Fisheries in the Waza Logone floodplain : an analysis of the status of the fisheries sector and mitigation of conflicts within the sector in North Cameroon

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2

Waza Logone Floodplain within the Sahel Wetlands of West and Central Africa

2.1 Introduction

Situated in Central Africa, Cameroon is a large and diverse space. From the Southern region to the Far North, one passes from equatorial forest to the Sahel. The economy, as in all sub-Saharan countries, largely depends on natural resources, of which fresh water is considered to be the most important (MIDIMA, 2010).

This chapter will present data from literature as well as the results from the 2009 survey.

2.2 Geographic position

In terms of landscape, Cameroon can be divided into four parts: the humid forest area in the South, the savannah area (Adamaoua and East region), the high mountain area (western regions) and the sahelian area (northern regions). The Waza Logone floodplain is part of the Lake Chad Basin and is situated in the central eastern section of the Far North region[4] in the Sahelian area (IRAD, 2008; Figure 2.1).

4 Since 2008, the former 10 provinces became 10 regions. In this thesis, province and region have the same meaning.

Table 2.1
Major floodplain wetlands of the Sahel (West and Central Africa) (Drijver & Van Wetten, 1992)

Wetland	Surface area km²	Country
1 Senegal delta	3,000	Senegal, Mauritania
2 Senegal valley	5,000	Senegal, Mauritania
3 Niger inner delta	30,000	Mali
4 Niger fringing floodplains	3,000	Nigeria
5 Sokoto and Rima valleys	1,000	Nigeria
6 Hadejia-Nguru floodplains	4,000	Nigeria
7 Logone floodplain	11,000	Cameroon, Chad
8 Lake Chad floodplain	10,000	Nigeria, Cameroon, Chad
Total	**67,000**	**West and Central Africa**

It covers 6,000 km² in Cameroon(comprises the Logone floodplain) and represents about 10% of the total surface of major riverine wetlands in West and Central African Sahel (Drijver & Van Wetten, 1992).

The Lake Chad Basin is located in Central Africa, between 6° to 24° N and 8° to 24° E. It comprises a vast expanse of land made up of several catchments that feed Lake Chad.

Table 2.2 summarizes the surface area of adjacent watersheds. According to LCBC (2007), the Lake Chad Basin covers a total surface area of about 966,955 km², which is approximately 8% of the surface area of the African continent. The area is shared territory by Algeria, Cameroon, Central African Republic (CAR), Chad, Niger, Nigeria, Sudan, and Libya. All these countries use the area as a strategic source of fresh water, which is considered as one of the most critical resources to the livelihoods in the watershed.

Table 2.2
Surface area of the sub-watersheds of the Lake Chad Basin among the LCBC member nations (LCBC, 2007)

State	Size of sub-watershed (km²)	% of Conventional Lake Chad Basin	% of National Territory
Cameroon	56,800	6.0	12.12
Niger	162,375	17.0	12.70
Nigeria	188,000	19.0	22.15
Chad	361,980	36.0	28.42
CAR	197,800	22.0	31.75
Total	**966,955**	**100**	**–**

