of 60,000 to 70,000 tonnes

(Living Waters, 2003). However, as a result of environmental changes since the 1970s, including fluctuations in the level of the lake, there have been considerable changes in the fish fauna. These include high mortality, the disappearance of some open-water species, and the appearance of species adapted to swamp conditions in areas where they were previously unknown. The Lake Chad Basin which is shared by Algeria, Cameroon, the Central African Republic, Chad, Libya, Niger, Nigeria and Sudan is a large entity representing about 8% of the total size of the African continent, with a population estimated at 40 million inhabitants according to statistics of 2010. It is an essential water resource for fishermen, livestock farmers and farmers of the riparian countries most of them among the poorest in the world.



Source: Adapted from
 <http://encarta.msn.com/map_701513908/lake_chad.html>

Figure 1: Map showing the Shorelines of Lake Chad and the Riparian States



Source: GIS Lab, Gombe State University

Figure 2: Map of the Affected LGAs (Ngala and Kala-Balge) of Borno State, Nigeria.

Materials and Methods

Primary data regarding household characteristics and farm related data were collected in the two LGAs through pre-tested interview schedule while secondary data was collected from printed documents such as, progress reports, journal publications, development statistics etc.

The study designed a close-ended pre-coded instrument to conduct a survey of the dam affected communities located in the study area. One hundred and Fifty (150) questionnaires were administered in the villages in the riparian communities. These settlements include Sigal, Amsaburu, Abbari, Wumbi, Jukana and Wulgo.

Results and Discussion

Survey Results

The results of the questionnaire showed that 47% of the respondents are between the ages of 25 to 35 years. However, all the respondents are generally older than 25 years. In terms of nature of occupation, 73% of the respondents are farmers and 27% are fishermen, 10% of which take part in both business and farming, while 42% combine business and farming while 27% were civil servants. This pattern of distribution also shows that some civil servants engage in some other occupational types. In addition, inhabitants do combine as much as 3 occupational types in some instances. For example, teaching, farming, trading or fishing. All the respondents are Muslims. In terms of the level of education most of the respondents are relatively not educated. For example, 10% each have primary school education. 5% each have tertiary and secondary school education, while 70% have no form of education. On the level of income, some of the respondents did not declare their income, possibly of the danger of taxation. However the report shows that the income of these respondents is relatively low, with about 10% of the respondents earning less than the national minimum wage of 7,500. In most households (40%) family sizes are greater than 15 people. However, in 10% of the households, the family sizes are low.

Implications of Maga Dam on the Hydrological system of Ngala and Kala-Balge LGAs

Hydrologically,

The impact of climatic variability, particularly the significant decrease in rainfall in the basin since the 1960s, has adversely affected the lake. There has been a decrease in the number of large rainfall events and in river inflows into the lake.

Over the last 40 years, the discharge from the Chari/Logone river system at the city of N'Djamena in Chad has decreased by almost 75 per cent, drastically reducing the inflow into the lake. Coupled with this reduced rainfall is the problem of intermittent droughts. According Bdiya (2018), the region has experienced a series of back-to-back droughts in the 1970s and the 1980s which left serious adverse effects on the lake such as decreased flows in the major rivers that feed into the lake; falling of groundwater tables; disappearance of specific plant species and reduction of canopy cover; loss of wildlife populations; and increased soil erosion and/or loss of fertility.

Implications of Maga Dam on the socio-Economic Resources of Ngala and Kala-Balge LGAs

The Maga dam was constructed in 1979 and in 1994 a pilot program was started to drain some water back into the [floodplain](#). The outcome of the dam diverting vast amounts of water has negatively impacted communities downstream. Maga Dam is the subject of ongoing environmental studies which implicate the diversion of water, which served as natural inflow to downstream regions, as the primary cause of Lake Chad shrinkage (Michel Tchotsoua, Aboubakar Moussa, Jean-Marie Fotsing (2008).

The Maga Dam has created a permanent downstream hydrological drought. In addition, the free fertilization of the Yaeres by overflow and transported silt/minerals has stopped. It has blocked runoff onto the Yaeres causing a permanent artificial drought. This has resulted in degradation of pasture land. The grasslands are not so much over-grazed as under-nourished and under-irrigated because of the dam project. Herders must switch to de-branching trees for forage when confronted by poor grass production. The major water resources concern here is the Maga Dam, constructed primarily to support large scale rice production, which is now moribund. The Dam has had very disruptive effect on the ecology and economy of the Grand Yaeres and the Waza National Park (James, 1989). The resultant effect led to importation of rice from Cameroun by Nigerians (Bdiya, 2018).

