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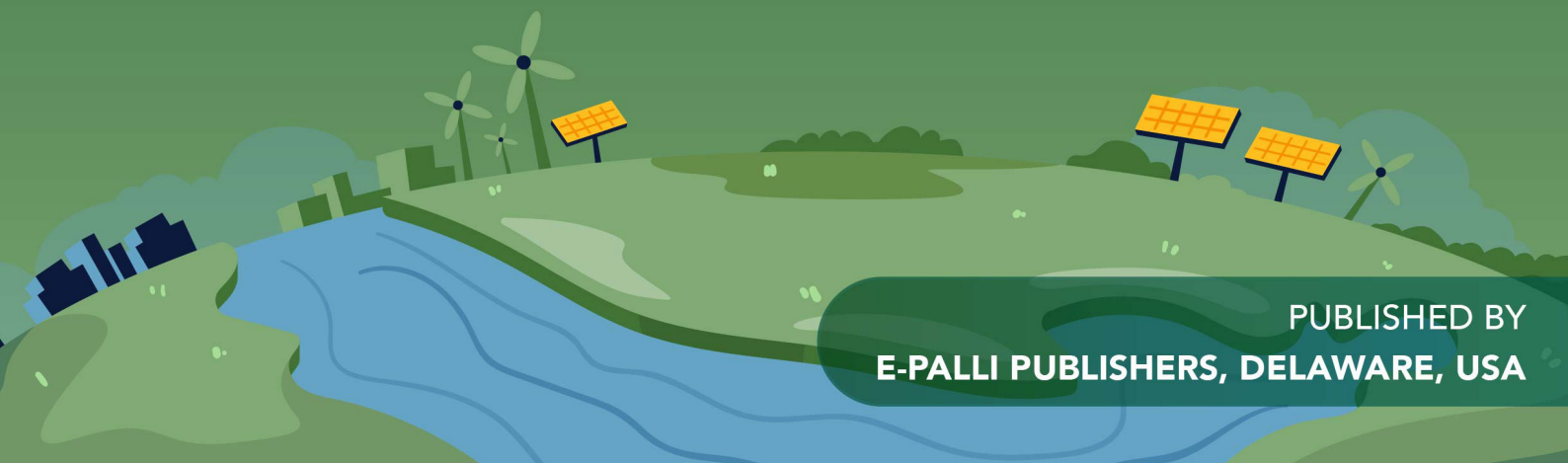

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Deterioration of Plant Resources in Contact with Nigerian Refugees, Returnees and Internal Displaced Chadians in Kaya, Lake Region, Western Chad

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ABSTRACT

Chad in general and Kaya in particular, hosts a large number of refugees, returnees and internally displaced persons. Wars, inter-community conflicts and the nebulous Boko Haram sect are the causes of massive displacement of populations from neighboring countries to Chad and Kaya. The arrival of Nigerian and Nigerian refugees, returnees and internally displaced Chadians has increased the population and the need for energy, especially firewood and charcoal. Moreover, to meet their food and financial needs, these migrants are forced to destroy the plant resources of the region and of Kaya in order to survive. This is damaging the natural environment and the economy of the Lac and Kaya region. Thus, 25 refugees, returnees and displaced persons were studied and empirical data collected in order to determine their responsibility in the degradation of vegetation in Kaya. Then, 3 people in charge of the environment in Bagassola were interviewed to gather their opinions on the role played by refugees, returnees and IDPs in Kaya in the environmental degradation in this area. Five interviews were held with NGOs in Bagassola to find out the underlying reasons that lead refugees, returnees and IDPs to destroy nature.

INTRODUCTION

The Chadian Sahel covers an area of 553,590 km2 or 43.11% of the country (Baohoutou, 2007). The Lake region, on the other hand, covers an area of 22,320 km2. The vegetation in this part of the country is steppe-like (Cabot and Bouquet, 1978). Indeed, the Chadian Sahel in general, and Kaya in particular, abounds in plant resources that have been subjected to unprecedented degradation in recent decades by local populations (4th National Report on Biological Diversity, 2009).

Recurrent droughts, especially those of 1972 and 2007 (DREM, 2008), which have occurred in the Lake region, on the one hand, and human actions on the other, have contributed to the degradation of the plant cover (field surveys, 2021; Bayang, 2023).