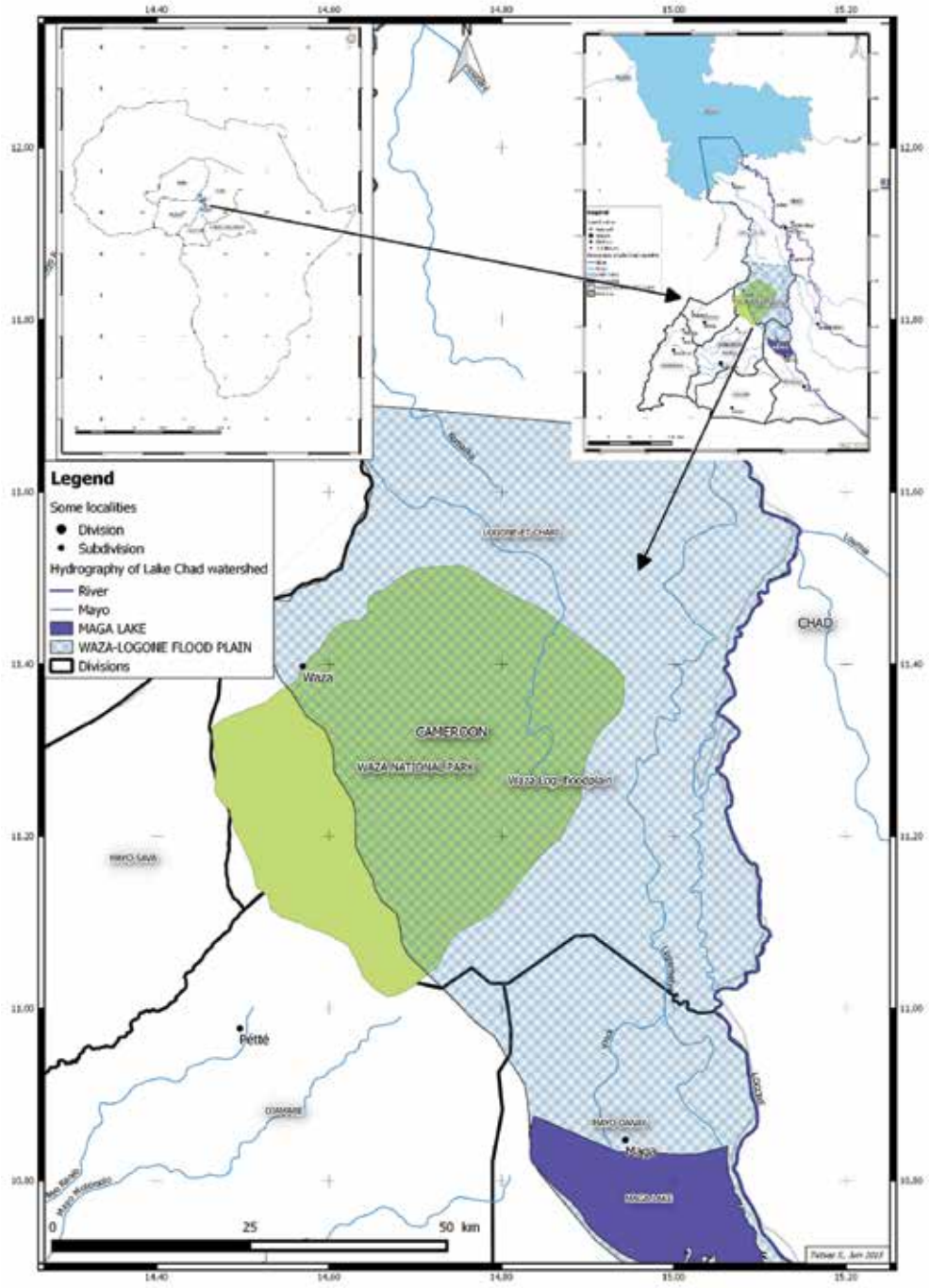

Figure 2.1
Waza Logone floodplain and area within the Lake Chad basin (From NIC data)

Since 1963, a general decline in rainfall in the Lake Chad basin has been observed. In conjunction with a steady degradation of the vegetation cover, this has greatly impacted the environment: the lake dried up, large areas desertified, crops failed and livestock and fish stocks suffered. More than 15 million people in the Lake Chad Basin were affected either socially or economically (LCBC, 2007). In response to this, the Waza Logone floodplain was classified in 2006 as a RAMSAR site (RAMSAR, 2008). Waza National Park, situated in the floodplain, has been recognized as a Man and Biosphere Reserve since 1979 (UNESCO, 2008).

The Waza Logone floodplain is divided into six divisions (Mayo Tshanaga, Mayo Danay, Mayo Sava, Mayo Kani, Diamare and Logone et Chari). Administratively, the floodplain comprises of three councils (Zina, Waza and Logone Birni in the Logone & Chari division, Maga in the Mayo Danay division, and Pette in the Diamare division. The state authorities comprise (i) the governor for the region, (ii) the senior divisional officer for the division[5] and (iii) the sub-divisional officer for the sub-division. Acting as the principal traditional authorities are the Sultan[6] of Logone Birni, the Lamido of Pouss and the Lamido[7] of Pette. Zina is the administrative center of the Waza Logone floodplain (Figure 2.2).

2.3 Population

Since centuries, the annual flooding of the Waza Logone floodplain provides livelihoods, mainly through fishing and farming (Van Est, 1999).

Among the people living in the Waza Logone floodplain are the Kotoko, Musgum and Massa. In the dry season, the area is visited by pastoralists who lead their cattle onto the grassy plains in search for available pasture (Scholte 2006a).

The Kotoko, descendants of Sao, were the first occupants of the land surrounding the Chari and the Logone River. Traditionally, homes of prominent community members are located in the northern section of each town while lower-class families and foreigners reside in the southern part of a town. In between, in the central part of town, the home of the Sultan (Mbaku, 2005) is situated. The Kotoko have always been fishermen, known for their successful use of several fishing techniques, including channel fishing. Although they are

5 A division is an administrative jurisdiction administrated by an official called a Prefect or Senior divisional officer

6 Depending on the traditional organization, the chief of the Fulani people is call Lamido and Sultan in Kotoko people.

7 See footnote 6.

mostly Muslim, they have integrated other traditional worship practices into their daily lives, including the belief in spirits that live in water (Molenaar & Van Santen, 2006).

The Musgum came to the Waza Logone plain several centuries after the Kotoko people. The Musgum settled in the southern parts of the floodplain, which were vacated by Kotoko. Since the independence of Cameroon (in 1960), the Musgum slowly started to migrate towards the northern part. South of where the Musgum settled, is now inhabited by the Massa. The Massa maintain their geographic and administrative center at Yagoua. They are mostly rice farmers. The Fulani people are temporary residents of the floodplain; they are mostly herders and transhumants (Mvondo *et al.,* 2003).

Nowadays, small numbers of other ethnic groups (such as Moudang, Guiziga and Toupouri) are also found in the area. They migrated to occupy positions as civil servants or as general employees in administration offices, mostly in the larger towns (i.e. Yagoua and Waza).

During the last national geographic census, more than 215,400 people were reported to live in an area estimated at approximately 8,293 km^2 (BURCREP, 2010). The density of human occupation is 25 people per km^2 in 2005 (Table 2.3).

