Lake Chad flooded savanna

This permanent shallow lake expands dramatically with seasonal floods, providing a vital refuge for birds migrating between the Palearctic and Afrotropical realms, and for resident animals. Up to one million waterbirds congregate on the lake in the Palearctic winter period. Located on the southern edge of the Sahara, Lake Chad is also critically important to the people who inhabit its shores. In recent years, these wetlands have come under increasing pressure from drought, plans for water resource projects, and intensified anthropogenic use. An estimated 20 million people rely on Lake Chad/ Hadejia-Nguru for their economic activities, a figure that is projected to rise to 35 million by the year 2020 (World Bank 2000).

Scientific Code
(AT0904)
Ecoregion Category
Afrotropical
Size
7,300 square miles
Status
Critical/Endangered
Habitats

Description
Location and General Description
Lake Chad contains the boundaries of four African countries: Cameroon, Chad, Niger, and Nigeria. It is the largest lake in Central and West Africa and the fourth largest lake on the African continent. The lake's waters presently cover 2,500 km2, only one-tenth the area they covered in the 1960's (FEWS 1997). The ancient Lake Chad Basin formed during the Cretaceous period, and extends over 2.5 million km2. The lake has undergone massive fluctuations in size, extending to the Tibesti Mountains in northwest Chad at one point during the Pleistocene (Monod 1963; Hughes and Hughes 1992). In recent years, severe droughts since the 1970's have decreased lake levels so that it is now extremely shallow and divided into northern and southern pools.

The climate in this ecoregion is dry, with an annual average of 320 mm of rain falling on the lake. Rainfall occurs from June through October with the northward movement of a volatile maritime air mass. Conditions are hot and dry from March through June, and dry and cooler from November through February. Evaporation is extremely high, reaching rates of 2,300 mm per year (Hammer 1986). Despite the high rates of evaporation, Lake Chad has low levels of salinity because the more saline waters sink and leave the lake through subterranean conduits in the north. These underground passageways account for 8 percent of the lake's total water outflow (Beadle 1981; Hughes and Hughes 1992).

Lake input is seasonal, the majority originating as precipitation on the Adama Plateau, brought to Lake Chad via the Chari and Logone Rivers. The Logone/Chari system is estimated to contribute 95 percent of the total riverine inflow while the Yobe River system carries less than 2.5 percent (Hughes and Hughes 1992). The lake is extremely shallow, with a maximum depth of 12 m measured in 1969 prior to the droughts of the 1970's (Jauro 1998). Today, the lake is greatly reduced in volume, and average depths vary between 1.5 and 5 m (Evans 1996) Any increase in lake volume means a substantial increase in lake area and shoreline.

The surface of the lake is covered with a mixture of island archipelagoes (23 percent), reed beds (39 percent), and open water (38 percent) (Dumont 1992). A swamp belt divides the lake into a north and south basin. Areas of open water persist in the southern basin, mostly near the Chari River inflow. Swamps are found to the west of this open water and archipelago zones are located along the northeast coast of the lake (Sarch and Birkett 2000). Vegetation in the south basin consists of Cyperus papyrus, Phragmites mauritianus, Vossia cuspidata, and other wetland plants. Phragmites australis and Typha australis grow in the more saline north basin (Beadle 1981). Occasionally, the floating plant Nile lettuce (Pistia stratiotes) covers large areas of open water (Denny 1991). Vast expanses of dark, cracking Pleistocene clays line the southern shore of the lake. Grassland communities dominate where flooding is extensive because most tree species cannot tolerate

prolonged flooding. Woody communities dominated by Acacia species grow interspersed with grasslands. These woody communities vary in density, ranging from scattered trees and bushy grasslands to woodlands and thickets. Xeric woodland species found around Lake Chad include baobabs, desert date palms, African myrrh, and Indian jujube.

