



Transboundary Diagnostic Analysis of the Lake Chad Basin

2018 Update

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Executive Summary

This document provides an update to the 2005 Transboundary Diagnostic Analysis (TDA) of the Lake Chad Basin, conducted as part of the Global Environment Facility (GEF) funded project, Reversal of Land and Water Degradation Trends in the Lake Chad Basin Ecosystem. This project, initiated in 2003 and completed in 2009, conducted by the Lake Chad Basin Commission (LCBC) and implemented by the United Nations Development Programme (UNDP), had as its major outputs the original TDA and a Strategic Action Programme (SAP) for the basin. The SAP provided a blueprint for a system of technical interventions and policy changes at national and regional levels, to address a set of priority transboundary problems identified in the TDA.

The Lake Chad Basin SAP was endorsed by all countries of the Lake Chad Basin in 2008 and, along with the Lake Chad Vision 2025 document, provided the vision, framework for action, and action programme which formed the basis of the Five Year Investment Programme (FYIP). The FYIP was adopted in 2012 for an implementation period of 2017-2017. Funding to realize these components was the topic for the Round Table Donors' Conference in Bologna, in April 2014. The FYIP and the donors' conference resulted in funding from the African Development Bank (AfDB), the German Federal Ministry for Economic Development (BMZ), the French Development Agency (AFD). The AfDB and GEF funded the major projects in the Lake Chad Basin, PRODEBALT and PRESIBALT.

Since the adoption of the 2008 SAP, two key developments in the basin were the reorganization of the LCBC and the adoption of the Water Charter. LCBC restructuring was recommended by the original TDA/SAP project and the restructuring process was fully implemented in 2018. The Water Charter commits the nations of the Lake Chad Basin to a set of harmonized laws and policies to protect the water and natural resources of the basin. The charter was formally approved in 2012 and as of May 2018, has been ratified by Niger, Chad, Cameroon, and Nigeria. Libya and the Central African Republic (CAR) have not yet ratified the charter, but ratification by only four countries is necessary to bring the charter into force, so implementation has been authorized to start.

In addition to the policy changes described above, other changes have taken place over the last decade in the basin. Severe drought in 2008 has brought recognition to the vulnerability of the basin's ecosystems to climate variability and change. Impacts of insecurity have escalated, with the rise of Boko Haram and other actors in the region causing a range of problems including involuntary migration, disruption of livelihoods, and of course violence and death. Combined with socio-economic distress and environmental pressures, insecurity has pushed the Lake Chad area to the point of a humanitarian crisis.

Within this context of change in the basin, and consistent with the best practices in the GEF TDA/SAP process, this document provides an update to the 2005 TDA. This update is timely, as it provides up-to-date information to support the planning process for the SAP implementation project, Regional Project for the Conservation and Sustainable Development of Lake Chad. This GEF/UNDP project was awarded in 2017 and project planning is currently underway.

This TDA update takes advantage of the increased capacity of the LCBC to collect and analyze scientific data and of several key studies that have been completed since the original TDA. Noteworthy are the Lake Chad Basin Observatory launched by the LCBC and studies produced by international partners. These include two studies produced by the German development organizations (Africa Supraregional, Adaptation to Climate Change in the Lake Chad Basin; and Report on the State of the Lake Chad Basin Ecosystem), a study produced by the French development organization AFD (Lake Chad Development and Climate Resistance Action Plan), and a variety of other new sources.

A key outcome of this TDA 2018 update was to revise the list of primary transboundary problems. The original list of seven transboundary problems was revised to the following four to respond to recent information through an updated analysis of priority transboundary issues at a workshop held by LCBC in January 2018. The key transboundary problems defined at this meeting:

- Variability in Hydrological and Hydrogeological Regimes

- Biodiversity Degradation
- Sedimentation
- Climate Variability and Change

This revised set of problems combines several of the original problems and adds the dimension of climate variability and change as a cross-cutting problem which can amplify the effects of the other three problems. At a regional workshop at LCBC headquarters in N'Djamena, these primary transboundary problems were analyzed through a causal-chain-analysis exercise. The results of this activity identified the goods and services at risk; ecosystem and socio-economic impacts; economic sectors impacted; and the immediate, underlying, and root causes of the problems.

Although not explicitly identified as priority transboundary problems, this TDA update captures other changing perspectives in the basin. These include enhanced awareness of gender issues; responses to security threats in the region; and the interlinkages among population growth, socio-economic stability, migration, climate change, and security.

This TDA update concludes that the Lake Chad basin continues to support its ecosystems and the services they provide to its inhabitants. The basin's ecosystems have evolved to be resilient and, so far, have resisted various threats. Even in its current Small Lake Chad state, the system still supports the socio-economic welfare of much of the basin's population. With population growth and the forecast for an increase in climate variability, the resources of the basin need to be managed carefully. SAP implementation will work toward that possibility.

Recommendations for continued future activities, particularly with regard to SAP implementation are the following:

- SAP actions should be oriented around a “no regrets” approach to considerations of climate variability, change, and adaptation.
- SAP formulation should include more information on stakeholder roles and their engagement during SAP implementation at regional, national, and local levels. This will also assist in the sustainability of interventions.
- LCBC should ensure that databases and analyses are continually updated and maintained to enable new basin assessments to be completed

readily. This includes information on all ecosystem and socio-economic aspects.

- LCBC should conduct basin assessments, similar in scope and scale to the 2016 State of the Basin Report, every five years or so. These assessments can provide the data necessary to support TDA updates and provide information relevant to other national and regional commitments, which include reporting for Sustainable Development Goal (SDG) progress and climate adaptation plans.
- LCBC should be prepared for emerging concerns by periodically re-evaluating monitoring needs and priorities. For example, water pollution is not currently identified as a priority transboundary threat, but as conditions change in the basin, this problem could emerge.
- LCBC should adopt a schedule for updating the TDA and reviewing SAP Ecosystem Quality and Water Resource Objectives. As part of this, the LCBC should plan now for the next TDA update to be produced internally, rather than with the assistance of external consultants.
- LCBC should undertake an initiative to track all interventions underway in the basin and evaluate the relevance of those interventions to the objectives of SAP implementation and other LCBC initiatives.



1 Introduction



1.1 Context

A Transboundary Diagnostic Analysis / Strategic Action Programme (TDA/SAP) for the Lake Chad Basin was initiated in 2003 as the major outputs of the Global Environment Facility (GEF) funded project, Reversal of Land and Water Degradation Trends in the Lake Chad Basin Ecosystem implemented by the United Nations Development Programme (UNDP) and the World Bank (WB) (IW Learn, 2003). The project had three specific outcomes:

1. Build capacity within the Lake Chad Basin Commission (LCBC) and its national committees related to success in its mandate of managing land and water resources,
2. Enhance policy initiatives and transboundary institutional mechanisms to ensure that the member countries jointly develop and manage the Lake Chad basin's resources, and
3. Conduct a TDA, implement pilot demonstration projects (ultimately with the support of the African Development Bank), design a SAP for sustainable management of the basin, and mobilize increased donor interest/support for implementing the SAP.

The original project followed a successful and well-established two-part approach, developed by the GEF for managing transboundary environmental problems. The first element of the approach, the TDA, is a technical assessment of the environmental, water resources, socio-economic, and governance conditions in the study area. Through collection of relevant data and work with stakeholders, the primary transboundary problems are identified, along with an assessment of the intermediate and root causes of the problems. The objective is to produce a factual summary of conditions in the study area, agreed upon by all participating nations, which can form the basis for developing sets of interventions to address problems in the basin. These interventions are developed in the second part of the approach, the SAP.

Changing conditions over time make it appropriate to update the TDA periodically. Since the original TDA for the Lake Chad Basin was produced in 2005 and adopted in 2007, a wide range of changes have occurred in the basin, in part due to successful interventions made pos-

sible through the TDA/SAP process and other initiatives. These changes include better and more complete data collection, national and regional institutional reforms, and refinement in the best practices for preparing TDA and SAP documents. At the time the original TDA was developed, the best practice for identifying priority transboundary problems was to focus on problems that are transboundary in scale: problems which originate in one nation and affect another. An example is the use of artificial fertilizers in an upstream nation which may cause eutrophication in downstream waters. More recently, practitioners recognized that cross-cutting problems have equal validity. In the Lake Chad Basin, climate change and variability have been identified as cross-cutting issues that threaten to amplify other priority transboundary problems.

Another critical development since the original TDA has been the deterioration of security in the region. The emergence of Boko Haram, and efforts to contain their activities, have impacted the region and its institutions in many ways, including involuntary migration of populations, loss of access to livelihoods around Lake Chad, and the disruption of the movement of goods to markets. Other forms of insecurity exist as well, which are both exacerbated by environmental problems in the basin and worsen environmental conditions. A wide range of efforts are underway to improve the environmental, socio-economic, and security conditions in the Lake Chad Basin. An update to the TDA is timely and appropriate, and can inform the updating and implementation of the SAP for the Lake Chad Basin.

1.1.1 The Interlinked Threats to the Lake Chad Basin

The ecosystems of the Lake Chad Basin are being pushed toward collapse. In recent years, the lake and riparian systems are slowly recovering from severe drought in 2008. Population growth and geographic redistributions of displaced populations have placed a heavy and growing demand on the lake's ecosystem services. Climatic variability has disrupted patterns of flooding and recession to which indigenous populations had relied upon for fishing, grazing, and agriculture.

Within this chaotic setting, conflict has emerged with Boko Haram terrorists (BHTs) occupying territory at the margins of the lake and on islands in the lake, placing local populations in danger and forcing their evacuation. Civilian and military responses to BHTs have also caused collateral damage to civilian populations. Further insecurity has resulted from conflicts between shepherds and farmers over the use of land around Lake Chad. One journalist described the situation in the Lake Chad Basin as, "... the world's most complex humanitarian disaster" (Taub 2017).

Relatively recently these problems are being recognized as all components of a single system with reinforcing feedback mechanisms. Insecurity and resource limitations outside the Lake Chad Basin create displaced populations who resettle near Lake Chad. Overuse of resources creates adverse environmental conditions, which in turn jeopardize the productivity of the region. Competition for increasingly limited resources fuels insecurity. Insecurity disrupts access to markets, worsening local poverty.