Table 2.3
Surface area and population of Waza Logone floodplain (from general population census, 2005)

Subdivision	Surface area (km^2)	Population
Logone Birni	2,261	52,589
Zina	1,169	25,572
Waza	2,604	15,013
Pette	1,233	37,125
Maga	1,026	85,100
Total	8,293	215,399

Other studies broadly estimate the surface area of the floodplain in Cameroon at about 6,000 km^2, with more than 100,000 people using the area's resources (Loth et *al.*, 2004), including migrant people, fishermen and pastoralists. Cattle owners in the area own an estimated number of cattle of up to 200,000 heads during the peak dry season (Scholte *et al.,* 2006).

During the present study, a rapid census was conducted in April 2009 in 91 villages in the floodplain. The list of the villages is presented in Annex 1. The total population was estimated at 41,415 people.

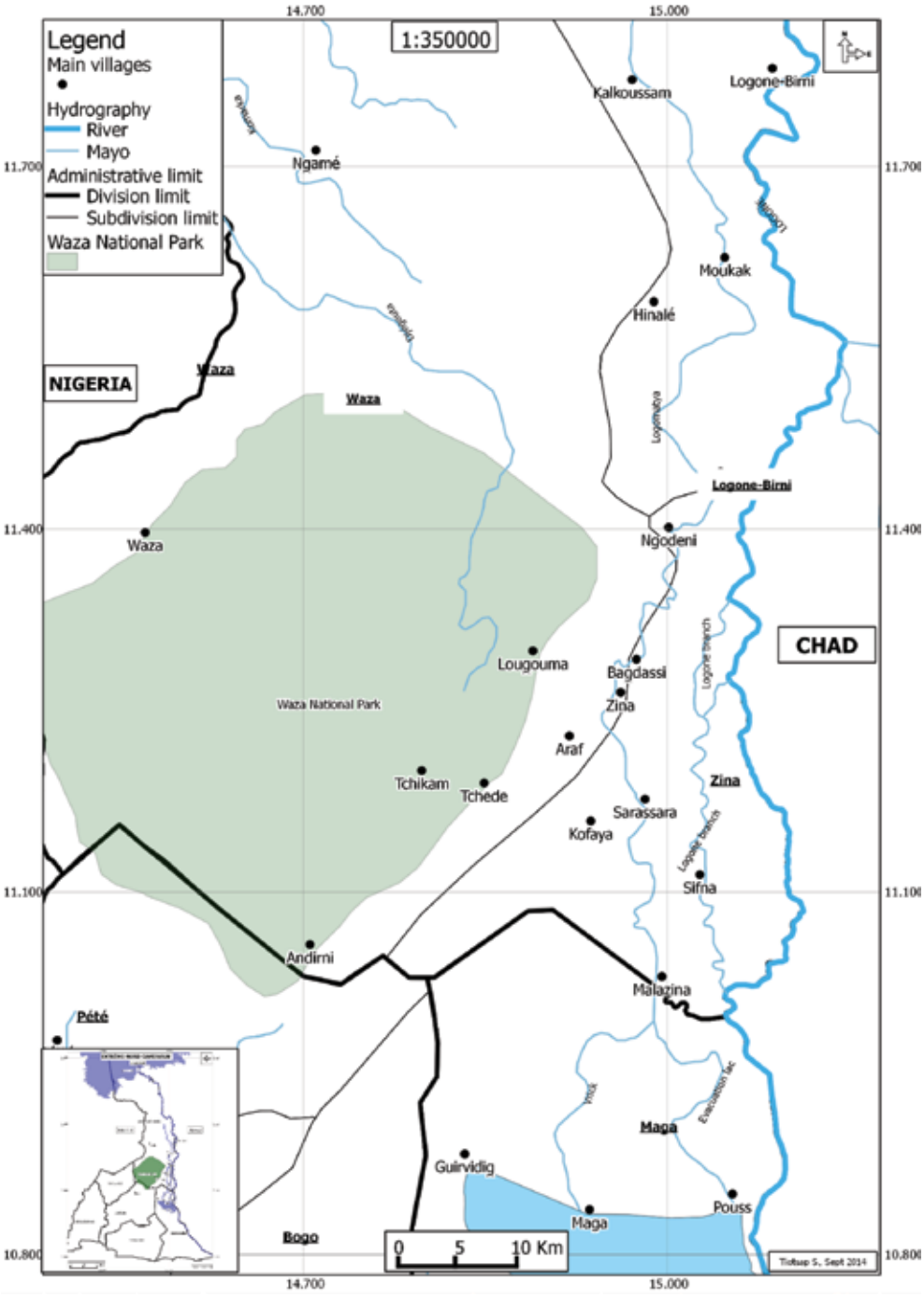

Figure 2.2
Villages and the National Park in the Waza Logone floodplain (NIC and field data)

In April 2010, a second census was conducted to provide details on 19 additional villages. This census was done jointly with interviews of household heads and included questionnaires on conflicts.

Age distribution and migration

Figure 2.3 shows the distribution of respondents according to their age. People aged over 50 years represent about 50% of the surveyed population (47.51%). This could be explained by the fact that a large proportion of the young population (i.e. in the age of 17 and 22) whose income is mainly derived from fishing, leaves the floodplain to seek out other fishing areas or migrates to cities or other area (e.g. Maroua, Lake Chad, Maga, Foumban, Douala, and Lagdo).