Among human actions, it should be noted that for almost a decade, in 2015, where 32,000 Chadians and other internally displaced people fled attacks by the nebulous Boko Haram sect. This is because the sect has committed atrocities in Nigeria and Niger, forcing people from neighboring countries, returnees and displaced Chadians to take refuge on the Lake in general and in Kaya in particular. The flow of displaced people is compromising the survival of the environment in general and plant resources in particular in this part of Chad (United Nations Communication Group, 2014; OCHA, 2021).

It is well known that the impact of this degradation of plant resources is enormous, and is felt at several levels in the Lac and Kaya regions. The sectors most affected by this phenomenon are agriculture and livestock breeding.

Materials and methods

Study Area

Kaya, the study area, is located in western Chad. It is

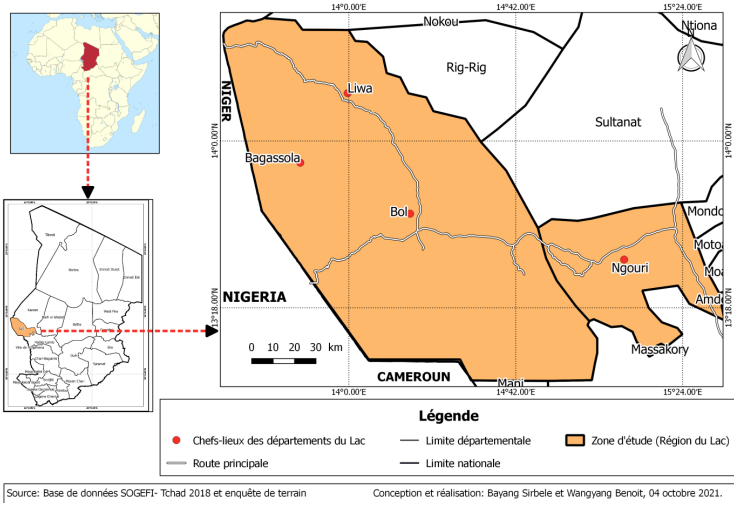

Figure 1: Situation and location of Baqassola

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located some 400 km from the Chadian capital and is part of the Lac region. The department of Kaya comprises the cantons of Nguéléa 1, Nguéléa 2 and Boudouma Dallah, whose respective chief towns are Nguéléa, Bagassola and Ngouboua. Kayac comprises 171 villages and covers an area of 1,302 km². Bordered to the north by the Liwa sub-prefecture, to the south by the Kangallam sub-prefecture, and to the east and west by the Bol sub-prefecture (Figure 2), the two cantons have an estimated population of 45,000. Nguéléa 2, which is the subject of this study, has a population mainly made up of farmers and herders, who play an important role in the environmental degradation of the Lac region through their activities. Refugees, returnees and internally displaced persons also have a negative impact on Bagassola's plant resources.

In the Lake region in Figure 1, Bagassola, chief town of Nguéléa 2 canton, is bordered by two main towns on the lake, Bol and Liwa, and by Nigeria, a giant African country. Bagassola is home to a large number of Nigerian refugees, returnees and internally displaced people.

Methodological Approach

Several methods were combined in this study:

• Fieldwork: this involved collecting data on the degradation of plant resources from public and private officials in the environmental field with group interview guides;

• Surveys were carried out and empirical data collected on anthropogenic actions of encroachment from Nigerian refugees, returnees and internally displaced people in Bagassola with a survey sheet;

• Using GPS, the geographical coordinates of refugee, returnee and IDP sites, viewpoints and other points relating to the degradation of Bagassola's plant resources were recorded.

RESULTS

Steppe Vegetation Formation of the Lake in Perpetual Anthropic Degradation

The vegetation of the Lac region in general, and Kaya in particular, belongs to the Sahelian domain, with a steppe formation characterized by thorny acacias, but others such as calotropis procera are not.