1.1.2 The Potential for Success

In spite of these dire conditions, there is the potential to stabilize environmental conditions in the Lake Chad Basin. For millennia the lake

has experienced extreme fluctuations in size. As a result, every component of the ecosystem has developed an inherent resilience allowing the system to adapt to constantly changing conditions. The human occupants have adapted as well.

Climatic variability resulting in patterns of wetting and drying along lake margins may impair fisheries, but the deposition of organic sediment may improve conditions for grazing and certain agricultural practices. In their study of livelihood dynamics in the Lake Chad area, Okpara et al. (2016) recognize that an attribute of robust societies is the capability to create livelihood options under uncertain conditions.

The international community is aware of the crisis. In 2017, United Nations Security Council (UNSC) Resolution 2349 recognized the adverse effects of climate change and insecurity on environmental and socio-economic conditions in the basin (UNSC, 2017). The UNSC has continued to monitor conditions in the basin. In January 2018 the UNSC issued a Presidential Statement on the crisis (UNSC, 2018a). In March 2018, at its 8212th Meeting the UNSC called for significant humanitarian and development action (UNSC, 2018)

Calls for action in humanitarian and international aid efforts have been met with investments from the international community. As part of its five



year investment plan, the Bologna Donor Conference in 2014 resulted in the financing of several major projects for implementation of the Lake Chad Basin Strategic Action Programme (Mahaman, 2014). In February 2017, a conference on the Lake Chad region co-hosted by Germany, Nigeria, Norway, and the United Nations took place in Oslo (Russell-Brown, n.d.). Donors pledged US\$672 million to emergency assistance and support in 2017 and beyond. The humanitarian response was scaled up significantly: more than six million people were reached with assistance in 2017, and a famine was averted in north-east Nigeria. The co-hosts from Oslo organized a second conference, held in Berlin in September 2018, to maintain momentum and expand international support (Steiner, 2018). Related efforts to address insecurity are bearing fruit. A compre-

hensive regional strategy to address root causes of insecurity has been proposed by the LCBC and the African Union Commission (LCBC & AUC 2018). If adopted, this plan has the potential to redefine some of the basic structural deficiencies in the basin associated with insecurity, governance, and socio-economic conditions.

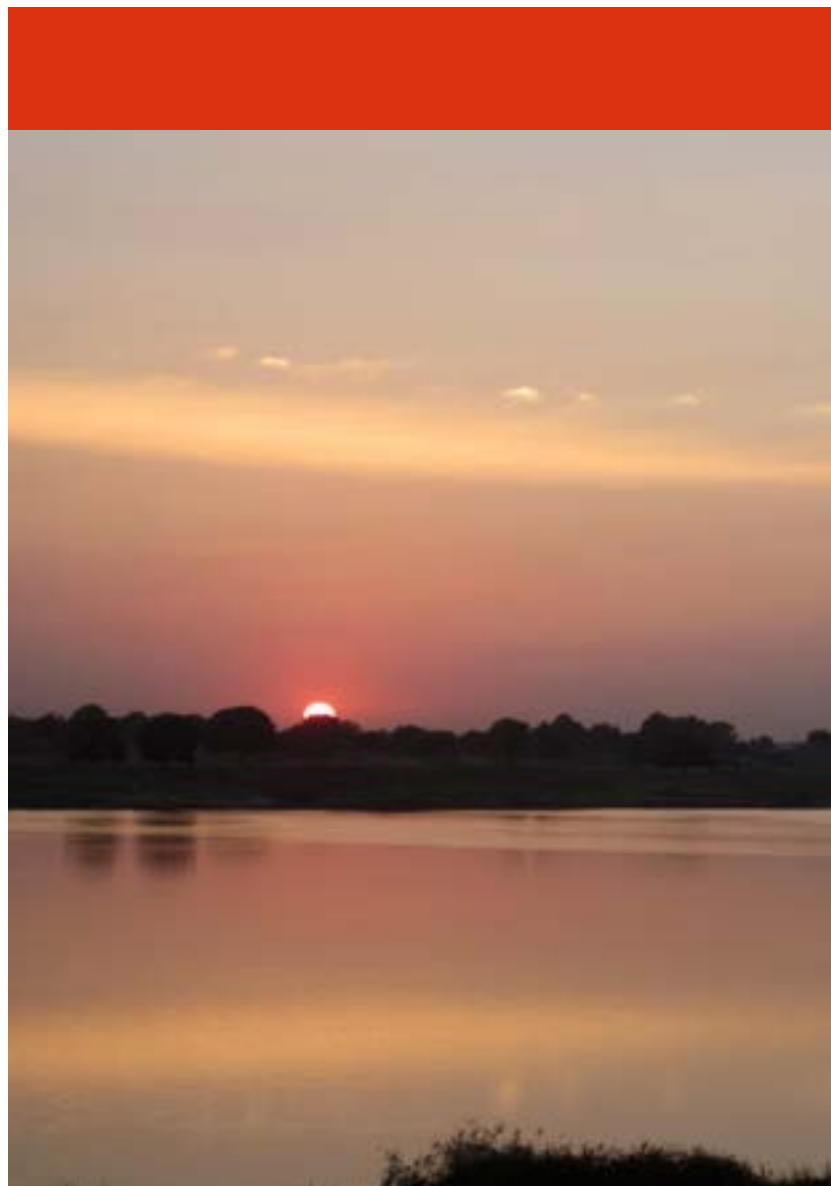
The inherent resilience that has evolved in the Lake Chad Basin provides the ecosystem with a chance for success. Clearly there are limits to which this resilience can be pushed. So far, the system has not yet reached its tipping point. With the current momentum in international aid interest in the region and with recent reorganization within the LCBC, success in creating a sustainable future for the Lake Chad Basin appears to be attainable.

1.2 Objectives

This TDA update has the following objectives:

1. Present a set of priority transboundary problems that reflect the current thinking on the nature and extent of environmental threats in the basin.
2. Identify and synthesize new information relevant to the basin.
3. Establish a protocol for the routine updating of the TDA.

Firstly, the LCBC and its partners at national and international levels recognize that a revision in the list of priority transboundary problems is appropriate and forms the core of the updated TDA. Secondly, it is the intention for this document to be brief. This document provides a concise synthesis of key developments in the basin since the original TDA. In this sense, the updated TDA can be thought of as a second volume of the Lake Chad Basin TDA. Thirdly, this document provides a template which can be used by the LCBC to produce additional volumes of the TDA on a regular basis as part of the adaptive management of the basin. External consultants have been employed to assist in the production of the original TDA and this update. An objective of this document is to establish with this document a protocol by which the LCBC can produce updates to the analysis (the TDA) periodically with inter-



2 Methodological Approach



The process of developing a TDA requires the cooperation of national teams and coordinating units at the regional level working with stakeholders to pull together scientific, socio-economic, and governance information on the basin. This process is described for the Lake Chad Basin in the original TDA, and occurred over an 18-month timeframe. This update followed a more simplified methodology and took place over less than a year. Key inputs from stakeholders and from the LCBC are summarized in Table 1 and provided the basis for a revised set of primary transboundary problems and the causal chain linking these problems with immediate, underlying, and root causes. Remaining efforts were oriented toward compiling published information, interviewing experts, and seeking feedback from the LCBC, national experts, and stakeholders.

With regard to format, rather than repeat the information presented in the original TDA, this document focuses on information and events that have occurred since the publication of the TDA. This information has been synthesized in a concise format and the reader is directed to original sources for additional detail. Sufficient background information is provided for the reader to understand the context of the new information presented.

The project team for this effort consisted of a working group at LCBC, staff from GIZ and two consultants. The LCBC working group responded to questionnaires (Annex 1) and compiled a list of relevant reports and studies (Annex 2). This information formed the basis for the updated TDA. GIZ staff facilitated communication with LCBC staff and provided logistic support for the project.

Table 1: Meetings and workshops in the development of the TDA 2018 Update

Event	Date	Description
Scoping Meeting	January 2018	LCBC and consultant met in N'Djamena to discuss scope of TDA update and determine priority transboundary issues.
LCBC Workshop	May 2018	LCBC and consultants met to review assessment of 2005 TDA, hold discussions with LCBC working group, and conduct causal chain analysis.
Regional Workshop	May 2018	National experts from Chad, Nigeria, Niger, and Central African Republic met with LCBC and consultants to review the causal chain analysis and discuss data needs.
CBC Validation Workshop	October 2018	LCBC heads of divisions, experts of the LCBC Technical Directorate, and representatives of PRESIBALT and BGR met with consultant to review the TDA 2018 update for accuracy, gaps, and relevance.
Regional Validation Workshop	February 2019	Experts from each country met with consultants for a final validation review of the TDA 2018 update document.

2.1 Recent Reports and Initiatives

This TDA update captures recent changes in the following areas:

- Scientific Studies conducted by LCBC and member states, including the Report on the State of the Lake Chad Basin Ecosystem supported by GIZ (LCBC 2013), hydrogeologic studies supported by the German BGR and IAEA, and the Joint Audit on the Drying Up of Lake Chad (GIZ 2015b).
- Governance Changes including the adoption of Vision 2025 for the Lake Chad Basin, ratification of the Water Charter, and administrative reorganization of the LCBC.
- Interventions by LCBC and donors, including the PRODEBALT and PRESIBALT projects financed by the African Development Bank, The Lake Chad Development and Climate Resilience Action Plan financed by the French AFD and World Bank CIWA, and the Lake Chad Basin Crisis Response Strategy produced by the FAO.

The LCBC working group identified over 40 reports and studies relevant to the TDA update. A bibliography of reports cited by the LCBC working group is provided in Annex 2 and reports cited in this document are listed in Section 9 References. Governance changes are described in the following section on the achievements of the original TDA and SAP and in Section 7 Governance Analysis Update.

These reports and studies reflect capacity that has been built within the LCBC since the publication of the original TDA in 2005. Examples include the launching of the Lake Chad Basin Observatory in 2010, implementation of a variety of on-the-ground projects as part of the PRODEBALT project, and real institutional reform with the reorganization of the LCBC and ratification of the Water Charter (Lee, 2017).

2.2 Changing Priorities

This TDA update reflects a change in priorities of the LCBC, based on new information and changing perspectives on basin management. The new information includes more sophisticated analysis of climate change impacts and adaptation, data compiled by the Lake Chad Basin Observatory,

and more advanced analytical capabilities. Changing perspectives include enhanced awareness of gender issues; responses to security threats in the region; and the interlinkages among migration, climate change, and security.