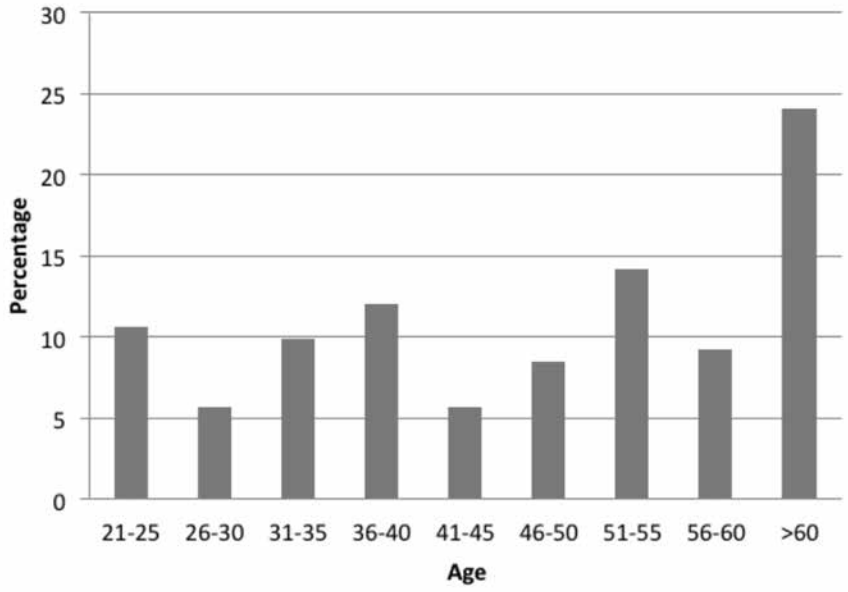

Figure 2.3
Distribution of respondents according to age (n = 143)

As an example, in 2010, 856 heads of households, out of a total of 1,619 (52.8%), left the floodplain after a period of intensive fishing activities. This shows the importance of migration and mobility in the population between the Waza Logone floodplain and other fishing areas.

Main production activities in the Waza Logone floodplain

In the study area, agriculture is regarded as the core business; it ensures household food security (Bauer, 2003). Although fishing generally generates more revenue, it is the second activity after agriculture. In line with this, more

than 20% of the people surveyed are involved in fisheries as a main activity, while it is a second activity of nearly 80% of those interviewed. When fish resources became more scarce after the construction of the Maga Dam (1979), due to reduced flooding of the floodplains, there was a gradual conversion of young fishermen into farmers (ACEEN, 2007). This coincided with a sudden increase in local initiatives to create rice fields between 1980 and 1990 (Fotsing, 2007). Our interviews revealed that a group of 17 of youngsters left the villages of Zina and Sarasara in the district of Mazera in 2006 and 2007 to farm rice crops in North region. This phenomenon of seasonal migration of fishermen characterizes this area and is linked to the hydrological disturbance that occurred after the construction of the Maga Dam in 1979. Since then, fishermen migrate to other areas like the Lagdo man-made reservoir or Lake Chad after the main fishing season (October-January). More details on this migration pattern are provided in Chapter 3 and Chapter 5.

Level of education

In the French part of Cameroon, primary level education ends with the First School Certificate after six years. The Secondary School Certificate may be obtained after four years education at the secondary level, while after seven years a Bachelor's degree could be obtained. In the rural Muslim dominated areas, such as the Waza Logone floodplain, children are often educated in Koranic schools. The teacher has the status of the Imam, a religious authority who has learned the Koran. Figure 2.4 shows the level of education within the population.

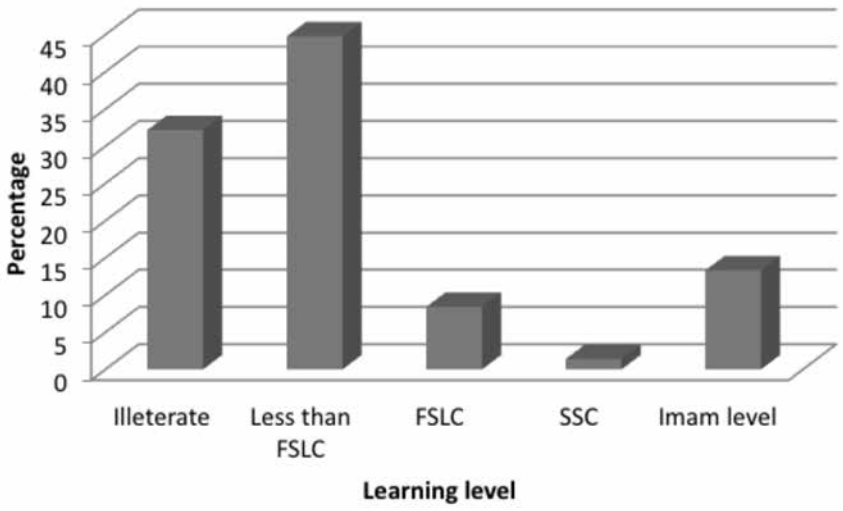

Figure 2.4
Distribution of respondents according to their educational level
FSLC: First School Living Certificate; SSC: Secondary School Certificate

Nearly 70% of the respondents have a formal education (Koranic, French or both systems). Within the French system, over 80% have not attained a First Level Certificate (Figure 2.4). This relatively low educational level could be related to the strong interest the local population attaches to the great fishing season that runs from November to January. As a consequence, the school year does not really start until mid-February, causing children to be deprived from education during more than half of the school year. Moreover, the drop-out rates remain high due to the seasonal migration of parents, particularly fishermen. The fact that the French education system in the area suffers from a lack of school infrastructure and teachers could be a further determinant in this low educational level.

