



IMPLICATIONS OF LANDUSE AND LANDCOVER CHANGES ON THE SOCIO-ECONOMIC ACTIVITIES IN THE NIGERIAN PORTION OF THE LAKE CHAD

Usman H. M.¹ⁱ, Ikusemoran M.², Elizabeth E.³, Joel M.B.²

¹Federal College of Freshwater Fisheries Technology Baga, P.M.B 1060
Maiduguri Borno State, Nigeria

²University of Maiduguri, Geography Department,
Maiduguri Borno State, Nigeria

³C/o Joshua Philibus, 223, Light Tank Batalion, Zuru,
Kebbi State, Nigeria

Abstract:

The study examines how changes in the landuse and landcover of the Nigerian portion of the Lake Chad affect socio-economic activities of the inhabitants of Lake Chad that is, the fishermen, farmers, cattle headers and water transporters. Abadam and Kukawa Local Government areas were sampled from all the other LGAs that share their boundaries with the lake for this study. The seasonal behavior of the Lake Chad results into seasonal changes in the lake's landuse and landcover. Structured questionnaire was administered to 270 respondents in the two LGAs. An oral interview was also conducted to generate more information to compliment those in the questionnaire. The results of the study show that the changes in the behavior of the Lake Chad control the socio-economic activities of those that rely on the Lake Chad for their survival. These changes bring about migration and switching of occupation by those who rely on the lake. The study concludes and recommends that, the current effort to recharge the lake by LCBC through River Oubangui in Central Africa should be sustained so that the lake can recover to its former size and landcover. Recharging the Lake Chad will boost fishing and agricultural activities on a commercial scale.

Keywords: landuse, landcover, change, socio-economic activities, Chad Lake

JEL: A10, I30, O13, O18, O41

ⁱ Correspondence: email bizzyhum2000@yahoo.com

Introduction

Land has different meanings to different people depending on the way they perceive it. Some look at it as an area of a ground or a structure that is not covered by water. Land is the major area where man takes refuge and sustains a living. Land is the most basic of all economic resources, fundamental to the form that economic development takes (Frank and Kirily, 2004). Land holds a central position in human existence and development (Briassoulis, 2000).

Landcover is the way a particular land area appears be it natural or transformed by man. Landcover can be defined as the biophysical state of the earth's surface and immediate subsurface (Turner *et al.*, 1995). Landcover represents other aspects of the physical environment (soil, biodiversity, surface and ground water). Landcover also represents all the structures installed by man to survive. While landuse, is the manifestation of human manipulations on the land to derive his optimum heart desire on the surface of the earth. It can be defined as human intended employment of, and management strategy placed on landcover by humans to exploit the landcover (Zubair, 2006; Charysoulakis *et al.*, 2004). This exploitation include conversion of land areas to residential or industrial areas, roads etc. While others includes conversion of forest area to farmland, grazing reserve, parks etc.

Landuse can be changed from farmland to grazing land, from forest to farmland, from forest to residential (Briassoulis, 2000). Landcover can change from one landcover to another based on physical factors. These physical factors include seasons, climatic variations, volcanic eruptions, earth quake, changes in river channels or sea levels etc (Tuner *et al.*, 1995). And these can be cyclical, for example wet and dry seasons which bring change in landcover (Tuner *et al.*, 1995). This change is termed landuse and landcover change. Landuse and landcover change refers to the changes in the aerial extent of a given type of landuse or landcover respectively (Briassoulis, 2000).

Impacts of climate change and anthropogenic activities have affected the entire Lake Chad environment. This results into the emergence of different landcovers. Man makes use of this landcovers for various socio-economic activities that are referred to as landuse: such land uses includes grazing, land cultivation, and settlements. These landuses and landcovers keep on changing due to the changing behavior of the lake.

In view of that, this paper identify the types of socio-economic activities that is related to the lake and examined the implications of these changes in landuse and landcover on those that directly rely on the Lake Chad for their socio-economic activities.