Steppe Characterized by a Shrubby Landscape

This landscape features a diversity of shrub species at Kaya that differs from one environment to another. Around the natron valleys, the most common species are doum palms, roasting palms, leptadenia pyrotechnica, calotropis procera and Ka-you . Here, in this environment, it should be noted that these species are spread along the sides of the valleys. In the villages of the natron areas, a category of ligneous trees is found. These include soap trees (balanites aegyptiaca) and neem trees (as in the village of Kaya). In the bush, leptadenia pyrotechnica, acacia and soap trees predominate. It should also be noted that plant species such as acacia albida, jujube, gum tree, etc. are found in the natron valley zone (field survey, 2021, table 1). Table 1 shows a plant society in the natron area. This plant society is defined by a group of plants living together in a common habitat and subject to the same living conditions. The dunes and the plant colonies are arranged jointly in a process referred to as a perfectly predictable "symbiotic partnership". Calotropis procera is one of the most widespread plant species in the natron area (Figure 2).

Table 1: Plant species at Bagassola in the Lake District

Geographical unit	Plant species		
	Scientific name	Name in local Arabic	Name in Kanembou
Around villages and water points	*Leptadenia pyrotechnica*	*Rtem*	*Kalemo*
	Acacia seyal	*Kitir/Asharat*	*Koloul*
	Balanites aegyptiaca	*Hidjilid*	
	Ziziphus mauritiana	*Nabak*	*Kongue*
	Acacia sieberiana	*Kouk*	*Keringa*
	Calotropis procera	*Atchoro*	*Kaya*
	Acacia raddiana ou Tortilis	*Talha*	*Kidile*
	Acacia albida/faidherbia[2]	*Haraz*	*Kouroulou*
	Acacia nilotica	*Garate*	
	Prosopis juliflora	*Soubsoubane*	*Kangar,komé*
Around the natron valleys	*Calotropis procera*	*Atchoro*	*Kaya*
	Hhyphaena thebaïca	*Dom*	*Soullou*
	Leptadenia pyrotechnica		*Kalemo*
	Borassus aethiopum		*Kourtou mdina*
	Salvadora Persica	*Arak*	*Kayou*
At the bottom of natron Without tree	Without trees		

Source: Field survey, July 2021

Figure 2: View of calotropis procera in Kaya
(Photo: Bayang Sirbélé, 2023) Andja, January 31, 2023 (N13°41'0.09"; E 14°16'29.1")

Figure 3: View of a fenced field in Dar Salam (Bagassola)
Photo: Bayang Sirbélé, 2023) Dar Salam, January 31, 2023 (N 13°32'9.3" and E 14°18'49.6")

Figure 2 shows calotropis procera growing on the sand dune at Kaya. Calotropis procera is most commonly found in the brown zone. This species (Figure 2) preferentially colonizes well-depleted soils. It has become the indicator of tired, infertile soils, known in Arabic as naga. It is protected to prevent silting-up of the valleys.
It should be noted that, depending on the geomorphology of the terrain, certain dominant species are found around the natron valleys and in the villages. These include calotropis procera and leptadenia pyrotechnica.

Grass-Dominated Lake Vegetation

Grasses populate the sand dunes of the Lake region. They include: aristida pallida, aristida funiculata, cymbopogon giganteus, andropogo gayanus, etc. (Cabot et Bouquet, 1974, 1978 and field survey, 2021).

Vegetation Destroyed by Salt

Trees don't grow at the bottom of valleys because of their salinity. Because the lowest parts of natron valleys are barren, they are devoid of all vegetation (Pias, 1970). Prosopis juliflora or prosopis chilensis is bushy and therefore tolerates these salty, highly acidic soils. It is a species of American origin, but has become pan tropical. It is an evergreen plant.
Vegetation in the Lake region and in Kaya is nowadays experiencing a high mortality rate of certain species due to the effects of climate change (field survey, 2021). This degradation is due to agricultural, pastoral and logging activities in the region and in Kaya.
In fact, the degradation of nature is the result of human action, with agriculture using thorn fences. The over-exploitation of woody vegetation is explained by the need to protect fields (korelo) with thorn fences or kalyi, to combat the incursions of the region's relatively large herd. Penicillary millet is grown on the dunes. To fence their fields, farmers and refugees generally use thorny acacia trees such as acacia seyal, acacia nilotica, etc. (Figure 3).
Figure 3 shows that the penicillium fields in Dar Salam are fenced. The fences are made of branches of acacia nilotica and other shrubs. In addition, dune fields are found on the outskirts of villages. This type of cultivation contributes significantly to the degradation of the ecosystem in the Lac and Kaya regions.