'Yaére' grasslands grow on the southern lakeshore where flooding is prolonged and water depth reaches 1 m to 2 m. Vegetation consists of Echinochloa pyramidalis, Vetiveria nigritana, Oryza longistaminata, and Hyparrhenia rufa. Yaére dries up completely during the dry season. In areas with shallow and less prolonged flooding, 'karal' or 'firki' vegetation is present. Acacia seyal is the dominant species here, but is replaced by A. nilotica nilotica in depressions. Below the trees, a layer of tall herbs and coarse grasses grows to 2 to 3 m in height, including Caperonia palustris, Echinochloa colona, Hibiscus asper, Hygrophila auriculata, Sorghum purpureosericeum, and Schoenfeldia gracilis (White 1983).

An outlier of the ecoregion is found at the Hadejia-Nguru floodplain in northern Nigeria. This floodplain forms where the Hadejia River joins the Jama'are River in a vast mix of criss-crossing water channels. Wet season rainfall falls from June through September and floods the headwaters in July and August. Peak inflow to the wetlands occurs in late August, resulting in extensive shallow flooding (Hollis et al. 1993, Acreman and Hollis 1996). These wetlands cover a total area of about 6,000 km2, with a water surface area of 2,000 km2 (FAO 1997). Referred to as an inland delta, the floodplain has a maximum width of 65 km at the confluence of the two rivers, but then diminishes to a 5 km span that continues for several hundred kilometers. Many patches of higher, unflooded ground are mixed within the floodplain.

Biodiversity Features

This ecoregion has highest biological importance for the large numbers of migrant birds that use the area, especially ducks and waders that spend the Palearctic winter period in Africa. Periodic counts of waterfowl and other species have been conducted in Chad and Hadejia-Nguru from 1955 to the present day (e.g. Roux and Jarry 1984, Scott and Rose 1996). Seventeen species of waterfowl and 49 other wetland bird species are recorded, and abundance varies in different years with the size of the lake and wetlands conditions elsewhere in West Africa. The most abundant bird is the wader ruff (Philomachus pugnax), with more than one million seen on the lake at one time (Keith and Plowes 1997). In the Hadejia-Nguru wetlands the most common waterbirds are white-faced whistling duck (Dendrocygna viduata), garganey (Anas querquedula), northern pintail (Anas acuta), and ruff (Philomachus pugnax) (Garba-Boyi et al. 1993, Scott and Rose 1996, Dodman et al. 1999).

Lake Chad also supports two near-endemic bird species, the river prinia (Prinia fluviatilis) and the somewhat more widespread rusty lark (Mirafra rufa). One other bird of note is the marbled teal (Marmaronetta angustirostris), which is occasionally seen on Lake Chad and in northern Chad; it is thought to be declining worldwide.

The bird life is threatened by decreasing water levels. Recent concerns include the availability of nesting sites for the endangered West African subspecies of black-crowned crane (Balearica pavonina pavonina) and adequate wintering grounds for intercontinental migrants such as the ruff (Philomachus pugnax) (World Bank 2000, Meine and Archibald 1996).

The semi-arid Sahel savanna supports relatively few mammal species, and their population numbers tend to be low. However, the wetlands of Lake Chad and the Hadejia-Nguru wetlands formerly attracted a higher diversity and abundance of mammals. Sahelian large mammal species which used to be common in the Lake Chad ecoregion include red-fronted gazelle, dama gazelle, and dorcas gazelle (Gazella rufifrons, G. dama, G. dorcas), patas monkey (Erythrocebus patas), striped hyena (Hyaena hyaena), cheetah (Acinonyx jubatus), caracal (Felis caracal), and the endangered wild dog (Lycaon pictus) (Happold 1987). Other species were found here because of the mesic lake habitat. These included African elephant (Loxodonta africana), two species of otter (Lutra maculicollis, Aonyx capensis), hippopotamus (Hippopotamus amphibius), sitatunga (Tragelaphus spekei) and kob (Kobus kob). Populations of these mesic species were probably quite widespread when the lake was more extensive. Two near-endemic rodent species were also found, Mastomys verheyeni and the Lake Chad gerbil, Taterillus lacustris. Currently, most of the large mammals have been hunted out and replaced by large numbers of cattle. The sitatunga (Tragelaphus spekei) is now considered extinct in Niger. Only a few small, declining populations remain in the Lake Chad region of Nigeria, and no recent information is available for Chad and Cameroon (East 1999). A reduced hippo population is still present and otters remain common (Hughes and Hughes 1992). Nile crocodiles (Crocodylus niloticus) are now uncommon in the lake.