It was understood that, the initial design of the Maga Dam has no provision for by-pass or overflow structure to allow downstream flooding for pasture, irrigation, forest growth, wildlife support, and fisheries. The lack of this design has adverse effect on the economics and conservation of the downstream.

The resources of Ebeji River provide subsistence for the diverse livelihoods (farming, herding, fishing, and harvesting of wild flora and fauna like wood, game, crops such as hungry rice (acha), rice, guinea corn, okro etc) It was described by Bdliya (2018) as Common Pool Resource (CPR) of millions of people, most of whom are farmers, fishermen and livestock breeders. But today the resources are no more as a result of the aforementioned factors. Food security in the area is therefore at danger.

For about four decades today recurring droughts, general decline in rainfalls, and degradation of the vegetation cover have led to drastic changes in the environmental conditions of the communities along the river. The drying up of the river, the encroachment of the desert, and the decline of agriculture, livestock and fisheries, threatens the social and economic well-being of the millions of people living along the shorelines.

This has also led to Trans-boundary environmental problem especially when the river that serves as the common resource for Cameroon and Nigeria republics has dried up.

Experience has shown that the shared resources across the national boundaries often constitute a major source of conflict among the users, as is the case in the Nile Basin and the Bakassi Peninsular between Nigeria and Cameroon.

The increasing aridity across the region and Yaeres has resulted in herders moving to the Lake Chad floor in the dry season for pasture and water. Emigration from these areas to Lake Chad has brought about interaction of people of different nationalities resulting from scramble over diminishing fishing grounds and emerging farmlands are commonplace. The Nigerian-Chad war of 1983 and the dispute over territory in the Lake area between Nigeria and Chad and between Nigeria and Cameroon are all fallouts from the dying up of the Lake (Bdliya, 2018). The dispute between Nigeria and Cameroon that led to the intervention of the International Court of Justice (ICJ) in 2002 is another case in point. The International Court of Justice (ICJ) ruling on the boundary dispute between Nigeria and Cameroon led to the ceding of 33 villages to Cameroon in the Lake Chad region.

On that note, if nothing is urgently done the river will simply disappear and there will not be any boundary between Nigeria and Cameroon in both Kala-Balge and Ngala Local Government Areas of Borno State.

Implications of Maga Dam on the Security of Life and property Ngala and Kala-Balge LGAs

Even though one of the characteristics of African rivers is its seasonality in nature, River Elbeid used to be almost all Season River. It served as the border and therefore used to hinder smuggling activities and illegal crossing. However, with the establishment of Maga Dam, illegal crossing of the border even with small arms and ammunitions is being done at any point in time and all over the boundary line from Tilde and Sigal in Kala-Balge to Wulgo in Ngala LGA. The border guards can not just control the border line effectively.

To restore the River Ebeji/Elbeid to its normal state the following recommendations are hereby proposed:

Recommendations

Channeling of some of the waters of Surbewel River by constructing a navigable canal to river Elbeid (one of the sources of water for Lake Chad) from Morokko to Tilde and also the dyking and the dredging of the Elbeid River channel from Tilde down to Wulgo in Ngala Local government and Terminating at Lake Chad. This when fully accomplished will prevent flooding in the whole region resulting in lost of lives and property. It would also combat desertification, land degradation and other ecological problems.

Educating and sanitizing the local communities to protect both the shoreline of the river and the adjacent areas as well as to create alternative means of generating energy to prevent wanton cutting of fire-wood by local inhabitants; an action that has greatly contributed to the desertification process.

There should be integration of the local communities in the decision making so that they would have a sense of belonging and commitment.

The installation of an alert system providing radio broadcasts in the local languages at the area FM and the Radio station's reception be increased.

The strengthening of the LCBC through greater political cooperation among riparian states, timely payment of annual subscription by member states, and vigorous implementation of capacity-building programmes for staff of the LCBC to enhance its effectiveness is another way of preventing the looming danger.

CONCLUSION

After construction of Maga dam, the crop production in the study area has significantly decreased leading to the mass movement of the border population

towards the Lake Chad, Lake Doi in Cameroun and South Western Nigeria such as Lagos-Ibadan axis. It also led to the problems of food, life and property insecurity which finally culminated into Boko Haram insurgency.

It is however my conviction that, given clear commitments to solutions, the challenges facing the river would be overcome and water for all uses would be available to eradicate poverty, provide food security and achieve sustainable development in the region if the waters of Surbewel is channeled.

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