Demographic Growth of the Lac Population

In human terms, the population of the Lac, like that of other attractive regions of Chad, is constantly increasing. This is due to the natural potential of the Lake region. As a result, many Chadians refer to the Lake as one of the breadbaskets of Chad.
Its approximate population was 88,911 in 1962. In 1968, an administrative survey put the population at 92,801. In 1989, the population was 127,974. With the 1st General Census of Population and Housing ($RGPH_1$), which took place in Chad in April 1993 and lasted 6 months, the population of the Lake was 248,226. This was the largest census in Chad's history, carried out by the BCR (Bureau Central du Recensement). Sixteen (16) years after the 1st census, i.e. in 2009, the 2nd census was carried out. At this latest census, the population of the Lake was 451,369. From 1993 to 2009, the population of Le Lake almost doubled. From 248,226 to 451,369 souls. The population almost doubled from 2009 to 2021. From 451,369 to 804,165. This is what draws attention to the fact that the population of Le Lac is indeed evolving. It is made up of sedentary and nomadic populations. The Kanembou and Boudouma are in the majority in the region.

Migrant Population at the Lake

The Lac is a cosmopolitan region, as its population includes several African nationalities (Senegalese, Malians, Nigerians, Cameroonians, Beninese, Ghanaians, etc.) (Figure 12). Nigerians are the most numerous and the most mobile. The Fricans who live in the region are attracted by the fishing opportunities on Lake Chad. They are concentrated on islands such as Kinaserom, Tetoua, Fitiné, Koulfoua, Tchongolé and others.
As Youssouf Mbodou Mbami, Bol Township Chief, explains: "The islands are heavily exploited by foreigners

who engage in intensive fishing and export their products to Nigeria. But with fishing no longer profitable, some of the foreign islanders are growing sugar cane and potatoes. Others have become lumberjacks. These are the returnees and refugees. This foreign population also includes Chadians from other regions (figure 4).

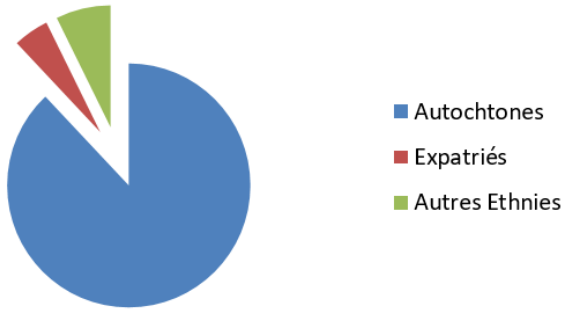

Figure 4: Percentage distribution of the Lake's population
Source: Laoro, 2001 and OCHA (2021)

Figure 4 shows that natives account for over 87.98%. Other ethnic groups from Chad to the Lake are representative at 7.3% and expatriates are at 4.72%.
The population of the Lac region increased in 2015 with the arrival of refugees, returnees and displaced persons (table 2) due to the Boko Haram sect.

Table 2: New migrants in Lake

Migrants	**Number/Year**	
	2021	**2023**
Refugees (Dar Salam camp)	16 277	18 247
Refugees outside camp		12 120
Returnees	30 356	
Total	**46 633**	**30 367**

Source : OCHA, 2021 and CNARR , 2023

Table 2 shows the number of new migrants to Lac. There are 16,277 refugees. There are 30,356 returnees. This gives a total population of 46,633 in 2021, according to OCHA. Updated statistics for 2023, according to CNARR, give a total of 18,247 refugees in the Dra Salam camp and 12,120 refugees outside the camp. This makes a total of 30,367 people.
Given Chad's population growth rate of 3.23% and the number of refugees and returnees to the Lake, the population of the Lake region in 2021 will be 804,165. This population has almost doubled in the 20 years between 2009 and 2021. The growth of the Lac population has a very strong influence on the plant resources of the Lac and Kaya regions.