2.3 Revised Key Transboundary Issues

In a January 2018 workshop in N'Djamena, the LCBC revised the priority transboundary issues. The 2005 TDA defined seven primary transboundary issues:

1. Variability of hydrological regime and fresh water availability
2. Water pollution
3. Decreased viability of biological resources
4. Loss of biodiversity
5. Loss and modification of ecosystems
6. Sedimentation in rivers and water bodies as a result of land degradation
7. Invasive species

Discussions within LCBC identified that in some cases there was insufficient information to sustain a priority issue (Problem 2) and that there was considerable overlap between Problems 3, 4, 5 and 7 (relating to biological resources). It was recognized that greater effectiveness could be achieved by focusing on problems for which there was sufficient evidence to address the issue, whilst acknowledging that pollution should be assessed following proposed implementation of the monitoring programme planned under the UNDP/GEF SAP implementation project. The issues selected were prioritised as important based on significant regional criteria (geographical and temporal scale, impacts, links with other transboundary issues, multiple benefits, lack of progress in addressing issues, etc.)

The original seven priority transboundary issues were revised to the following four:

TB Problem 1: Variability in Hydrological and Hydrogeological Regime. Similar to *Variability of Hydrological Regime and Fresh Water Availability* in the 2005 TDA, but adds groundwater considerations.

TB Problem 2: Biodiversity Degradation. Combines *Decreased Viability of Biological Resources, Loss and Modification of Ecosystems, and Invasive Species*.

TB Problem 3: Sedimentation. Unchanged from *Sedimentation in Rivers and Water Bodies as a Result of Upstream Land Degradation*.

TB Problem 4: Climate Variability and Change. A new cross-cutting issue.

The transboundary problem Water Pollution, in the 2005 TDA was removed completely. LCBC determined that existing monitoring data do not indicate that pollution is currently a significant problem in the basin. Monitoring continues in the basin and the LCBC will keep this transboundary issue 'under review' until data indicates if water pollution is an emerging concern. This will be considered during future updates of the TDA undertaken by LCBC.

In addition, the security situation in the basin was identified as an additional cross-cutting transboundary problem that was not included in the 2005 TDA. Whilst many of the causes of insecurity are beyond the scope of the TDA (and the subsequent SAP) it was recognized to be important by the LCBC workshop to consider the effects of insecurity on the key transboundary issues presented above. The role of insecurity in the basin is complex and can be considered both a root cause and at the same time, co-dependent with climate change, institutional instability, and environmental degradation. In this TDA update, rather than identify insecurity as a separate primary transboundary problem, insecurity is considered as a threat multiplier, along with climate change, acting to intensify the four primary transboundary problems.

3 Achievements of the TDA / SAP



The 2005 TDA and 2008 SAP were influential in bringing together scientific, socio-economic, and governance information on the Lake Chad Basin, identifying a set of strategic actions to realize basin-wide goals for addressing environmental and socio-economic problems in the basin, and

on mobilizing support for realizing those goals. The first activities of the TDA update were to review the 2005 TDA and summarize the impacts of the 2005 TDA and 2008 SAP. This information then guided the development of recommendations for the focus and content of the revised TDA.

3.1 Review of 2005 TDA

A critical evaluation of the 2005 TDA was conducted to assess the strengths, weaknesses and information gaps in the report. This evaluation was submitted to the LCBC in early May 2018. Written responses were provided by LCBC prior to the LCBC and regional workshops held in N'Djamena in late May 2018. The assessment was presented and discussed at the LCBC workshop. The full text of the assessment and LCBC comments are presented in Annex 3 and are summarized here.

An earlier assessment of the 2005 TDA was conducted by the GEF in 2013 as a case study in their revised Transboundary Diagnostic Analysis / Strategic Action Programme Manual, Volume 1: Introduction to the TDA Process (GEF 2013). Their assessment found the following:

Strengths: The TDA was clear and logical and was completed in 18 months, was adopted by the steering committee and the nations, followed best practices for preparing TDAs, and provided a good foundation for the SAP document.

Weaknesses: Initial problems with poor project management and a lack of strategic direction, poor participation among nations, and problems with data availability and quality. The TDA and SAP process were driven by external consultants rather than the Project Coordination Unit and the countries, which resulted in a lack of collaboration and consultation.

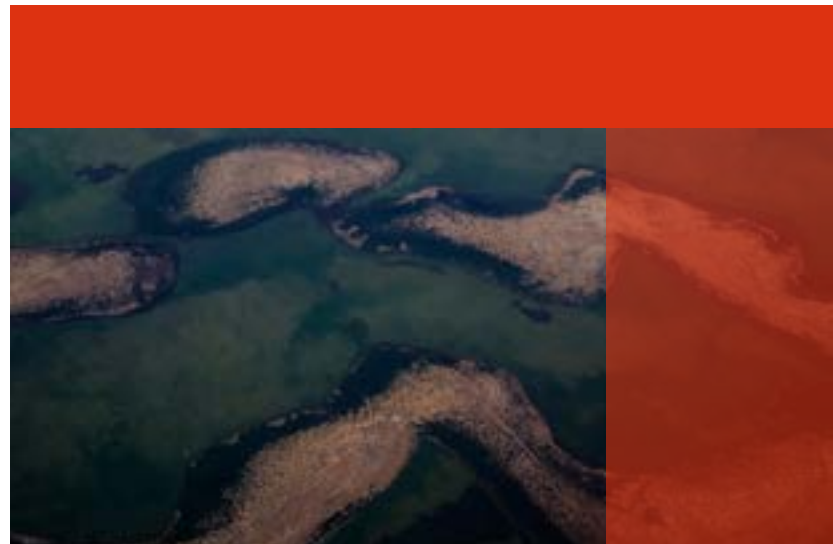
Overall, the assessment concludes that the 2005 TDA provides a thorough technical analysis of priority threats to the Lake Chad Basin. The only significant deficiencies in the document were an incomplete Stakeholder Analysis and a somewhat limited Governance Analysis. The Baseline Information chapter was thorough and up to date for 2005, but needs to be updated to capture more

recent data, studies, and events which have taken place since 2005. The LCBC responded in writing to the assessment with clarifications for some parts of the assessment and comments on others. Their full response is provided in Annex 3.

The TDA assessment was presented at the Regional Workshop on 25 May 2018 to a panel of national experts from participating countries. The panel commented as follows:

- The panel asked for clarification on the socio-economic analysis;
- Commented that security issues need to be expanded to include human trafficking, socio-economic impacts, and cross-border crime; and
- Commented that more detailed information needs to be included on the geology of the basin and mining activities in the basin.

The TDA assessment, written comments, and discussion points have been integrated into later sections of this document.



3.2 Impact of the 2005 TDA and 2008 SAP

The TDA / SAP process was highly influential in identifying priority areas of development and investments in subsequent years. The 2008 SAP document proposed a set of interventions designed to meet targets for desired future conditions in the basin. These targets were organized in terms of five ecosystem quality and water resource objectives. The process of identifying goals, targets, and interventions was driven by the findings of the 2005 TDA (priority transboundary problems), and was also guided by the vision documents for Africa and for Lake Chad. To quote from the 2008 SAP,

The SAP evolves from the kinds of goals and objectives that are articulated in The Africa Water Vision for 2025: Equitable and Sustainable Use of Water for Socioeconomic Development (Africa Water Vision) and Lake Chad Vision 2025 (Vision 2025) consequently developed by the LCBC.

LCBC, 2008, Page 4

The Lake Chad Vision 2025 document established two principal objectives, which were consistent with the Africa Vision (Consult, n.d.):

- *A Lake Chad Region where the regional and national authorities accept responsibilities for freshwater, ecosystem and biodiversity conservation and judicious integrated river basin management to achieve sustainable development.*
- *A Lake Chad Region where every Member State has equitable access to safe and adequate water resources to meet its needs and rights and maintain its freshwater, ecosystem and biodiversity resources.*

The Lake Chad Vision 2025 document was adopted by the Summit of the LCBC Heads of State in 2008, the same year as the SAP (Bila, 2018). Vision 2025 and the 2008 SAP provided the vision, framework for action, and action programme which formed the basis of the Five Year Investment Plan (FYIP), which was adopted in April 2012, for an implementation period of 2013 – 2017 (Abdullahi, 2014). The FYIP had three components:

1. Sustainably managing the natural resources and preservation of the ecosystems of the Lake Chad Basin.
2. Enhance the quality and the quantity of the waters of the Lake Chad Basin;
3. Execute the National Action Plans (NAPs) of the Integrated Water Resources Management (IWRM) of the Member States of the Lake Chad Basin.

Funding to realize these components was the topic for the Round Table Donors' Conference in Bologna, in April 2014. The FYIP and the donors' conference resulted in funding from the African Development Bank (AfDB), the German Federal Ministry for Economic Development (BMZ), the French Development Agency (AFD). Two major projects have been launched in the Lake Chad Basin as a result of the SAP. The AfDB funded the PRODEBALT project, and AfDB and GEF funded the PRESIBALT project. Table 2 provides a summary of these projects and their scopes. Both projects support implementation of the SAP.

Table 2: Key interventions resulting from the 2008 SAP

Project Details	Overview
PRODEBALT Lake Chad Basin Sustainable Development Programme 2009 – 2015 41.84 billion CFA francs Funded by African Development Bank	Project goal was to sustainably reduce poverty among the population dependent on the resources of Lake Chad and its basin. “PRODEBALT has been formulated to implement the Strategic Action Plan (SAP) Prepared by the LCBC with the support of GEF/ World Bank (About-Sabaa, Ken Johm, & Traore, 2008).” The project had three technical components: 1. Protection of Lake Chad and its basin. Outputs were oriented around landscape management, control of invasive species, sediment control, and reservoir management. 2. Adaption of production systems to climate change. Work elements included groundwater monitoring; forestry, pasture, and fishery management; encouraging socio-economic growth; and public health improvements. 3. Institutional support. Capacity building in areas of stakeholder skills, LCBC institutional capacity (e.g., strengthening of Lake Basin Observatory), research on sediment control; and work toward trans-basin water transfer project.
PRESIBALT Programme to Rehabilitate and Strengthen the Resilience of Socio-ecological Systems in the Lake Chad Basin 2015 - 2020 53.82 billion CFA francs Funded by African Development Bank and Global Environment Facility.	Project goal was to build the resilience of socio-ecological systems for sustainable and inclusive development in the Lake Chad Basin (Tounkara, 2015). Project outcomes were: 1. Preservation and development of water resources. Projects oriented around silt and erosion control, improved meteorological and hydrologic monitoring systems, and small-scale water supply systems. 2. Development of ecological resources and service as well as value chains. Work areas included projects to stimulate socio-economic growth and sustainable energy systems, promoting gender equality, and the creation of a transboundary biosphere reserve and world heritage site. 3. Institutional development and programme management. Activities included strengthening local governance capacity and related gender equality.