Religious groups

In accordance with geography patterns, Islam is the predominant religion in the Waza Logone floodplain (Table 2.4). Over 90% of the population adheres to this religion, which is reflected in the predominantly Islamic infrastructure in the zone. Mosques are present in most villages and small towns in the floodplain. Churches can only be found in a few small neighborhoods such as Raïnaba, Sifna and Davagan in the sub-district of Lahai.

Table 2.4
Distribution of respondents according to their religion (n=143)

Religion	Numbers	Percentage
Islam	135	94.4
Christian	7	4.9
Animism	1	0.7
Total	143	100.0

Household size

Household size reflects the total need of households in terms of sustenance and is thus a realistic determinant of existing competition risks and pressure on natural resources in a certain area (Bene *et al.*, 2003). Within the surveyed population, the largest household is 28 persons and the smallest household has only one member (Table 2.5). The average size of households in the study area is 10.83 persons. This is twice the average size of a household on national level (4.8 per household) and almost equal to what has been reported for the study area at the start of the Waza Logone project (UICN-WLP, 1994a; 1994b).

Table 2.5
Statistical information on households (n= 143)

Household Statistics	Value
Average number of members	10.83
Standard deviation	5.4
Interval between maximum and minimum size	27
Minimum size	1
MaximumMaximum size	28

The fact that the majority of the population is Muslim and thus generally adheres to a polygamous lifestyle adds to this high average household size; households are often characterized by more than one woman with their children.

2.4 History of development actions in the Waza Logone floodplain

In the 1970s, a 30 km-long earth dam was constructed near the village of Maga in order to collect water (400-1000 km^2) needed for rice production. Due to this construction, the Waza Logone floodplain became deprived of practically all of its natural flood water. The embankments on the west bank of the Logone River intensified this effect and further compromised the ecological potential of the floodplain. Many local people who relied on natural resources for their livelihoods were seriously affected in terms of income due to reducing fish stocks, available land for cultivation, and products such as fuel wood, fruits, medicines and merchandise such as Gum Arabic (Loth, 2004). Table 2.6 summarizes the timeline of events and management interventions that took place in the Waza Logone floodplain since the completion of Maga Dam in 1979.

From 1990 to 2003, the government of Cameroon and the International Union for the Conservation of Nature (IUCN) worked to rehabilitate the degraded Waza Logone floodplain by conducting the IUCN-Waza Logone Project (IUCN-WLP). This project initiated so called 'pilot flooding' by opening the '*petit Goroma'* creek that was cut off by the embankment along the Logone River (Scholte, 2007).

During the last few years, the fishing grounds in the Waza Logone floodplain have been opened to everyone. These developments have resulted in decreased fish yields per household (ACEEN, 2007).

With the exception of a number of waterholes which are managed on the basis of local agreements, most fish resources have shown declines during

recent years (Molenaar & Van Santen, 2006). They are exploited without any regulations and corruption practices have added to the damage. In addition to this, the presence of so called fishing channels, constructions of 20 to 2,000 meters long, which are meant to enhance fishing efficiency, has shown a sharp increase between the late '90s and 2006. Their number grew from 1,188 channels in 1998 (IUCN-WLP report cited by Belal, 2003) to over 3,000 fishing channels on the Cameroonian side of the border in 2006, with an additional 500 channels on the Chadian side (ACEEN, 2007).

Pastoralists have always travelled great distances to benefit from the floodplain's rich resources, particularly in recent decades, which was at the same time characterized by a slowly disappearing water surface and a gradual decline of other resources (Scholte, 2006). The reflooding of the Waza Logone floodplain in 1994 resulted in an increase of the number of pastoralists and herds of cattle. Moritz (2003) estimated the annual growth rate of nomadic herds from 1993 to 1999 at 4.5% per year in the Waza Logone floodplain. During this period, the grazing intensity increased from 27 to 69 cattle per km^2 and pastoralists stayed longer in the floodplain than before (Scholte *et al.,* 2006).

During the 1984-1985 drought in the area, palatable grasses and water for herding cattle became scarce. In response to this, the livestock service of Kousseri, decided to build a small dam in Zilim Village in 1985, on the Logomatya River (Figure 2.2). This dam was developed further by integrating some nearby channels, to function as the SEMRY rice scheme which also inundated a large area for grazing (Oijen & Haberland, 1991). This scheme was still operational in 2010.

An impact assessment conducted in the area by the Dutch Development Organization (SNV) in 2007 showed that the reduction of the flooding area modified the conditions of watering and foddering of animals considerably (Fotsing, 2007).

Since 2006, the Lake Chad Basin Commission (CLBC), SNV and regional services in charge of natural resources have started to develop strategies to tackle these problems and combat the degradation of resources while promoting sustainable practices. CLBC developed a plan with a scope until 2025, targeting the entire basin, but specifically the Waza Logone floodplain. The long-term objective is a floodplain with sufficient water and soil resources (in terms of quality and quantity) to satisfy sustainable development, while creating a framework for equitable sharing of the resources and benefits (LCBC, 2007).