Characteristics of Refugee, Returnee and IDP Sites and Shelters in Kaya

Three sites shelter refugees, returnees and internally displaced persons (IDPs) in Kaya in the Lac region. The site reserved mainly for Nigerian refugees is located 12 km from Bagassola, in a locality called Dar Salam. According to CNARR, there will be 18,247 people in this camp by 2023.
The majority are Haoussa, followed by other ethnic groups including Peul, Kanouri, Peul, Boudouma, Arab, Kanembou, Margui and Gousa. They have come from Baga Kawa in Nigeria and Karaga in Niger. They have been in the Dar Salam camp since 2014(Figure 5).

Figure 5: View of a refugee dwelling and tents at Dar Salam (Bagassola)
(Photo: Bayang Sirbélé, 2023) Dar Salam, February 01, 2023 2021 (N 13°3730.8" and E 14°17'50.7")

Figure 5 shows, from left to right, a refugee shelter in the Dar Salam camp. The shelter is made from a tarpaulin and fenced with an aquatic plant from Lake Chad, known in the local language as kaye. Opposite this habitat, tented houses have been set up in the camp, with financial support from the HCR.
On the other hand, 30,356 returnees and 45,951 internally displaced persons are housed in shelters in a village 2 km west of Bagassola called Kousseri 1, 2, 3. Most of them are Boudouma. They live in dwellings built by international NGOs (Figure 6).
Photo 1 of Figure 6 shows the makeshift shelters in Kousseri 3. These shelters are made of kaye, an aquatic grass found in Lake Chad, with a tin roof. The shelters were built with funding from the UNHCR and implemented by the Chad Red Cross (CRT). Photo 2 of Figure 6 shows shelters in Kousseri 2. These shelters are still made by kaye with financial assistance from the Luxembourg Red Cross, and the project was carried out by Boudouma women.
There is an elementary school in the Dar Salam camp. The school has a total of 3,055 pupils from CP_1 to CM_2, of whom 1,625 are refugee children. The school was created by the Foulbé community of Dar Salam in 2010, and became official on February 03, 2015. The school is run by Mahamat Abakar Adam and 18 other community teachers supported by UNHCR. The WFP provides food for the children, while UNICEF donates school supplies (Figure 7).

Photo:1

Photo: 2

Figure 6: Returnee and IDP shelters in Kousseri 3 and 2
(Photo: Bayang Sirbélé, 2023), Photo 1: Kousseri 3, February 01, 2023 (N 13°31'35.3"; E 14°17'35.7"), Photo 2: Kousseri 2, February 01, 2023 (N 13°31'37.3"; E 14°17'48.0")

Figure 7 shows the Dar Salam elementary school. It shows classrooms and a schoolyard with pupils running around and a teacher in a white coat at recess.

Figure 7: View of the pri (school in Dar Salam (Bagassola)
Photo: Bayang Sirbélé, 2023) Dar Salam, February 01, 2023 2021 (N 13°37'24.4" and E 14°17'34.4")

Figure 8: View of the primary school la Paix in Kousseri 1 (Bagassola)
(Photo: Bayang Sirbélé, 2023) Dar Salam, February 01, 2023 2021 (N 13°31'57.2" and E 14°18'21.7")

Outside the Dar Salam camp, in Kousseri 1, there is also a full-cycle elementary school from CP_1 to CM_2, called the "Ecole de la Paix", with 1,038 pupils, including 359 children of displaced persons and 205 children of returnees. The school is run by Mahamat Tchari Ali and has 11 teachers (Figure 8).
Figure 8 shows the Peace elementary school in Kousseri 1. Classrooms are visible, as well as pupils are running and others playing soccer during recess.
The three categories of displaced persons in Lac and Kaya, namely returnees, internally displaced persons (IDPs) and third-country nationals (TCNs), are mobile (DTM , 2019). They have a negative impact on plant resources in the Lac and Kaya regions, causing enormous damage to these resources.