Governmental and UN organizations, among others, have contributed to the knowledge base and capacity building within LCBC. The German Federal Institute for Geosciences and Natural Resources (BGR) and the German Development organization GIZ produced the Africa Supraregional, Adaptation to Climate Change in the Lake Chad Basin study (GIZ 2015), GIZ worked in partnership with the LCBC to produce the Report on the State of the Lake Chad Basin Ecosystem (LCBC 2013). The German Federal Institute for Geosciences and Natural Resources (BGR) built the capacity of the LCBC to conduct and produce a series of studies on the hydrogeology of the Lake Chad basin (Vassolo, Dr., n.d.). The French Development Agency (AFD) and the World Bank program Cooperation in International Waters in Africa (CIWA) produced the Lake Chad Development and Climate Resilience Action Plan (World Bank 2016). As part of their SAHEL initiative the International Atomic Energy Agency built the capacity of LCBC mem-

ber states to apply isotope hydrology approaches to further characterize the hydrogeology of the basin in their project, Integrated and Sustainable Management of the Shared Aquifer Systems of the Sahel Region (IAEA 2017). While not all of these projects were made directly possible as a result of the TDA / SAP initiatives, their scopes of activities were all consistent with the technical needs of the TDA and the strategic interventions of the SAP.

A second impact of the TDA / SAP process was the restructuring of the LCBC. An output of the GEF project that produced the TDA / SAP was an Institutional Assessment (IA) of the LCBC. The IA proposed solutions to the various problems the institution was facing. The IA produced three reports with the final report issued in June 2008. In 2010, the first stage in the restructuring process was carried out, with new job descriptions based on a revised organizational chart recommended by the IA reports. This new organizational chart

was designed to support SAP implementation. The second phase of reorganization was carried out from 2013 to 2018 and reorganization was fully launched in May 2018 (LCBC, 2018).

A third major impact of the TDA / SAP process was the adoption of the Water Charter for the Lake Chad Basin (LCBC, 2011). The Water Charter commits the nations of the Lake Chad Basin to a set of harmonized laws and policies to protect the water and natural resources of the basin. The Water Charter was formally approved at the 14th Summit of the LCBC Heads of State held in April 2012 (LCBC, n.d.). As of May 2018, the Water Charter has been ratified by Niger, Chad, Cameroon, and Nigeria. Libya and CAR have not yet ratified the Water Charter, but ratification by only four countries is necessary to bring the charter into

force, so implementation has been authorized to start. Appendices to the Water Charter provide the technical basis for implementation and are themselves a significant undertaking. To date, five appendices have been completed. A fourth impact of the TDA / SAP process was the award in 2017 of the GEF/UNDP SAP Implementation Project, Regional Project for the Conservation and Sustainable Development of Lake Chad (UNDP, n.d.). Planning of this project is underway and the updated TDA will support the planning process.

SAP implementation at the national level includes water resources management plans and strategic action plans for the Komadugu Yobe Basin in Nigeria, a GEF/UNDP project to enhance resilience in Niger (PANA), and for climate change adaptation projects in Chad (AMCC) and Nigeria (BNRCC).

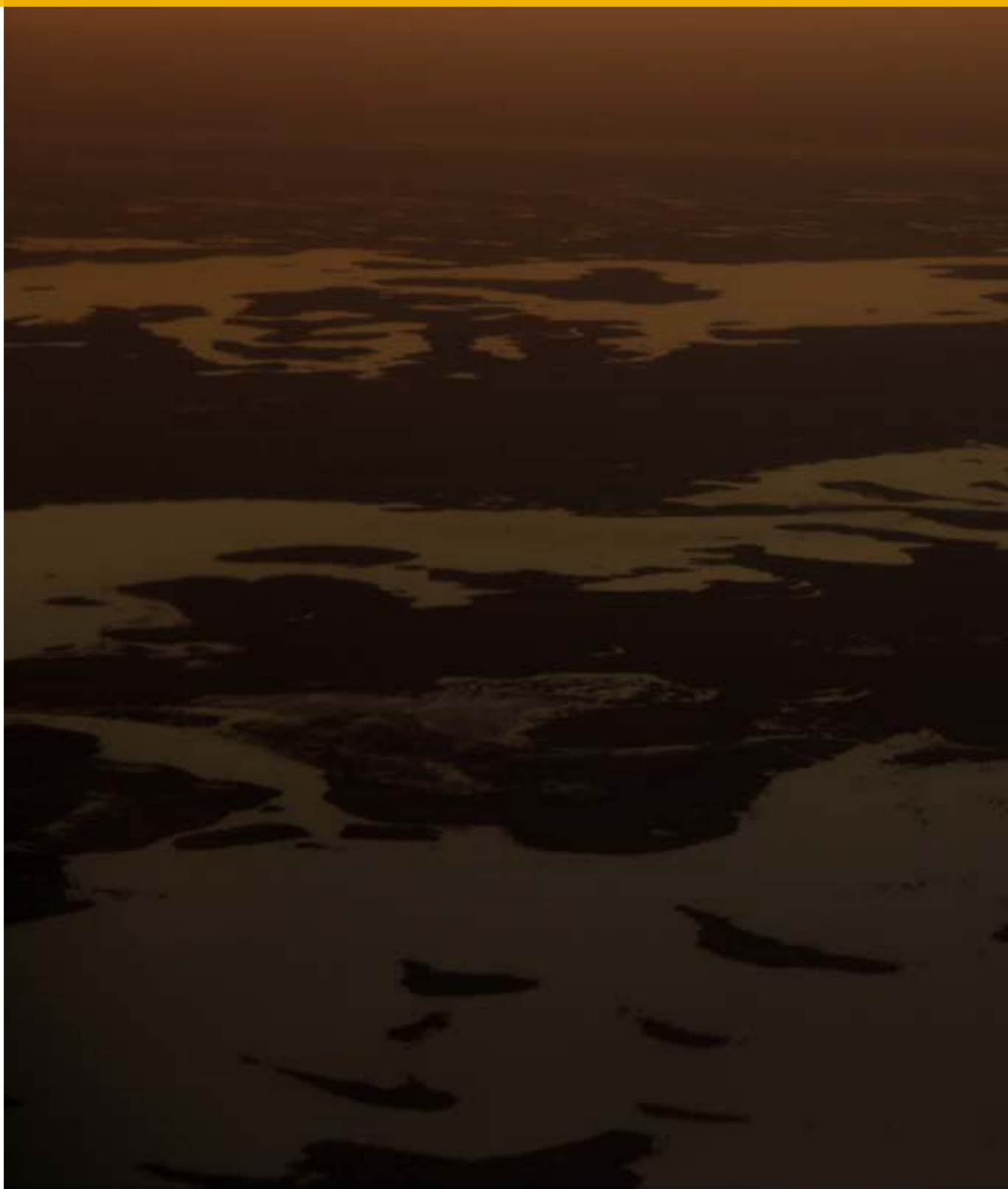
3.3 Summary Recommendations

The updated TDA builds on a thorough and effective 2005 TDA and 2008 SAP. Factors affecting the focus of the revised TDA include the following:

- A revised set of priority transboundary problems that is simplified and reflect a better understanding of the ecosystem
- Recognition of the importance of climate variability and change in the system
- Response to the complex role that insecurity plays in the basin
- Inclusion of gender equality
- More attention to the role of groundwater in the basin
- Attention to building the capacity of LCBC to produce future TDA updates internally, rather than through external consultants.

Since the publication of the 2005 TDA, much new information has become available, and climate change and insecurity have emerged as important drivers in the management of the basin. The speed and magnitude of change in the basin argues for routine updating of the TDA and for building the capacity within LCBC to manage these updates.

4 Update of Baseline Information



4.1 Geographical Scope

The Lake Chad Basin is situated in north-central and west Africa (Figure 1) within a closed basin occupying a climatic gradient which is humid and tropical in the south (Sudanese), moderately arid in the central basin (Sahelian), and highly arid in the north (Saharan) (Figure 2). Nearly all of the basin in the Saharan zone to the north is topographically connected to Lake Chad, but contributes no surface water flow to the lake. The hydrologically active part of the basin is known as the conventional basin or the active basin (Figure 1). Shallow bathymetry (as shallow as 1.5 m average

depth depending on hydrologic conditions), combined with highly variable inflows, result in wide ranges in the size of the lake over time.

Additional Resources

The State of the Basin Report provides facts and figures at a glance for each country and for the complete basin.