Study Area

Lake Chad is bounded in the north by Chad Republic, in the east by Cameroun Republic, south by Nigeria and in the north-west by Niger Republic. The Lake Chad portion of Abadam and Kukawa Local Government is situated within Latitude $12^{\circ}42'$ and $13^{\circ}45'N$ and Longitude $13^{\circ}05'$ and $13^{\circ}46'E$. The Chari River, fed by its tributary, the Logone provides over 90% of the Lake Chad's water with a small amount coming from Yobe River Nigeria/Niger. In Nigeria, only Borno state has boundary with Lake Chad, with Abadam and Kukawa having the largest area among the LGAs that shares boundary with the lake. According to LCBC (2005), there was a considerable shift in the rainfall pattern the Lake Chad region as a whole in the past 35 years which resulted into a reduction of the rainfall southward. Temperature around the Lake Chad region is high and humidity is low with the exception of rainy season between the months of June to august (LCBC 2005). The vegetation of Lake Chad region according to Sarch (2000) cited in Ayuba and Dami (2011) is made up of woodland species, however northward the woodland gradually reduces to few trees and shrubs. The 2006 population census shows that the population of Abadam and Kukawa local Government is 100, 065 and 203,343 persons respectively. But the presence of the Lake Chad supports an estimated 18 million person, units of livestock (cattle, goats and sheep, camel and donkeys). There are many ethnic groups, each exploiting the natural environment by a range of activities which serve as their source of livelihood. The major language spoken is Hausa, Kanuri, and Fulani and the major occupations the study area are farming, fishing and animal rearing.

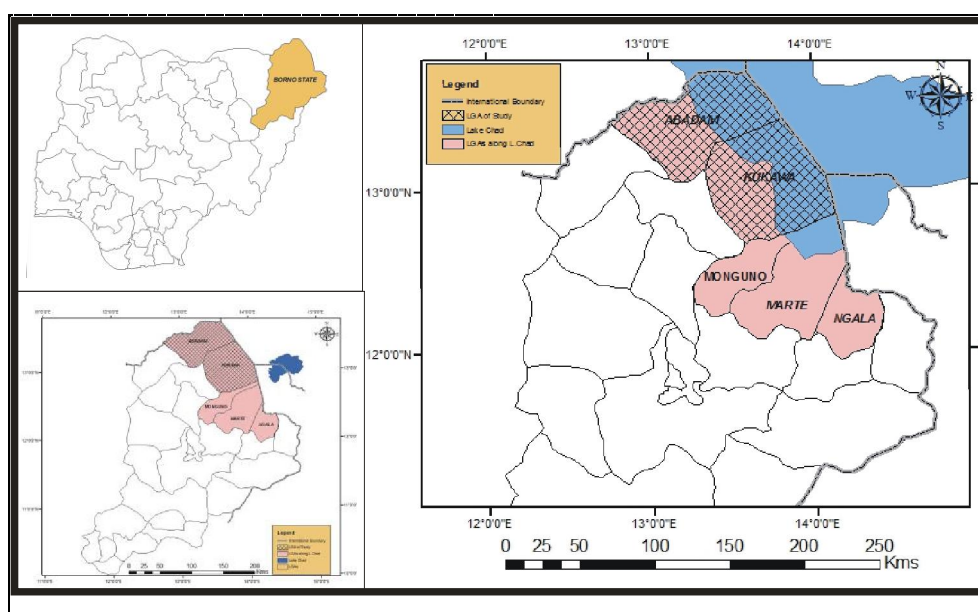


Figure 1: The Study Area

Source: Digitized from Dada *et al* (2007)

Materials and Methods

Two local Governments were purposively selected among the Local Governments that share boundary with the Lake Chad; they are Abadam and Kukawa Local Government Areas. These two Local Governments were selected because they cover major portion of the Lake Chad. Three settlements (Mallam Fatori, Tumbun Dan Katsina and Fay Dondiya from Abadam while Baga, Fish Dam and Daban Masara from Kukawa) were also purposively selected from the two LGAs. These selected villages were not only located close to the Lake Chad but were also accessible and save from the insurgents when the study was carried out. Structured questionnaire was administered to two hundred and seventy respondents. The respondents include farmers, fishermen, cattle herders and water transporters as shown in table 1.

Systematic random sampling technique was employed in the selection of the respondents. The structured questionnaires seek information on the implications of the landuse and landcover changes on socio-economic activities of those who rely on the lake as their source of livelihood. Oral interview was also conducted in order to generate more information to compliment those in the questionnaire. Data on the implications of landuse and landcover change on socio-economic activities were analyzed using descriptive statistics. The output information was displayed in tables.