Degradation of Plant Resources by Refugees, Returnees and IDPs in Kaya

The gradual destruction of plant resources in the Lac and Kaya areas is nothing new, as it is not a recent phenomenon. Plant damage is generally caused by farmers, herders, etc. in Lac and Kaya. Refugees, returnees and displaced persons have now been added to the list of people damaging plant resources in Lac and Kaya. The most deforested plant species is acaca nilotica, known in local Arabic as garate (table 1).
Indeed, given the precarious living conditions endured by these vulnerable people and the poor care they receive, the activities (farming and livestock rearing) carried out by mobile people force them to degrade the vegetation. Many of the refugees, returnees and displaced persons have integrated into the socio-economic life of Kaya by growing small millet and beans. Others, on the other hand, raise goats and sheep. Both of these activities contribute negatively to the degradation of vegetation (Figure 3).
In addition, men, women and children in and outside the Dar Salam camp are engaged in the massive destruction of plant resources all around the sites some 1 or 2 km away (Figure 9).
Figure 9 shows the cleared area at Kousseri 3. The area

Figure 9: View of a cleared area at Kousseri 3 (Bagassola) *(Photo: Bayang Sirbélé, 2023) Kousseri 3, February 01, 2023 2021 (N 13°31'57.2" and E 14°18'21.7")*

shows trees cleared in the vicinity of the makeshift shelters at Kousseri 3. A few trees are still visible in this area and have not been cut down.

Trees are felled to provide firewood, charcoal and wood for building sheds (Figure 10). The principal of the peace school said that parents use their children to degrade the environment, and a refugee at the Dar Salam site admitted that during the vacations, children cut wood for their parents. The environmental inspector in Bagassola reported that migrants play a major role in the destruction of vegetation in Kaya, and urged that their living conditions be improved so that they can limit their "massacring of nature" (field survey, 2023).

Photo 1 of Figure 10 provides information on charcoal. A koro of charcoal costs 300 FCFA and a bag 5,000 FCFA, while the photo 2 on Figure 10 shows that firewood is still being moved to the Bagassola market by Boudouma

Photo:1 *Photo: 2*

Figure 10: View of bags of charcoal and firewood at Bagassola market *(Photo: Bayang Sirbélé, 2023) Photo 1. Bagassola market, February 01, 2023 (N 13°32'8.22"; E 14°18'35.2") Photo 2. Bagassola market, February 01, 2023 (N 13°32'8.37"; E 14°18'38.3")*

women. A heap of this wood is sold for 1,250 FCFA.

International and national NGOs such as HCR, CRT, etc. have contributed to the deterioration of plant resources in Kaya by helping to finance the construction of shelters for refugees, returnees and internally displaced persons. These buildings are generally made from kaye, a herbaceous plant that grows in Lake Chad. As a result, many people have taken to cutting down these kayes in order to raise money. Hence the massive deterioration of the kayes in Kaya.

Consequences of the Degradation of Plant Resources by Refugees, Returnees and IDPs

Disappearance of Plant and Wildlife Species

Degradation of plant resources has had a considerable impact, as many plant species have disappeared. In addition, there are empty spaces. Trees have been cleared, so no agricultural activities are carried out on these deforested areas (Figure 11).

Figure 11 shows the deforested area at Kousseri 3. No trees can be seen in the vicinity of the makeshift shelters at Kousseri 3. This is because the area is devoid of trees

Figure 11: View of a cleared area at Kousseri 3 (Bagassola) *(Photo: Bayang Sirbélé, 2023) Kousseri 3, February 01, 2023 2021 (N 13°31'35.4" and E 14°17'35.7")*

due to the deforestation carried out by the returnees and displaced persons.

The deterioration of the vegetation is forcing the animals

to disappear. They no longer have habitats in which to hide. As a result, they are threatened and attacked by hunters. As a result, they are forced to flee and migrate to areas where they can survive.

Aquatic plants such as the kayes of Lake Chad should provide shelter and breeding grounds for the fish and other aquatic animals that frequent the lake's littoral zone. They also provide food for certain aquatic organisms. Unfortunately, we have to admit that these organisms will no longer have shelter and food, as the kayes have been destroyed for humanitarian purposes.

Soil Stripping

The Lake District boasts a variety of soils. These soils are known as brown or red-brown soils, brown steppic sandy soils and salty soils. They are poor and erodible.

In the Lake District, we can also distinguish between soils such as naga (Arabic for sterile), modern polders, semi-modern polders, traditional polders or false polders, sandy soils and sub-arid brown soils.

The soils are increasingly bare and degraded today, and erodible by the wind as a result of natural and anthropogenic actions.