Large fish migrations correspond with seasonal inputs, the fish navigating to the rich floodplains to eat and to breed (Beadle 1981). The seasonal influx of water combines with a seasonal increase in air temperature to yield decreased salinity, increased turbidity, and increased nutrient levels. These conditions catalyze blooms of phytoplankton and zooplankton, followed by the growth of larger vegetation. An exceptionally rich fish fauna comes to capitalize on these resources; 179 different species have been counted. Many of these species are also occur in the Nile, Niger, and Zaire Rivers (Sarch and

Birkett 2000, World Bank 1993, Beadle 1981). During the Pleistocene, the Lake Chad Basin was connected more than once to the surrounding basins of the Niger, Nile, and Zaire Rivers. Today, it is only tenuously connected to the Niger Basin by the Mayo-Kebbi drainage system (Hughes and Hughes 1992). The non-migratory fish have developed adaptations to survive extended drought periods, such as air breathing or aestivating in a mucous cocoon or egg.

The decrease in crocodile and hippopotamus populations may have adversely affected fish populations. Crocodile prey heavily upon catfish (Clarias gariepensis) which consume the eggs and fry of tilapia and other cichlids. Without crocodiles to control catfish populations, the catfish reduce tilapia stocks. Hippos also maintain fish stocks by stirring up rich water sediments and increasing water fertility with their dung (Meine and Archibald 1996).

Current Status

The Lake Chad Game Reserve is currently the only protected area on Lake Chad. It occupies 7,044 km2 along 150 km of the western lakeshore in Nigeria, more than half the Nigerian shoreline of the lake (Hughes and Hughes 1992). However, East (1999) indicates that this reserve is a conservation area only in theory and that local communities have claimed the land for settlements, farms, cattle grazing and as bases for fishing. A similar situation exists in the Hadejia-Nguru wetlands where there are some forest reserves and small areas that are under National Park status, but local populations also heavily use these areas. Lake Chad poses a unique challenge for fishing regulations because it lies within four different countries. Systems of regulating access to fishing were recently created. Taking Nigeria as an example, Sarch (2000) shows that regulations are very complicated and haphazardly enforced, with confusion among different administrative agencies over regulation and taxation.

In July 2000, the Lake Chad Basin Commission (LCBC) met and declared all of Lake Chad a transboundary Ramsar site of international importance. A Global Environmental Facility (GEF) project has been approved for Ramsar designation, including a management plan for the lake and the basin. World Wide Fund for Nature's Living Waters Campaign is in the process of awarding grants to each of the LCBC member countries to assist in the designation of related Ramsar sites in each country.

The Hadejia-Nguru Wetlands Conservation Project was started in 1985, as a joint undertaking by IUCN, BirdLife International and the Nigerian Conservation Foundation. In 1990, the European Community started a major development project that included the eastern part of this area. The North East Arid Zone Development Project (NEAZDP) has a large budget to generate village-based initiatives, and it has partly focused on the potential resources of the wetlands (FAO 1997).

Disagreements over water use can become volatile, sparking conflicts between neighboring provinces and countries (Hollis et al. 1993). The Lake Chad Basin Commission was formed in 1964 to regulate and plan uses of the water and natural resources within the Lake Chad Basin. The commission has mostly concentrated on coping with the extended droughts that devastated this region between 1973 and 1983-84. Cameroon, Chad, Niger, and Nigeria were founding members of the commission. The Central African Republic was admitted in 1994; Sudan was admitted in 2000 (Jauro 1998).

Types and Severity of Threats

Severe drought through the 1970s devastated the Sahelian region. The persistent drought and desertification led to decreased inflows into the lake, and the lake shrank from a 25,000 km2 surface area in the 1960s to 2500 km2 in recent years. The intense drought increased human pressure on the dwindling lake, and the entire ecosystem of the extended Lake Chad Basin was destabilized (Jarou 1998).