LCBC 2013, Pages 24-25

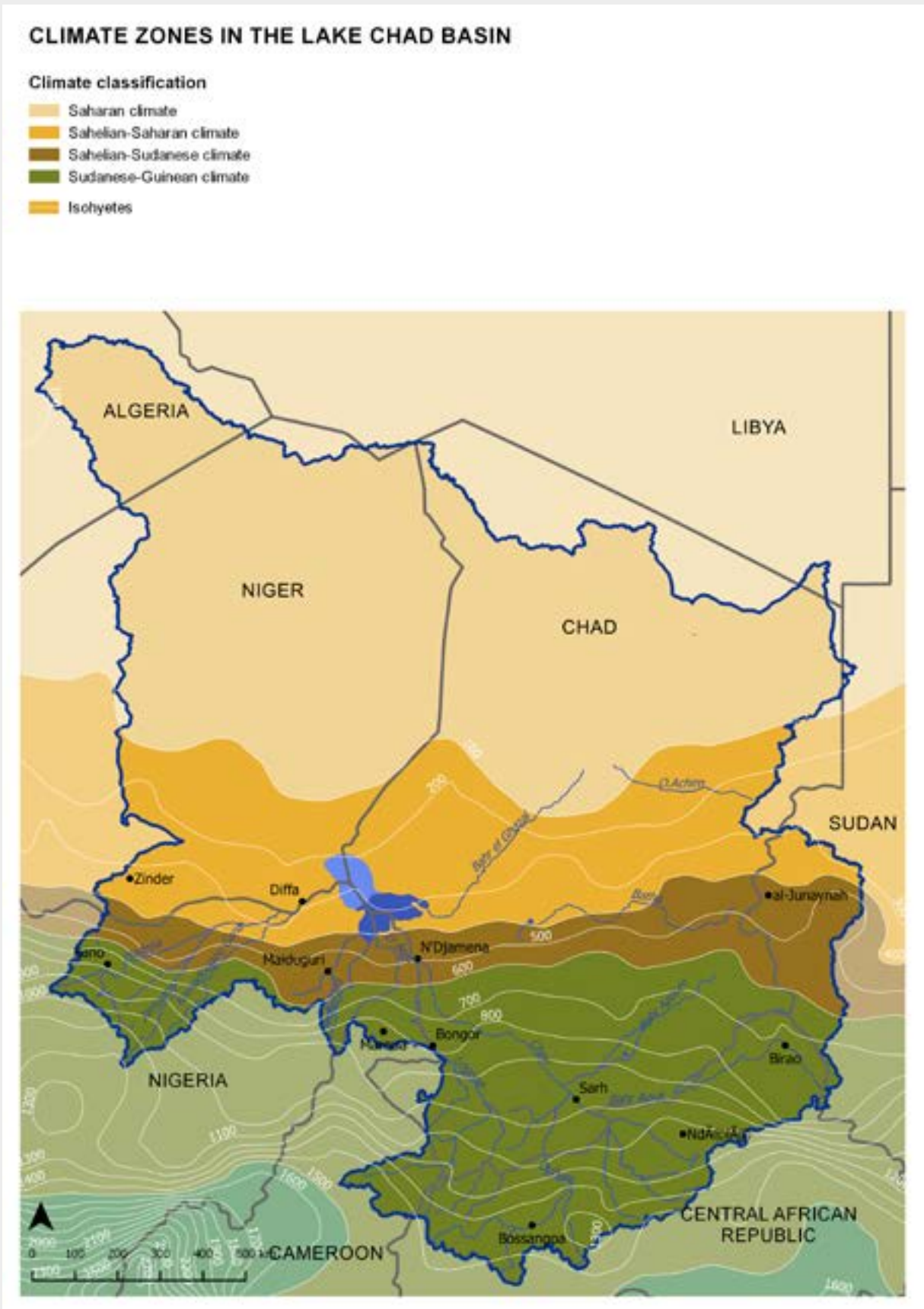


Figure 1 Delimitations in the Lake Chad Basin



Source: State of Basin Report, Page 32 (LCBC 2013).

Figure 2 Climatic zones in the Lake Chad Basin.



Source: State of Basin Report, Page 45 (LCBC 2013).

In the past ten thousand years, the lake has varied in size from about 2,000 km² to 25,000 km² (Figure 3). During the last glacial period, when north Africa was under humid conditions, the lake extended far beyond its current size and occupied what is known as Mega Lake Chad. This was a time of high rates of recharge to aquifer systems in north Africa. Because

of the frequency and magnitude of fluctuations in the size of the lake, no single measure of lake extent or volume can really characterize the lake. Tilho (1928) proposed a classification scheme of three lake size categories, which was recently modified by the French Research Institute for Development (IRD, 2012) to include a fourth category (Table 3).

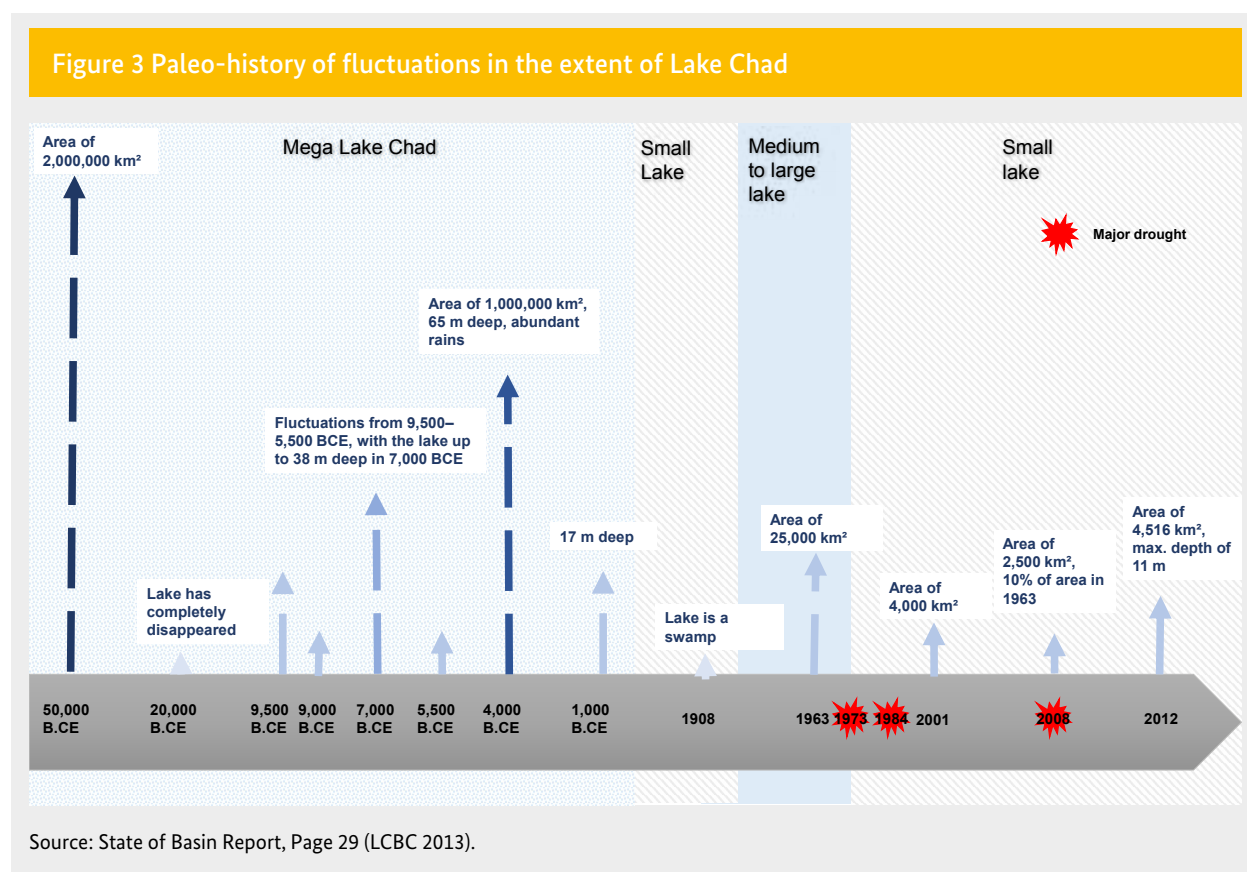


Table 3 The state of Lake Chad in different periods

State of Lake Chad	Small and dry	Small	Medium	Large
Categorization by	IRD	Tilho	Tilho	Tilho
Flow rate of the Chari-Logone River (km ³ per year)	<15	15-34	35-43	>43
Water level (m)	Northern pool dry	Different levels	280-282	>282.3
Number of water bodies	Several	Several	One	One
Area of the lake under water (km ²)	2,000-6,000	2,000-14,000	15,000-19,000	20,000-25,000
Area of the lake under water in its northern pool (km ²)	0	0-8,000	9,000	10,000
Main land typologies	Swamp and savannah	Swamp	Dune archipelago	Open water
Aquatic vegetation	++	+++	++	+

Source: State of Basin, Page 29 (LCBC 2013).

Within the past five decades, the lake has occupied all four size categories at various times. For most of the 20th century, the lake remained within the Medium Lake Chad size category, growing to Large Lake Chad during two exceptionally wet

periods. A severe and prolonged drought from 1973 to 1985 pushed the lake into the Small Lake Chad configuration and it has remained in that size range since, with a severe drought occurring again in 2008.

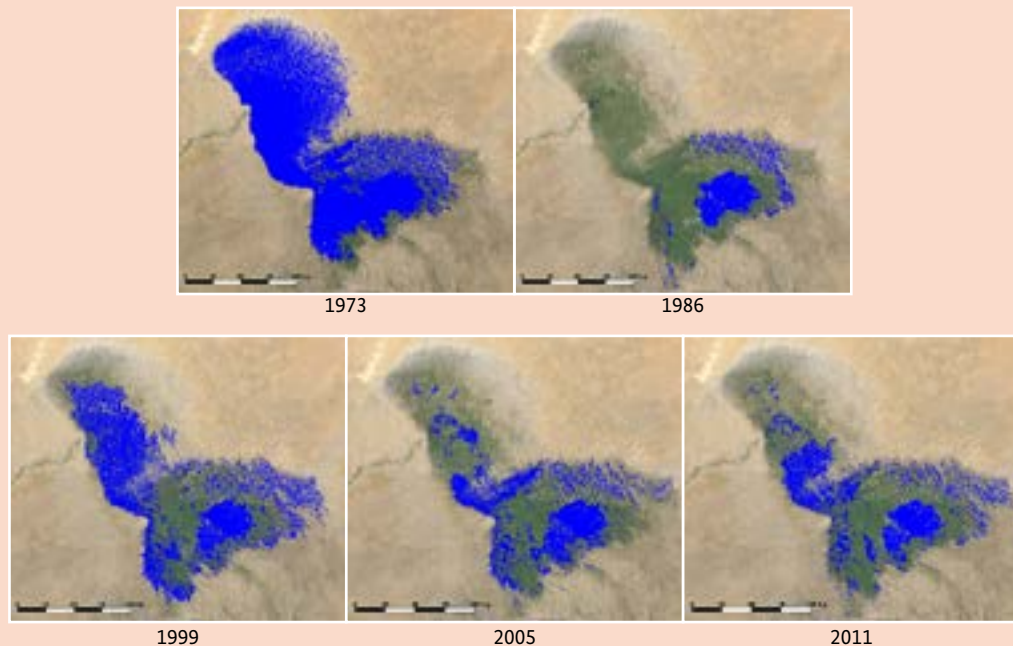
The Unique Lake Chad System

The Lake Chad Basin has two unusual characteristics, which would normally result in ecosystem impairment or collapse, but which instead support its inherent resilience.