Agro Pastoral Impacts

As far as human activities are concerned, the effects of the degradation of the vegetation cover are visible and real. Village dwellings are scattered and visible from a distance due to the absence of vegetation. The soil is bare, which leads farmers in general and refugees, returnees and internally displaced persons to have dune fields on the outskirts of villages due to the destruction of vegetation. This reduces the productivity of cereals and market garden produce. Livestock farming is also suffering a fatal blow from the degradation of plant resources. Animals are finding it extremely difficult to feed themselves. As a result, they have to fall back on dried calotropis procera leaves for food.

DISCUSSION OF RESULTS

Recurrent Droughts at the Lake

Everywhere else, rainfall is the determining factor in human activities, as it is an indispensable link in the Sahel in general and in the natron area in particular. Rainfall is very poorly distributed in the Lake region. Rainfall and its intensity are irregular and low. Most of the time, it comes late, leading to droughts (Beauvilain, 1995, p. 8; Koumbaye, 1996, p. 19).

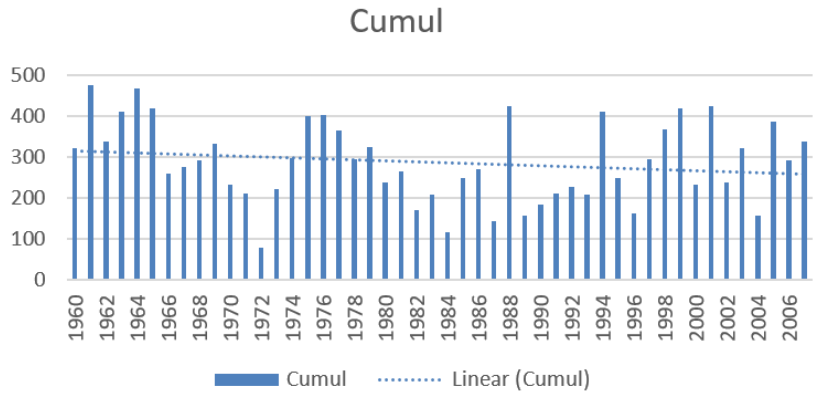

Figure 12: Low rainfall at Ngouri
Source: Climatology Division, DGM/N'djamena, 2018

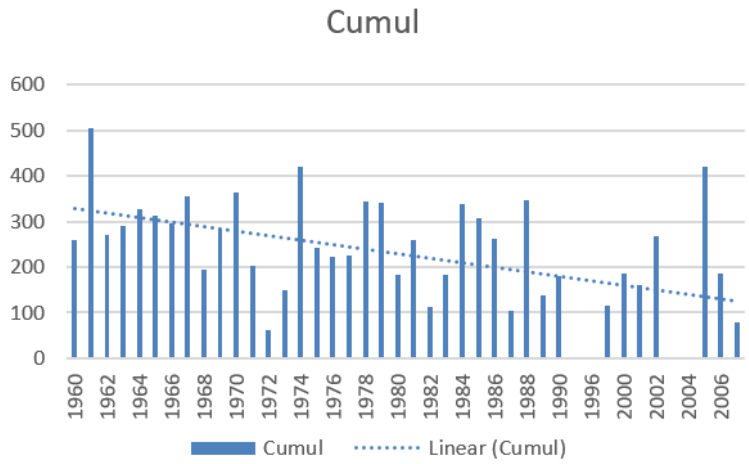

Figure 13: Low rainfall at Bol
Source: Climatology Division, DGM/N'djamena, 2018

Droughts are frequent in CILSS member countries. In the Lac, they are present because the region experiences rainfall deficits almost every ten years. In Chad in general, and in the Lake region in particular, the drought years of 1972 and 1984 justify this. These periods of drought have attracted the attention of many researchers and

governments. To better understand the phenomenon of drought in the Lake region, we can observe the low rainfall in Bol and Ngouri to understand the intervals of drought. Rainfall records for 1972, 1987, 1982, 1998, 2007, etc. at Bol and 1972, 1984, 1987, 1989, 2004, etc. at Ngouri are clearly deficient (figures 11 and 12).