Table 2.6
Chronological description of main events impacting development in the Waza Logone floodplain (adapted and completed from Loth *et al.*, 2004)

SEMRY/Maga dam	Scale	Waza Logone Project and other projects
▪ Construction of the Maga dam ▪ High increase in rice production and extraordinary yields ▪ Creation of a new city (Maga) ▪ Improvement of social infrastructures (education, health, water supply) ▪ Collapse of the floodplain and fisheries ▪ Ecologic disaster.	1979	
▪ Less competitivity of local rice compared to imported rice ▪ Beginning of the economic crisis	1986	
	1988	▪ Feasibility studies of Waza Logone Project ▪ Research and development activities ▪ Participation of populations, traditional leaders and authorities ▪ Creation of enable conditions for the restoration of ecology ▪ Initiation of conservation and co-management of natural resources ▪ Restoration of biodiversity
▪ New orientation of the management of SEMRY (disengagement of the government, abandonment of the commercialization function within the company) ▪ Fall of rice production	1989	
	1992	▪ Law on the right of association ▪ Creation of common groups and associations
▪ Devaluation of FCFA ▪ Grain in competitivity ▪ Remanent economic crisis ▪ Underperformance of the production unit ▪ Sub productivity	1994	▪ First pilot reflooding of the Waza Logone floodplain ▪ Opening of the Aretekele (20 m^3/s)
	1997	▪ Second pilot reflooding ▪ Opening of the Petit Goromo (7-10 m^3/s)
▪ Strike by rice farmers against the SEMRY authority Appointment of new General Director ▪ New contract Plan with the government ▪ Increase in rice production	2000	▪ End of the Waza Logone Project ▪ Set up of the CACID ▪ Process of transferring activities to local organizations ▪ Creation of CFAID, ACEEN, AIDR by the former animators of the Waza Logone Project
▪ Strike by rice farmers against the SEMRY authority ▪ Appointment of a new General Director ▪ Stop in rice production	2007	▪ Broad diagnostic in the Lake Chad Basin by the LCBC ▪ Funding of small grants in the floodplain (GEF/CBLT) ▪ Decision of the Governor concerning measures for the reverse of tendency of degradation of natural resources ▪ Dry up of the Logomatya ▪ Mobilization of several development actors (LCBC, SNV, ACEEN, Councils of the floodplain) ▪ Impact environmental assessment of the rebuilding of the Zilim dam
	2009	▪ Funding of the PRODEBALT ▪ Funding of the PDRP/CL

2.5 Climate

The Waza Logone area comprises 600,000 hectares in the Far North region of Cameroon, and has its geographical location between 10°50' and 12°10' North latitude within the Lake Chad Basin (Figure 2.1 and 2.2), at an altitude of approximately 305 m above sea level. The floodplain, locally known as the *yaere*, stretches over an area of 6,366 km^2 (20% of the Far North region). Temperatures vary between an annual maximum of 41°C to an annual minimum of 13°C. The annual average rainfall varies from around 750 mm in the South to 600 mm in the North (average 687 mm; Figure 2.5).

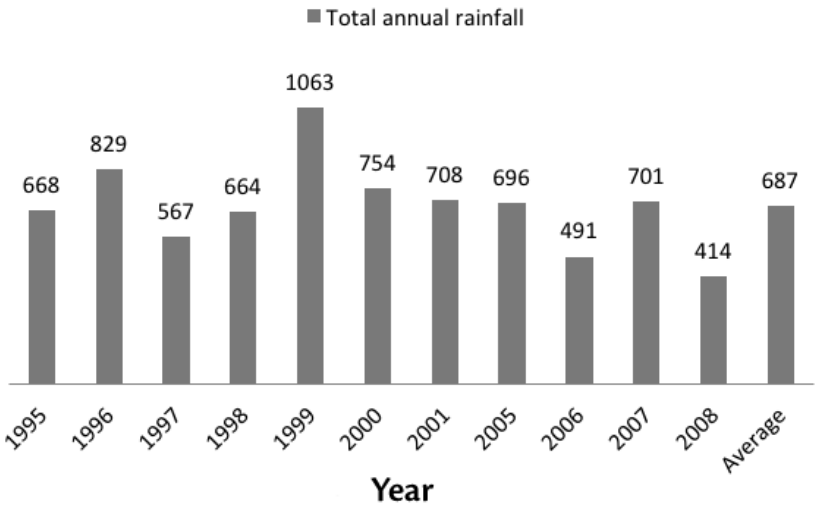

Figure 2.5
Rainfall data (in mm) in the central part of the study area (personal data collected by Mahamat[8], a rainfall monitor in Zina from 1995 to 2008)

The wet season lasts only five months – from mid-May to mid-October, with July (33%) and August (32%) accounting for 65% of the total annual rainfall, while there is little or no rainfall during the rest of the year (MIDIMA, 2010; Figure 2.6).

Recent climatic analyses show a clear space-time variability in the distribution of the rains in the region and reveal a downward trend (Donfack & Seiny, 1997). Due to climatic changes, wet seasons become shorter and precipitation patterns are slowly shifting North, leading to gradual modifications in local hydrology and ecology.