Closed Basin: In the absence of an outflow and under high rates of evaporation, closed-basin lakes commonly have high salt content. Examples are the Dead Sea and the Great Salt Lake. In fact, the water balance presented in Table 6 shows that the magnitude of evaporation in the system almost equals the combined inflows of the rivers. The lake is able to maintain soft-water conditions due to discharge of lake water to groundwater systems.

Hydrologic Variability: The dramatic and well-known image below demonstrates the massive swings in surface area that Lake Chad has undergone in recent decades. This variability is due to a combination of hydrologic variability and the broad, shallow topography of the lake bed. The observed losses of up to 90% of the surface area over such a short period of time can cause ecosystem collapse in many lake systems. A well-known example is the Aral Sea. However, Lake Chad continues to support fisheries in the remaining lake areas and agriculture and grazing on the lake margins exposed as the lake dries. Paleo-hydrologic studies indicate that high magnitudes of variability have always been present. As a result, the ecosystems of the basin evolved, and the human occupants have learned, to adapt to highly variable conditions.

This inherent resilience, combined with the lake's natural mechanisms of salt-regulation, provide the potential for successful conservation and restoration efforts.



Source: State of Basin Report, Page 30 (LCBC 2013).

Lake Chad is fed by two major river basins (Figure 1). The Chari – Logone river system has its headwaters in the Central African Republic (CAR) and Cameroon, enters the south basin of the lake, and provides over 90 percent of surface inflows to the lake. The Komadugu – Yobe river system has

its headwaters in Nigeria and Niger and enters the north basin of the lake. A third and much smaller system consists of the El Beid, Yedeseram and Ngadda rivers, which flow into the southern basin of Lake Chad. These were referred to collectively by Kindler et al. (1989) as the Borno Basins.

Table 4 Water balances for Lake Chad under Medium and Small conditions

	Medium Lake Chad (1954- 1969) km ³ /year	Small Lake Chad (1988 -2010) km ³ /year
	Gains	
Chari	42.0	21.1
El Beid	1.5	0.3
Komadugu-Yobe	0.7	0.5
Direct rainfall	7.4	1.9
Total	51.6	23.8
	Losses	
Evaporation	48.8	22.6
Net infiltration	2.3	1.0
Overflows	0.2	0.0
Total	51.3	23.6

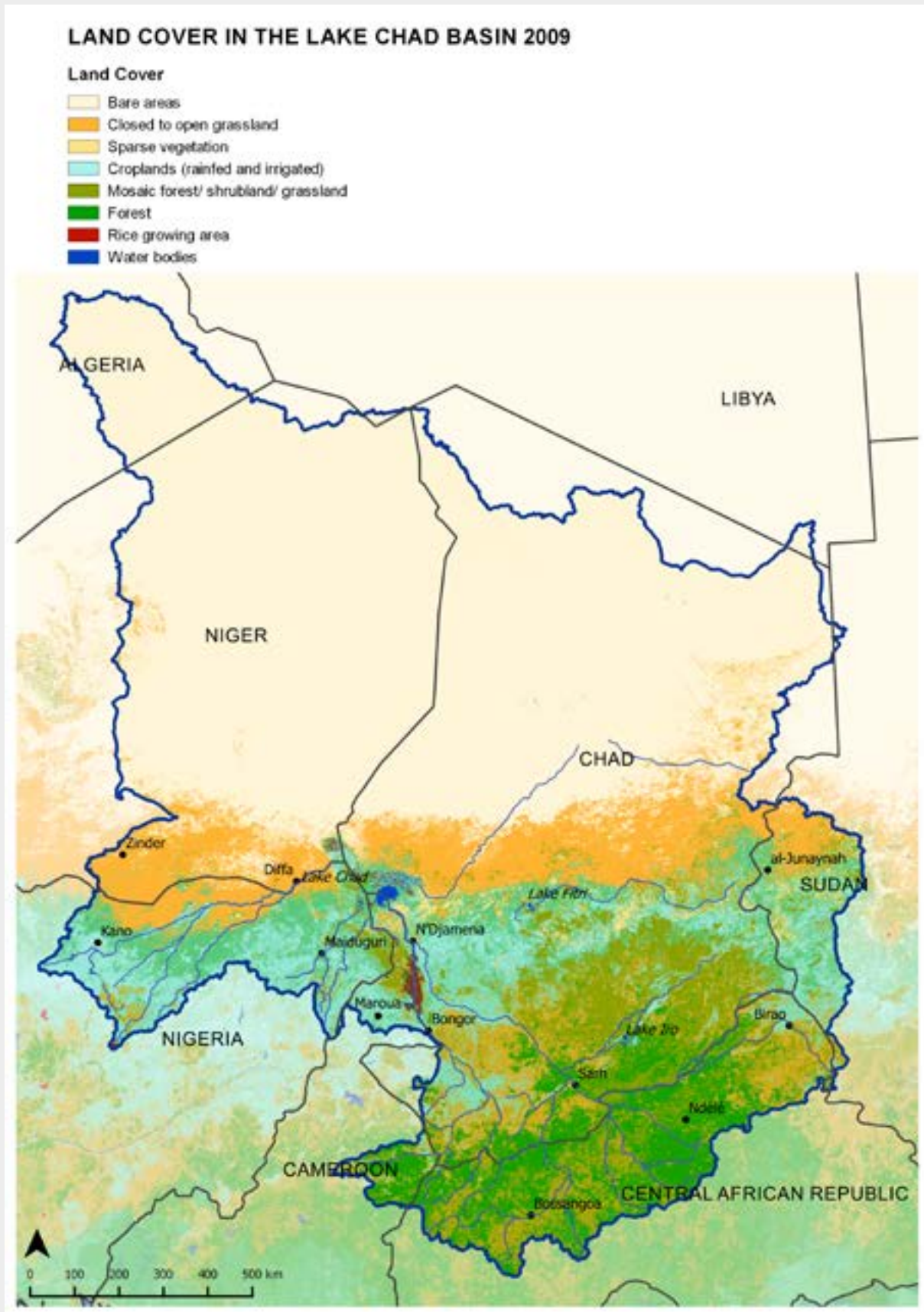
Source: State of Basin, Page 143 (LCBC 2013).

The Lake Chad Basin supports a wide range of ecosystems (Figure 4), from forests in the southernmost tropical (Sudanese – Guinean climate) regions of CAR, to hyper-arid desert, occupying the northern third of the topographic basin and more or less defining the northern boundary of the conventional basin. The basin also supports significant wetland areas within the lake itself and along riparian zones in locations that are in close hydrologic interaction with the aquifer systems.

These ecosystems are undergoing change brought about by human impacts, which have increased

in magnitude with growing population pressure in the region, and by a changing climate. These impacts and their causes are explored in greater detail elsewhere in this report, but several important changes in the ecosystems of the Lake Chad Basin are underway. One example is a southward progression of the climatic zones shown in Figure 2 due to climate change. Human-caused changes in the ecosystems include desertification, erosion, and sedimentation caused by over-grazing; and deforestation associated with collection of wood for fuel.

Figure 4 Land cover in the Lake Chad Basin



Source: State of Basin Report, Page 50 (LCBC 2013).

4.2 Lake Chad Sub-basins

The 2005 TDA provided descriptions of the water resources, ecological resources, and human resources (ethnography and socio-economic profiles) for each of eight sub-basins and referred to as diagnostic basins. These particular sub-basins were defined in the original diagnostic study of the basin conducted by Kindler et al. (1989). The 2005 TDA and Kindler et al. (1989) can be consulted for detailed information on each of these sub-basins. Because subsequent studies and projects in the Lake Chad Basin did not continue to use these basin distinctions, this report provides summary information on Lake Chad and its two major hydrologic basins.

Additional Resources

The State of the Basin Report provides detailed information on the Chari-Logone and Komadugu-Yobe basins of the Lake Chad Basin.

LCBC 2013, Pages 126-129

4.2.1 Lake Chad

In the past several decades, Lake Chad has been in the Small Lake Chad category, which features extensive wetlands and islands, and distinct northern and southern basins separated by a sill known as the Great Barrier (Figure 5). The only large open-water areas are in the southern basin. In the Small Lake Chad condition, the lake is sufficiently shallow and covered with vegetation, that the entire system can be thought of as a wetland. Since 1973, the size of Lake Chad has varied from about 8,000 to 17,000 km² and as of 2012 was about 12,000 km² (LCBC 2013, Page 143).

Lake Chad supports an ecosystem that drives the economy of the region. As shown in Figure 6, fish, livestock, and agricultural goods produced in or nearby Lake Chad find market destinations primarily in Maduguri, Nigeria and N'Djamena, Chad, but also support market needs in Niger to the west and rural Chad to the northeast. See Section 4.7.3 below for more information on market products.