The Lake Chad Basin contains some of the poorest countries in the world, and permanent infrastructure cannot be installed on the lake's ever-fluctuating shores, compromising significant development. Because of the variable lake size, people living around its basin are chronically vulnerable to food instability (FEWS 1997). Pressures to utilize the lake's and its tributaries' water resources are high in this arid Sahelian region, and a number of ambitious irrigation projects have been planned. The South Chad Irrigation Project (SCIP) began in 1979 with the goal of irrigating the lands surrounding Lake Chad. The project has a gross area of 660 km2 and would divert approximately 3 percent of the annual inflow to the lake. While two of the three stages of the project have been completed, the project was put on hold during the disastrous droughts. The installations are being maintained in good condition awaiting the recovery of the lake (Evans 1996).

One major project promoted by the Lake Chad Basin Commission aims to replenish the Lake Chad Basin by augmenting it with water from the Zaire River Basin. Still in the conceptual stage, this plan proposes moving 100 billion m3 of water annually from the Zaire River in a navigable canal 2,400 km in length. This project involves constructing dams at the donor and receiving basins, which would then be used to produce electricity. An area of between 50,000 to 70,000 km2 in the Lake Chad Basin would be put under extensive irrigation development as a result (Jerou 1998).

The Hadejia-Nguru wetlands have also come under increasing pressure from drought and water resource projects. Water is stored upstream in dams, diverted past the wetlands for agricultural use downstream, and human activities within the wetlands are intensifying (Barbier et al. 1997). These wetlands are known as an important center of fish production, a resource that is increasingly threatened by water resource projects. The extent of irrigation within the wetlands greatly increased after the introduction of small gasoline-powered pumps (FAO 1997).

Dam construction has far-reaching repercussions. Dams change the timing and extent of seasonal flooding as well as disrupting fish migrations. Salinization of the soil is increasing, partially due to irrigation, but also due to the natural water seepage and evaporation. This may halt large-scale agricultural expansion (Hughes and Hughes 1992).

The fish populations in the lake have suffered declines recently from drought, overfishing, diversion or blockage of instream flows, and increased juvenile catch due to use of smaller mesh (World Bank 2000). The most important fish in Lake Chad are the characin (Alestes baremoze) and the Nile perch (Lates niloticus). Characin populations have decreased drastically while Nile perch catch-sizes have decreased substantially so that they seldom exceed 5 to 8 kg in weight (Keith and Plowes 1997).

The World Bank recently voted to fund the development of an oilfield in southern Chad and the construction of a pipeline through Cameroon to the Atlantic Ocean. The oilfields to be developed are located in the Doba region, a part of the Lake Chad watershed. The pipeline would cross the Mbéré River that feeds into the Logone River and then into the Shari River, as well as several other tributaries of Lake Chad (World Bank 1999).

Justification of Ecoregion Delineation

As with the Inner Niger Delta, Lake Chad Flooded Savannas ecoregion was based on the ecological role it plays for migrating birds. The linework for the ecoregion boundaries around Lake Chad follow the ‘herbacious swamp and aquatic vegetation’ unit of White (1983). There is an outlying polygon of the ecoregion in Nigiera, which covers the Hadejia-Nguru wetlands. These are a similar wetland ecosystems connected to Lake Chad by rivers and providing habitat to species that still move between the two areas (especially birds).

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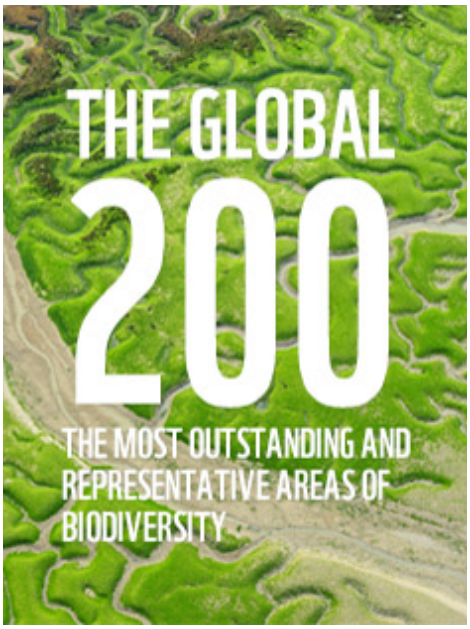

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