8 Former hydrological Assistant of the Waza Logone Project.

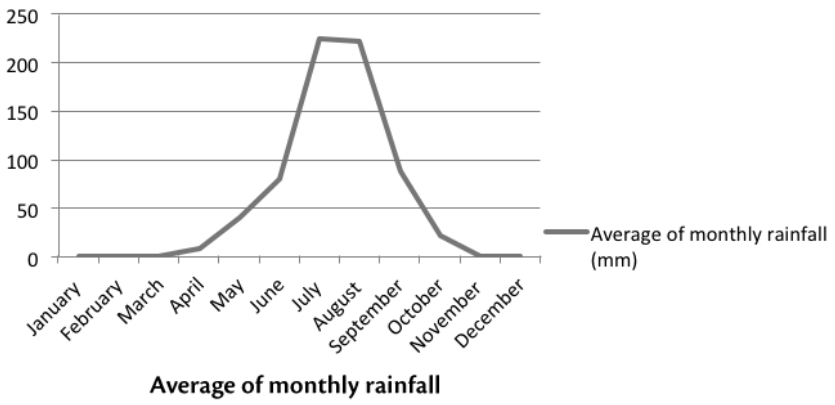

Figure 2.6
Seasonal rainfall dynamics in the Waza Logone floodplain (data collected by Mahamat, a rainfall monitor in Zina from 1995 to 2008)

2.6 Hydrology

The hydrology of the Waza Logone floodplain has been described by several authors, for instance Bouchardeau (1968), Benech *et al.* (1986), Olivry (1986), Naah (1990), and Loth *et al.* (2004). The main river in the area, the Logone River is mainly fed by rain water from the Adamaoua Region, a higher rain fall zone in Cameroon, and from Chad and the Central African Republic. During September and October the peak flow reaches the lower floodplain and, except during exceptionally dry years, the river overflows its banks. Because the area is geographically almost completely flat, the floodwater spreads over a large area into the floodplains. The Logone water splits in the floodplain through a northern (700 m^3/s) axis oriented SE-NW and a southern (1200 m^3/s) axis parallel to the first one (Naah, 1990). The floodplain is heavily flooded when the Logone discharge reaches 1500m^3/s (Benech *et al.*, 1982; Olivry, 1986), so the El Beid River can transfer water from the Logone River to Lake Chad. In 1972 and 1973, the discharge was less than 1500 m^3/s (Olivry, 1986). The flood levels vary between 0.7 and 1m water depth (Naah, 1990).

Hydrological data collected from 1968 to 1978 show that annual fluctuations in flooding play a leading role in the *yaere* hydrology. Local precipitation and the resulting pre-flood in the El Beid River also causes changes in natural resources, such as pasture and water (Loth, 2004).

The Waza Logone floodplain functions as a large natural 'compensation reservoir': the flood level is lowered, and flood flows are distributed more uniformly, over a larger area, thereby channeling large volumes of water into shallow inundations through which flow infiltrates, evaporates and evapo-

transpirates (Naah, 1990). Through this process, pastures can be irrigated, the water table is normalized and suitable habitat is created for fish reproduction and growth. The Waza Logone floodplain can regionally be considered as the most productive in terms of fisheries and non-systematic flood-retreat cropping, but also as an alternative food and water source for livestock and wild animals. After the water recedes, the remaining lakes and waterholes attract fishermen from the surrounding communities (LCBC, 2007).

In the past, two principle seasonal rivers originating from the Mandara Mountains – the Mayo Tshanaga and Mayo Boula – also contributed to the inundation of the Waza Logone floodplain. Nowadays, their entire flow is captured by the Maga dam and their contribution to the flood has been greatly reduced.

After two watercourses, which formed an important connection between the Logone and Logomatya Rivers, were opened in 1994, the hydrological conditions of the floodplain improved. (IUCN, 1994a). Fish production also improved and grazing pastures as well as water availability for both livestock and wildlife were enhanced. The natural vegetation flourished and resident as well as migratory birds arriving from Europe during the winter months were attracted to the floodplains. During a recent flood monitoring survey Westra and Wulf (2005) estimated the average area of the floodplain that becomes flooded at 6,399 km^2.

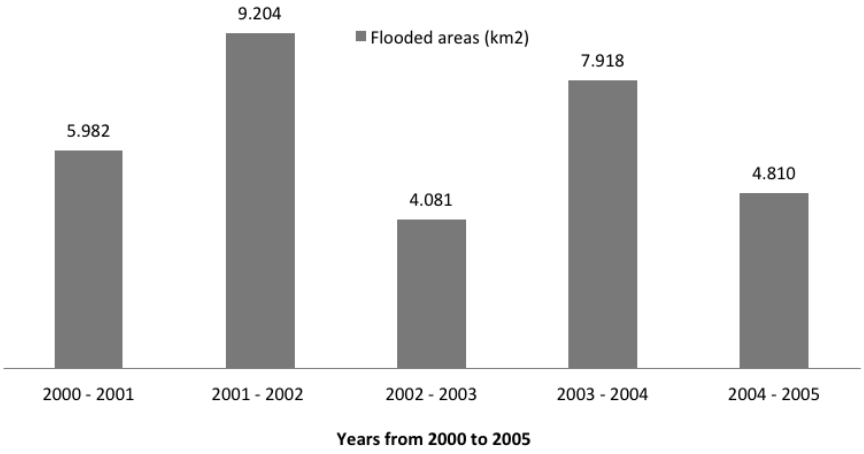

Figure 2.7
Extent of the flooding (km^2) in Waza Logone region (Cameroon and Chad) for different years (Westra-Wulf, 2005)

The annual flooding cycle also greatly influences the vegetation (Scholte *et al.,* 2006).