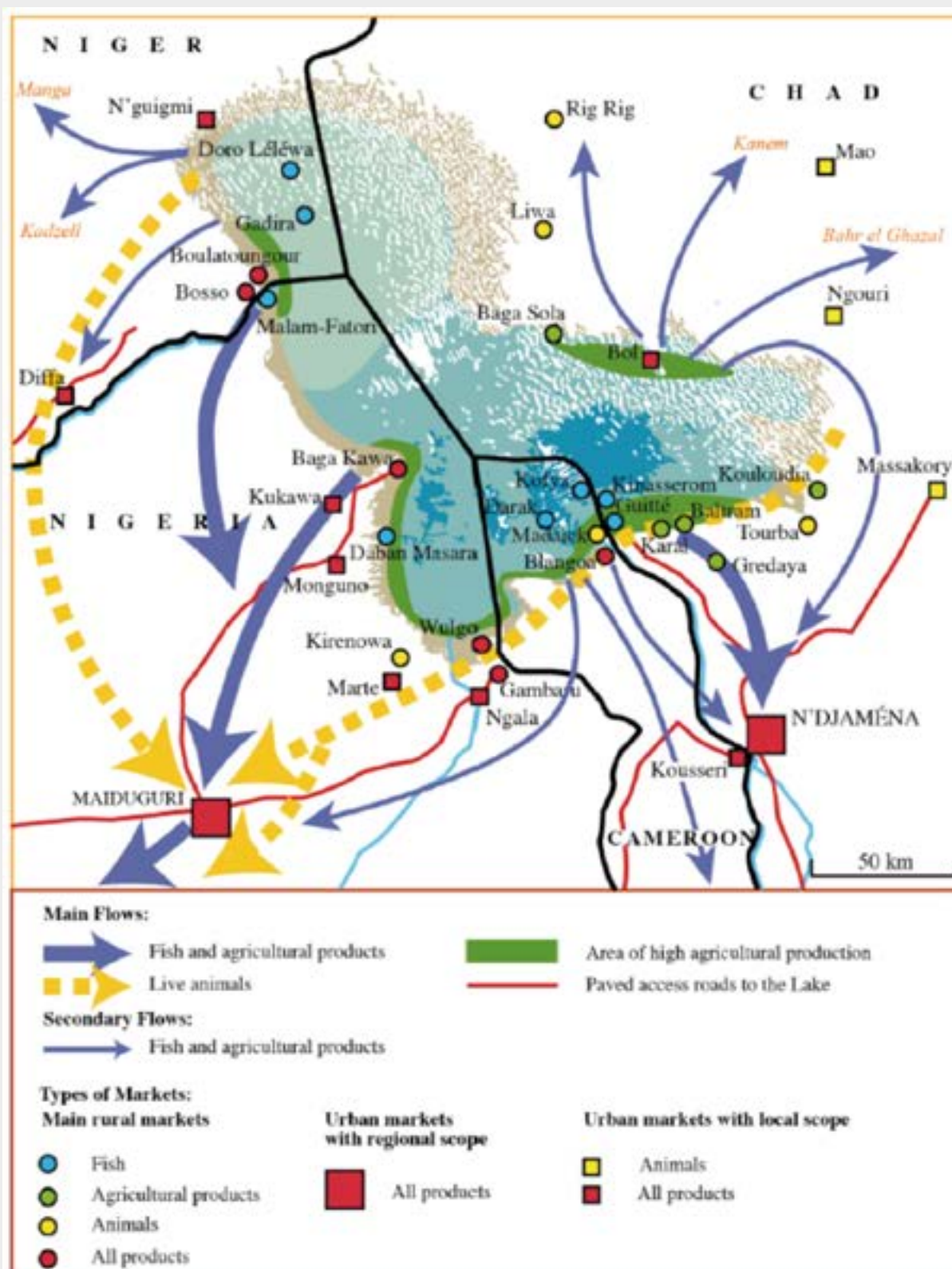


Figure 5 Average conditions in Small Lake Chad



Source: Lake Chad Development and Climate Resilience Action Plan, Page 8 (World Bank 2016).

Figure 6 Market flows from Lake Chad



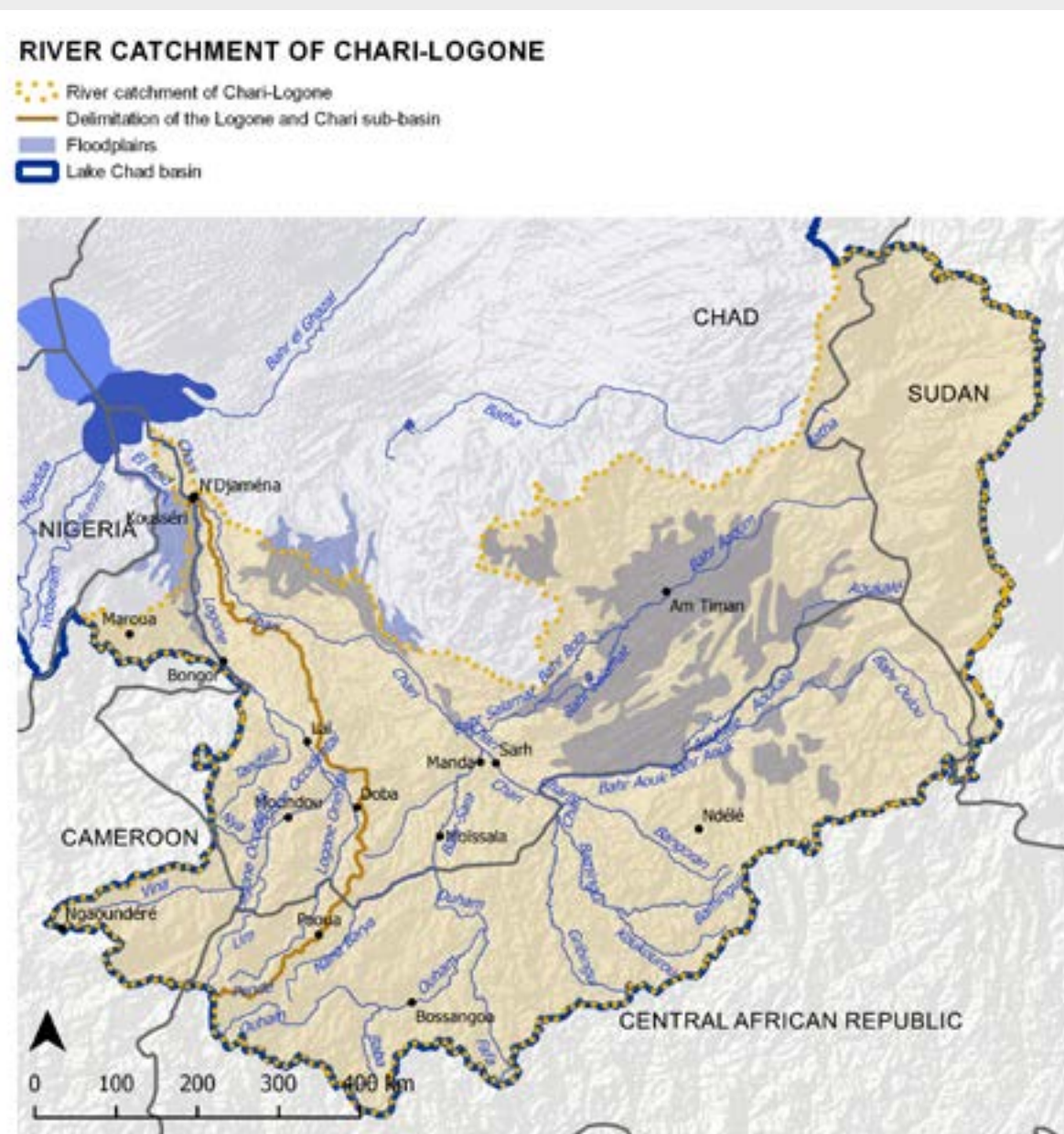
Source: Lake Chad Development and Climate Resilience Action Plan, Page 13 (World Bank 2016).

4.2.2 Chari – Logone Basin

The Chari – Logone basin (Figure 7) occupies 690,000 km² and is by far the largest tributary system in the basin. The Chari and Logone Rivers extend through Cameroon and CAR and into Chad, with their headwaters in the southernmost reaches of the basin in CAR. Rainfall in this region is the highest in the basin, with annual averages from 400 to 1,300 mm/year. As the range in

average precipitation suggests, there is also large inter-annual variability in the basin, and consequently in river flow as well. As a result, the Chari – Logone system provides about 95% of the surface flow to Lake Chad. Both the Chari and Logone sub-basins feature extensive floodplains vegetated with grasslands and marshlands. This region of the basin supports most of the rain-fed farming in the basin.

Figure 7 The Chari – Logone River Basin



Source: State of Basin Report, Page 127 (LCBC 2013).

4.2.3 Komadugu – Yobe Basin

The Komadugu – Yobe Basin (KYB) covers a total area of 148,000 km² in Niger and Nigeria (Figure 8), representing about 35% of the land area of the conventional Lake Chad Basin. This river system contributes about two percent of the surface water flow to Lake Chad. The population of this basin exceeds 23 million, which is about

and has doubled in the past 30 years. At the same time, river flows have decreased 35% due to the combined effects of two reservoirs built in the 1970s, abstraction from irrigation projects, and climate variability. In addition to stresses placed on the system by increased water demands, the river system has experienced problems with siltation and infestation of invasive aquatic plants.

Figure 8 The Komadugu – Yobe River Basin



Source: State of Basin Report, Page 128 (LCBC 2013).

4.3 Climate Variability and Change

The Lake Chad Basin crosses several climate zones with annual rainfall varying from under 100 mm/year north of the conventional basin to over 1,300 mm/year in the far southern part of the basin (Figure 2). The annual cycle of precipitation follows a monsoonal pattern with a single rainy season. Rains starting in about April, peak rainfall in July or August, and diminish by November (LCBC 2013, page 133). As described earlier, the climate history of Lake Chad is characterized by high variability in precipitation and consequently lake size and volume (Figure 4). Considering the natural climate variability in the region, it is difficult to determine the extent to which climate change is responsible for the current Small Lake Chad conditions. An increase of between 1.0 and 1.5°C in the average temperature of the basin has been observed since 1950, with rainy seasons becoming shorter (LCBC 2013, Page 195).

Additional Resources

The State of the Basin Report provides a map of the basin, showing mean monthly temperature by season.

LCBC 2013, Page 47

4.3.1 Climate Prediction Models

Predictions for the future climate of Lake Chad are uncertain. Global models predict warming in the Sahel above global warming averages. Changes in precipitation due to climate change cannot be predicted reliably, though. The West African Monsoon, the key driver of precipitation in the region, has been notoriously difficult to predict, due to the complexity of the various mechanisms that control the monsoon (Roehrig et al., 2013, cited in Nagarajan et al., 2018). Whereas most models predict more rainfall coupled with higher inter-annual variability and extreme events, countervailing mechanisms such as a cooling of the Atlantic as a result of accelerated ice sheet melting around Greenland might induce a large decrease of Sahel rainfall (Defrance et al. 2017, cited in Nagarajan et al., 2018). The net effects are unclear at this point. However, there seems to be a trend towards increasing variability.