Figure 12 shows data covering the period from 1960 to 2007. This range of years shows that the lowest rainfall was recorded in 1972 (78.6 mm). Low and irregular rainfall was also observed in 1984 (114.4 mm),

1987 (141.5 mm), 1989 (154.5 mm), 2004 (155.1 mm) and 1996 (161.7 mm). It can be seen that 11972 and 1984 were years of low precipitation. Figure 12 also gives an idea of the eight-year low rainfall in the period 1960-2007, with an average of 145 mm.

Figure 13, on the other hand, shows the case of the Bol station (1960-2007), with the lowest rainfall in 1972 (62.0 mm) compared with Ngouri (Figure 12). Low rainfall was also recorded in 2007 (80.1 mm), 1987 (102.8 mm) and 1982 (113.4 mm). The average low rainfall over thirteen (13) years is 141.3 mm (figure 13). The irregular rainfall observed at Ngouri is also found at Bol. The low rainfall in the region has a negative impact on production.

Increasingly Dry and Violent Winds in the Lake Region

Generally speaking, the intertropical zone is the domain of trade winds, including the harmattan or boreal trade wind. This is a dry wind that considerably dries out nature. It then transports fine particles (sand, silt, etc.), giving rise to dry mists. It comes from the Saharan anticyclone. It carries winds from the east and north-west of the Sahara to the south-west, and dominates during the dry season. According to natron operators, the wind generally blows from November to February or March.

Another type of wind that prevails in the Lake region is the so-called monsoon. This is a moisture-laden maritime wind. It moves in the opposite direction to the harmattan. of these two air masses, harmattan is the main cause of silting in the natron valleys at Le Lac (table 3).

Table 3 shows that the average wind speed at Mao varies from season to season. The average maximum wind speed oscillates between 1.6 m/s and 1.9 m/s. The absolute maximum wind speed recorded at Mao was 4.7 m/s in November 1989.

Due to the lack of wind speed data in the Lac region, the Mao data were collected in the Kanem region, adjacent to the Lac region. In addition, the old data on rainfall and temperature are due to the lack of data data available from the General Directorate of Meteorology.

Table 3: Average wind speed (m/s) for Mao

Année	J	F	M	A	M	J	J	A	S	O	N	D	T
1970	2,1	2,5	2,3	2,3	2,0	2,0	2,0	1,6	1,9	2,3	2,5	2,6	2,2
1971	2,4	2,4	2,3	2,3	2,2	2,3	2,2	1,6	1,7	2,3	2,6	2,7	2,3
1972	2,2	2,7	2,7	2,0	1,9	1,9	1,9	2,1	1,9	2,1	2,8	2,5	2,2
1973	2,5	2,5	2,7	2,4	2,4	2,1	2,3	1,7	1,9	2,3	2,9	2,5	2,4
1974	3,1	2,8	2,8	2,1	2,3	2,3	2,1	1,7	1,8	2,0	2,6	2,7	2,4
1975	2,6	2,3	2,4	2,1	2,0	2,2	1,9	2,0	1,8	2,1	2,2	2,6	2,2
1976	2,3	2,5	2,2	2,3	2,0	2,1	2,2	2,0	1,6	1,8	2,1	2,2	2,1
1977	2,3	2,8	3,2	2,4	2,0	2,1	2,3	1,6	1,6	2,2	2,1	2,4	2,3
1978	2,2	2,1	2,4	1,9	1,8	2,1	2,1	1,6	1,6	1,5	2,1	2,1	2,0
1985	3,0	3,2	3,5	3,0	2,9	2,2	1,9	2,1	1,8	2,0	2,1	1,9	2,5
1989	3,1	3,3	3,9	2,2	2,2	2,7	2,7	2,4	1,8	3,6	4,7	3,8	3,0

Source : DGM of N'Djamena (2019)

CONCLUSION

Ultimately, the study concludes that the destruction of the ecosystem is generally caused by man and by Nigerian refugees, Nigeriens, returnees and internally displaced Chadians, who are directly involved in modifying the plant landscapes of the Lac and Kaya in a very significant way. This is to harvest firewood, charcoal, etc., leading to deforestation associated with human settlements and their expansion.

However, as this ecosystem is degraded, the consequences for mankind are far-reaching. For farmers and shepherds in Lac and Kaya, this degradation of plant resources has a considerable impact on cereal and pastoral production.

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