Naah (1990) investigated the volume of water crossing the Waza Logone floodplain. The contributions of the *mayos* (0.7 km^3/year) and the outflows at Tildé (0.5 km^3/year) appeared to be negligible, while the contributions of precipitation (6.8 km^3/year) and the Logone River (5.3 km^3/year) are globally equilibrated by evaporation (12.3 km^3/year). This evaporated volume is comparable to what was estimated by Gac (1980) over the whole of the Lake Chad Basin (28km^3/year). With a contribution of 44% to the total evaporation, the Waza Logone floodplain is indeed a major source of water in the global balance of Lake Chad (Delclaux *et al.*, 2010).

2.7 Soil

The soils (mostly vertisoils and hydromorphic soils with calcium nodules and slumping) are extremely flat and therefore not susceptible to erosion. Soils are scattered alkaline soils with bands of sandy ferruginous leached soils (LCBC, 2007). Before the construction of dykes and dams the y*aere* collected 850,000 tons of clay, silt and mineral sediment (a 'natural fertilizer') on a yearly basis, from water flowing at more than 1,500 m^3 per second (Benech *et al.,* 1982).

As the soils in the Lake Chad Basin are vulnerable to degradation, large portions of the soils of the conventional Lake Chad Basin have become degraded. Overexploitation and the use of unsustainable harvesting methods, while carrying capacity is limited, in order to meet food requirements has caused this area to be classified now as highly biologically degraded (LCBC, 2007). The widespread erosion and encrustation of allomorphic alkaline soils are clear indicators of this.

2.8 Vegetation

The strong demand for plant based materials such as fuel wood and construction wood, but also livestock fodder, foods and medicines, has strongly reduced the vegetation cover in the Lake Chad Basin (LCBC, 2007). The regeneration of the plant cover is not fast enough to meet exploitation rates, which has severely impacted certain tree species, some of which have gone extinct in this area (LCBC, 2007). Drought also forms a threat for several tree species; numbers of *Terminalia avicennoides, Anogeissus, Leiocarppus, Scleorcarya birrea*, and *Lannea spp* have gone down and, where the water table has dropped, *Acacia nilotica* has become less abundant (LCBC, 2007). On

the leached, ferruginous soils of the south-east, and the isohumid soils of the north trees are also increasingly becoming exposed to these threats.

In the Waza Logone floodplain, grasses include *Eragrotis atroviren*, *Panicum arabaptistrum*, *Hyparhenia rufa*, *Erichloa nubica*, *Vetiveria nigritana*, *Oryza longistamina*, *Pennisetum pedicelatum* and *Sorghum arunditinacum* (IUCN-WLP, 1994b). Pockets of *Echinochloa* are especially important to livestock (Scholte, 2007).

The Waza Logone floodplain has few trees. There are some forested patches or islands with *Balanites aegyptiaca*, *Bauhinia rufescen*s, *Borassus aethiopium*, *Ziziphus mauritiana*, *Calotropis procera*, *Borassus flabeliifer*, *Hyphaene thebaica* and *Acacia seyal* (Adam, 1995; Sighomnou, 2003) and a few domestic species such as *Azachdirachta indica* and *Manguifera indica* (IUCN-WLP, 1994b).

The species-poor perennial grasslands of the floodplain are typical of African seasonally flooded grasslands (Denny 1993). The floodplain contains stands of *Oryza longistaminata* and/or *Echinochloa pyramidalis,* while *Vetiveria nigritana* is more widespread, especially along drainage lines and on higher grounds. Perennial grasses are seldomly encountered on the clay soils above the present flood line, where mostly annual grasses (in particular *Sorghum arundinaceum*) and herbs occur as well as patchy thickets of *Acacia seyal* and *Piliostigma reticulatum* trees (Scholte *et al.,* 2000a).

2.9 Wildlife

The Waza Logone area contains two national parks: The Waza National Park (WNP) and the Kalamaloué National Park (KNP). The Waza National Park (1,600 km^2) has been designated as a Man-and-Biosphere Reserve by UNESCO, and originally retained large numbers of mammals and birds that depend on the annual inundation of the floodplain. The park provides suitable habitat for Elephant *(Loxodonta africana)*, Kob *(Kobus kob)*, Roan antelope *(Hypotragus equinus)*, Tsessebe (*Damaliscus lunatus*), Bohor reedbuck *(Redunca redunca),* Giraffe *(Giraffa camelopardalis)*, Lion *(Panthera leo leo)*, Serval cat (*Felis serval*), Jackal *(Canis aureus* and *Canis adustus),* Hyena *(H. hyaena* and *Crocuta crocuta),* Warthog *(Phacochoerus ethiopicus)*, and three species of primate, in addition to smaller or less abundant species (Scholte *et al.,* 1999; De Iongh *et al.,* 2004; Tchamba & Elkan, 1995). Some 379 bird species have been identified in the park, of which some depend on fish for their alimentation (Scholte *et al.,* 2000b). The Kalamaloué Park is situated in the north of Waza National Park. It covers only 45 km^2 and has become heavily degraded.