Table 1: Summary of sample areas, respondents and the questionnaires administered

LGAs	Settlements	Sample respondents and questionnaires administered				Total
		Farmers	Cattle herders	Fishermen	Fishermen	
Abadam	Mallam fatori	10	7	7	7	31
	Tumbun Dan Katsina	10	7	7	7	31
	Fay dondiya	10	7	7	7	31
Kukawa	Baga	20	13	13	13	59
	Fish Dam	20	13	13	13	59
	Daban masara	20	13	13	13	59
Total	6	90	60	60	60	270

Result and Discussion

Types of socio-economic activities related to the Lake Chad

The study reveals that numerous socio-economic activities were carried out in the Lake Chad area. The socio-economic activities that are related to the lake directly were classified into two:

A. Agriculture

The major socio-economic activity round the Nigerian Lake Chad is agriculture. The agricultural activities that are practiced in the study area include: land cultivation, fisheries and pastoral farming.

a. Land Cultivation: Land cultivation in the Nigerian Lake Chad is divided into recessional farming, rain-fed and irrigation farming. Majority of the respondents are into multiple farming that is either into recessional and rain-fed, recessional and irrigation or rain-fed and irrigation. As shown in table 2 about 49% of the respondents are into both recessional and rain-fed, 14.44% are into both recessional and irrigation farming, while 4.44% are into both rain-fed and irrigation.

i. Recessional Farming: The study reveals that majority of the people that are into land cultivation practice recessional farming as shown in 2. This is a type of farming where farmers target the receding lake to plant their crops. These crops will thrive with the moisture that is available in the soil. The period of planting using recessional farming is December and January, 66% of these farmers (Table 3) cultivates in December, while 44% in January the subsequent year. The crops that are cultivated include water melon (*Citrilus Lanatus*), beans (*Vigna unguiculata*), maize (*Zea mays*) groundnut (*Arachis hypogaea*), sweet potatoes (*Ipomoea batata*), okra (*Abelmoschus esculentus*) etc. Crops are harvested in March and April as stated by the farmers.

ii. Rain-fed Farming: The second major farming system practiced in the study area is rain-fed faming as shown in table 2. Farmers in this study area start planting in the month of July (Table 4) and harvest in the months of October. Crops cultivated during rainy season include beans (*Vigna unguiculata*), groundnut (*Arachis hypogaea*), okra (*Abelmoschus esculentus*), millet (*Panicum spp.*) etc.

Table 2: Types of land cultivation farming in the study area

Type of farming	Frequency	Percentage
a Rain-fed	7	7.78
b recessional	5	5.55
c Irrigation	17	18.89
a & b	44	48.89
a & c	4	4.44
b & c	13	14.44
Total	90	100

Source: Field survey 2014

Table 3: Months of planting in recessional farming

Month	Frequency	Percentage
January	41	66
December	21	34
Total	62	100

Source: Field survey 2014

Table 4: Months of planting in rain-fed farming

Months	Frequency	Percentage
June	4	7.27
July	45	81.82
August	6	10.91
Total	55	100

Source: Field survey 2014

iii. Irrigation Farming: Irrigation is the least farming system practiced in the study area. Irrigation on the Nigerian Lake Chad is done in dry season that is from the month of September. Majority 44.14% (Table 5) starts cultivating in the month of September. Farmers rely either on the water siphoned directly from the lake, wells or washed bore holes. Crops cultivated include water melon (*Citrilus Lanatus*), beans (*Vigna unguiculata*), maize (*Zea mays*), sweet potatoes (*Ipomoea batata*), okra (*Abelmoschus esculentus*), pepper (*Capsicum spp.*), tomatoes (*Solanum Lycopersicum*), onion (*Allium spp.*) etc.

Table 5: Months of planting in irrigation farming

Months	Frequency	Percentage
September	15	44.12
October	10	21.41
November	5	14.70
December	4	11.76
Total	34	100

Source: Field survey 2014

b. Pastoral Farming: Pastoral farming is another type of farming practiced in the entire Nigerian Lake Chad. The lake provides water and grazing land for the pastoralist. They move closer to the lake in dry season for water and grass, and then move away in the rainy season. The animals that the nomads are rearing include Cattles, Sheep, Goats and Camels.

c. Fishing Activities

Fishing activities is among the major occupations that people are engaged in the Nigerian Lake Chad. About 80% (Table 6) of the respondents that are into fishing believe that fish is more available during heat time that is March-June. About 9% of the respondents are of the opinion that fish is available throughout the year. This implies that there is fish throughout the year in the Nigerian portion of the Lake Chad but the abundance differs with time.

Table 6: Peak period of fish abundance in the study area

Months	Frequency	Percentage
March-June	48	80
October-January	3	5
All of the above	9	15
Total	60	100

Source: Field survey 2014

B. Transportation Services

Transportation by water is another socio-economic activity that respondents are engaged in using boats of different types and sizes. This occupation is common when the lake water level is high from the month of October. This is logical because when the water level in the lake is high, transportation of people, goods and services is much easier and cheaper using boats. Majority, 48% (Table 7) of the respondents that are transporters abandon the business into farming when the lake recedes. Others (22%) migrate to the area where water is still available especially on the Chad and Cameroun portion of the Lake Chad to continue with their transportation business.

Table 7: Transporters occupation when the lake recedes

Occupation	Frequency	Percentage
Transportation(migrate)	13	21.7
Farming	29	48.3
Trading	8	13.3
Raising animals	3	5
Others specify	7	11.7
Total	60	100

Source: Field survey 2014

Implications of Landuse and Landcover Change on Socio-economic Activities

Effects of Landcover Change on Land Cultivation

The lake changes periodically, farmers are directly affected in one way or the other especially those that are into recessional farming. According to those that are into recessional farming, there are some periods that the lake water does not recede from farmlands, which forces the farmers to migrate to other areas in search of farmlands to cultivate. The implication of landuse and landcover changes is either positive or negative, depending on the trend. The negative are loss of land used for economic purposes and the positive aspect are periodic gains obtained from addition of farmlands, and soil fertility due to alluvial deposits by floods.

Effects of Landcover Change on Fishing Activities

Fishing in the Nigerian portion of Lake Chad is done throughout the year, but with fluctuation in its abundance as a result of the change in the Lake. The season the lake recedes makes fish catch to be less. Fishermen are left with the decision either to move further or switch to other occupations. Some of the respondents 52% (Table 8) migrate to as far as Chad and Cameroun waters to continue fishing, while 48% switch to other occupations. By implication, the seasonal change in landcover in the Nigerian Lake Chad brings about abundance of fish when the lake is high, while when it recedes fishermen are forced migrate to Chad and Cameroon Lake Chad. This often results into physical assaults by the Chadian and Cameroonian gendarmes (Onuoha 2008). While those that switch to other occupations had to adjust with the challenging occupation.

Table 8: Occupation of the fishermen when the lake recedes

Occupation	Frequency	Percentage
Fishing (migrating)	31	51.67
Farming	19	31.67
Animal rearing	5	8.33
others specify	5	8.33
Total	60	100

Source: Field survey 2014

Effects of Landcover Change on Pastoral Farmers

Pastoralists are known with movement in search of water and feeds for their livestock. When they are within the lake, they move lesser distance because of the presence of both water and pasture. But when the landcover changes (increase in lake water) they are forced out of the entire area, making them move longer distance. It is this migration that brings about clash between the pastoralists with farmers. By implication, the landuse and landcover change in the study area affects pastoralists. According to Ayuba and Dami, (2011), the Fulani pastoralists encroach on farmlands due to shortage of fodder on the range land. This encroachment sometimes leads to bloody conflict between farmers and pastoralist. Though the pastoralists stated that migrating does not lead to conflict, but few conflicts occur along the migration route when cattle stray into farmlands and destroy crops.

Effects of Landcover Change on Transportation Services

The study reveals that, transportation services in the Nigerian portion of Lake Chad, is controlled by the landcover change in the behavior of the Lake Chad. The month of October (Table 9) marks the beginning of water transportation, when the lake's water is high. While the month of March and April marks the beginning of transportation abandonment. By implication, there are some months within the study area that transportation via water is not viable. Transporters had to think of another source of livelihood leading to switch in occupation. And those that are not ready to switch had to migrate to Chad and Cameroun Lake Chad to continue their transportation activities.

Table 9: Months of transportation business on the lake

Months	Frequency	Percentage
September-March	2	3.33
October-March	49	81.67
November-March	9	15
Total	60	100

Source: Field survey 2014

Conclusion

The finding in this study show that landuse and landcover change affects the socio-economic activities of those that rely on the Lake Chad. The effect of the change in the behavior of the Lake Chad affects these people that rely on the lake both positively and negatively. Result from the study revealed that farmers, fishermen, transporters as well as cattle herders take advantage of the lake's changes to earn a living. Farmers take advantage of the receding lake to plant their crops on the flood plain. Cattle herders have a routine pattern of migration which corresponds with the seasonal changes of the lake. Fishermen follow the behavior of the lake in order to fish in the lake; likewise, transportation becomes viable when the lake is at its peak. When the changes in the lake's behavior is not favorable to these set of people (Fishermen, Farmers, cattle herders and transporters), some switch to other jobs or migrate to another place to continue with their type of job. It is evident that, despite the fact the lake has shrunk to a meager size, the size is not stable and this instability had control over the socio-economic activities on those that directly rely on the lake for their source of livelihood.

Recommendations

The current effort to recharge the lake by LCBC through River Oubangui in Central Africa should be sustained so that the lake can recover to its former size and landcover.

Recharging the Lake Chad will boost fishing and agricultural activities on a commercial scale. Landuse and landcover change in the Lake Chad, usually affects those depending on the lake, to the extent that some had to migrate to the Chad or Cameroon Lake Chad, especially fishermen. These people should be encouraged to go into aquaculture; this will stop them from migrating to other countries to catch fish.

Reference

1. Ayuba, H. K and Dami, A. (2011): Environmental science: *An introductory text*. Book Wright Pub. Nigeria.
2. Briassoulis, H. (2000): Analysis of Landuse Changes: The theoretically and Modeling-Approaches. Regional Research Institute. www.briassoulis.edu.com
Retrieved on 08-07-2012
3. Chrysoulakis, N., Kamarianakis, Y., Fasari, Y. Diamandakis, M. and Prastacos, (2004): Combining Satellite and Socioeconomic data for Landuse Models Estimation. In Goossens, R. (Edt.), Proc. Of 3rd Workshop of EARsel Special interest Group on Remote Sensing for Developing Countries (in press).
4. Dada, O.A., Jibrin, J.M. and Ejeoma, A. (2010): Secondary Atlas. Macmillan Nigeria.
5. Frank, S. and Kirily, J. (2004): The Political Economy of Land: Putting George Henry in His Place. *The Journal of Australian Economy*.
6. Lake Chad Basin Commission (2005): An Information System for Water Assessment and Lake Management of the Lake Chad Basin. A sub-regional component of The World Hydrological Cycle Observing System (WHYCOS). A Draft Project Proposal. Dec. 2005.
7. Onuoha, F. C. (2008): Environmental degradation, livelihood and conflict: A focus on the implications of the diminishing water resources of Lake Chad for North-eastern Nigeria. *African journal on conflict resolution*. Vol.8, No 2, 2008.
8. Sarch, M. T. (2000): Institutional Evolution of Lake Chad: traditional administration and Flexible Fisheries management. Pp. 133-164 In: Ayuba, H.K

- and Dami, A. (2011): *Environmental Science: An Introductory Text*. Book Wright Pub. Nigeria.
9. Tuner, B. L., Skole, D., Sanderson S., Fischer, G., Fresco, L. and Leemans R. (1995): Landuse and Landcover change; Science/Research Plan, IGBP Report No35, HDP Report No. 7 IGBP and HDP, Stockholm and Geneva.
10. Zubair, A. O., (2006): Change Detection in Landuse and Landcover Using Remote Sensing Data and GIS (A case study of Ilorin and Its Environs in Kware State). M.Sc. Thesis, University of Ibadan, Nigeria.

Creative Commons licensing terms

Authors will retain copyright to their published articles agreeing that a Creative Commons Attribution 4.0 International License (CC BY 4.0) terms will be applied to their work. Under the terms of this license, no permission is required from the author(s) or publisher for members of the community to copy, distribute, transmit or adapt the article content, providing a proper, prominent and unambiguous attribution to the authors in a manner that makes clear that the materials are being reused under permission of a Creative Commons License. Views, opinions and conclusions expressed in this research article are views, opinions and conclusions of the author(s). Open Access Publishing Group and European Journal of Economic and Financial Research shall not be responsible or answerable for any loss, damage or liability caused in relation to/arising out of conflict of interests, copyright violations and inappropriate or inaccurate use of any kind content related or integrated on the research work. All the published works are meeting the Open Access Publishing requirements and can be freely accessed, shared, modified, distributed and used in educational, commercial and non-commercial purposes under a [Creative Commons Attribution 4.0 International License \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/).