As part of the German cooperation programme, “Sustainable Water Management of the Lake Chad Basin,” The results of several available Global Circulation Models (GCM) were analyzed for the Lake Chad Basin. GIZ (2015) selected the hundred-year period covering the 21st century (2000 – 2100) under a range of assumptions for future scenarios of population growth, economic development, and the introduction of new and more efficient technology (GIZ 2015a). Scenarios identified as A1 and B1 assume that population growth peaks in the mid-21st century, then declines. Scenario A2 assumes that population continues to increase throughout the 21st century.

4.3.2 Future Temperature and Precipitation

Climate change under the various change scenarios is mostly driven by temperature increase. No significant difference in temperature development is forecast until toward the middle of the 21st century. Thereafter temperatures rise more quickly under the A2 scenario and less quickly under the B1 scenario. The modeling results forecast the highest increase in mean annual temperature for the central and eastern Lake Chad Basin of 3 to 6°C by the end of the 21st century. Notably, the temperature increases observed from 1973 to 2013 were greater than the increases predicted by 2100 under all scenarios. Rising temperatures will result in increased evaporation and evapotranspiration. The GIZ (2015a) forecast predicts a reduction in the available water resources from 4 to 10 percent by the end of the century. Increases in evaporation and evapotranspiration will be highest during spring and fall, corresponding with the highest changes in seasonal temperature that have been predicted.

With regard to precipitation, the GIZ (2015a) study recognized the modeling uncertainties discussed above and did not make quantitative predictions for precipitation. However, because predictions of ecosystem impacts required moisture values, they selected the GCM which reproduced most accurately precipitation during a known period of record for moisture predictions. Furthermore, GIZ (2015a) recognized another important limitation in the GCMs prediction of precipitation: these

models do not accurately predict the extreme storm events. There seems to be general agreement among climate scientists that the variability in intensity of storms has a high likelihood of increasing in the future. This has important implications for predicting the future hydrology of the Lake Chad Basin.

4.3.3 Hydrologic Predictions

Taken collectively, the modeling study of GIZ (2015a) and other modeling studies predict that there will be an increase in the variability and in the intensity of rainfall. In a general sense, low-intensity storm events produce little or no runoff to streams and rivers, due to infiltration of precipitation, which contributes to aquifer recharge. High-intensity events can produce rainfall so quickly that infiltration processes are overwhelmed and runoff is produced. Extreme events can cause flooding. While quantitative predictions are not available on the frequency of high-intensity or extreme events, it is reasonable to expect that these events will occur more frequently in the future.

Higher variability in precipitation in the Lake Chad Basin can have several possible impacts on the system. One possibility is that less frequent, but more intense storms will occur. This can result in short bursts of runoff and decreased recharge to aquifer systems. Some of the precipitation that infiltrates into shallow aquifers discharges into nearby stream channels. In a climate situation where there are frequent, low-intensity storms, streams can have a steady base flow. If the climate changes to less frequent low-intensity storms, the base flow can decrease and instead, pulses of flow can move quickly through the river channels. This condition may not affect Lake Chad itself. In fact, if there is less recharge to deeper aquifers, the total amount of flow into Lake Chad may increase. The greatest changes would occur in tributary rivers, where the amount and timing of runoff would change and erosion would increase with more intense storms.

4.3.4 Future Ecosystem Conditions

The climate models analyzed by GIZ (2015a) indicated that the rainy season will become shorted

across the Lake Chad Basin. Combined with higher temperatures, this will result in changes in ecosystems. GIZ (2015a) evaluated the potential effects of these changes on both agricultural and natural systems.

Agriculture and Upland Ecosystems

From an agricultural perspective (See Section 4.7.1 for more information on agriculture in the Lake Chad Basin), the length of the rainy season defines the growing period of a crop. Considering the typical growing periods for crops in the Lake Chad Basin (Table 2), GIZ (2015a) made predictions of the locations in the basin where the growing period would be 120 days by the end of the 21st century and compared this prediction with current conditions. Modeling results showed that the position of the “120-day line” will shift southward, requiring from 70,000 to 135,000 km² of land to be reclassified for more arid agriculture.

The effects on ecosystems will be most pronounced at transition zones between ecosystem types. The boundary between arid and hyper-arid conditions remains almost unchanged under all climate change scenarios. Impacts of climate change increase southward in the basin, as growing seasons lengthen. Toward the end of the century, areas that have sufficiently long growing seasons to be considered tropical, decrease in size and become fragmented or disappear. Climate conditions supporting the growth of tropical forests may no longer exist by the end of the century.

Wetlands and Lake Chad

GIZ (2015a) estimated changes in river discharge from predictions of the decrease in available water due to increases in evaporation and evapotranspiration. This is an imperfect approach, as models of the complete hydrologic system would be necessary for the best analysis. But this approach provides a good initial set of predictions. They applied this change in runoff to water balances of the Yaere – Naga wetlands in the Logone River basin and of Lake Chad.

Accurate predictions of the various wetlands in the Lake Chad Basin will require more analysis. With regard to the Yaere – Naga wetlands, GIZ (2015a) forecasts some shrinkage or fragmentation due to changes in patterns of flooding, accompanied by as shorter green period. Many of the wet-

lands in the Lake Chad Basin rely on groundwater discharge to support their hydroperiod. Expansion or contraction of wetlands not directly connected to river systems will depend on how recharge patterns change, as described above.

Lake Chad is vulnerable to increased evaporation associated with higher temperatures due to its large surface area relative to its volume. The simplified hydrologic model of GIZ (2015a) predicts that the lake can still maintain more or less its

current boundaries, but is unlikely to expand to its 1963 shoreline during this century. GIZ (2015a) further predicts that flow into the northern basin will be less frequent and intervals of high soil moisture will become shorter, but will still be long enough to sustain the growth of crops. Green periods in the northern basin will decrease, as with the Yaere – Naga wetlands. The flooded area in the northern basin will shrink, but locations will still exist with abundant water.

4.4 Water Resources

The ecosystem and human needs of the basin are supported by a combination of precipitation delivered primarily to the southern part of the basin (Figure 2) and by groundwater delivered to the system over geologic time. The hydrology of Lake Chad itself is dominated by three factors: Surface-water flow from the Chari – Logone River system, evaporation from the surface of Lake Chad, and exchange with groundwater.

4.4.1 Surface Water Resources

Surface hydrology in the Lake Chad Basin follows the seasonal rainfall patterns, which peak in about August of each year, with gradually declining flows starting in November or December, and low-water conditions in April or May just prior to the onset of seasonal rains again. As with patterns of rainfall, surface water discharges vary considerably from year to year and decade to decade. The hydrologic basins vary widely in size, but share the

characteristics that runoff collects and is mostly discharged through the river channels toward Lake Chad. Some portion of the flow, however is routed through wetlands and into lowland floodplains, primarily at the highest-flow conditions. Figures 7 and 8 show these lowland areas for the Chari – Logone and Komadugu – Yobe systems. The riparian wetlands are shown in Figure 9. Once discharged to the wetlands and floodplains, water is either evaporated / transpired, or recharges the surface aquifers. These wetlands are important reserves of biodiversity and the lowlands support agriculture activity (LCBC 2013, Pages 134-139).

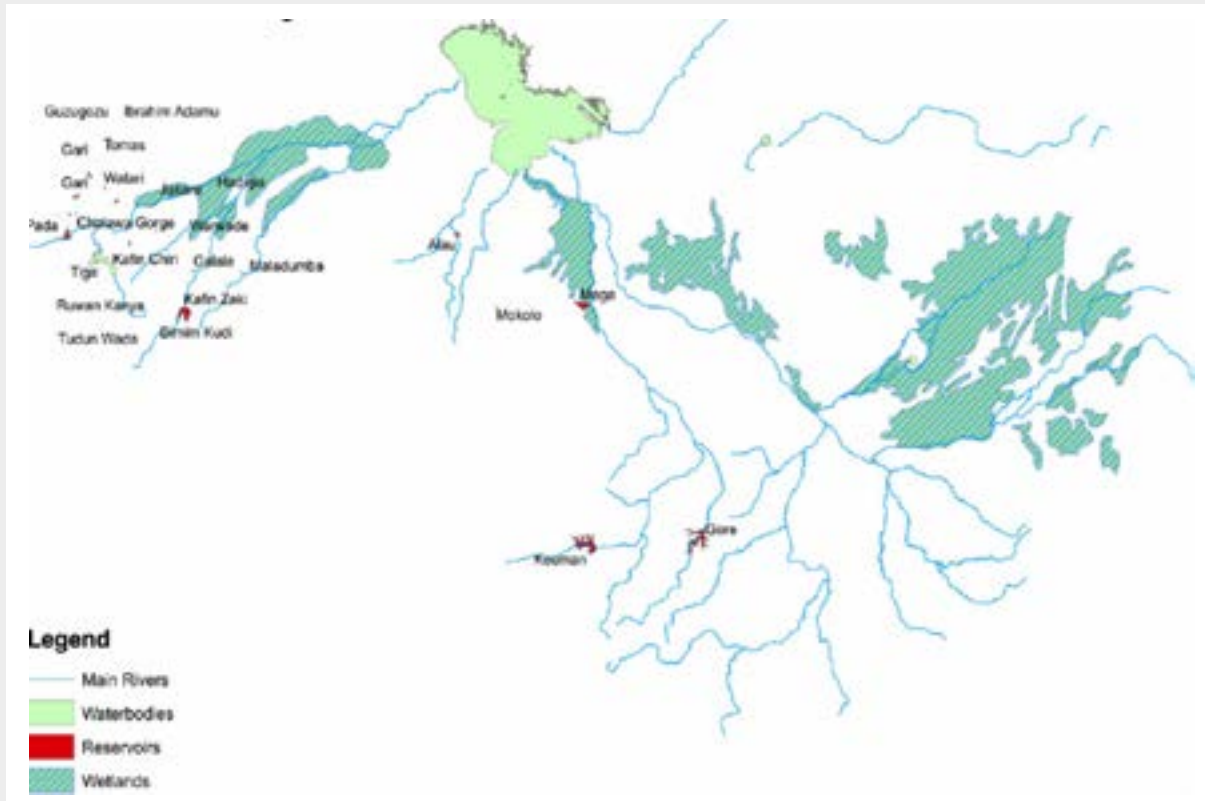
Additional Resources

The State of the Basin Report provides more information on precipitation patterns and rainfall collection systems in the Lake Chad Basin.

LCBC 2013, Pages 130-133



Figure 9 Waterbodies and wetlands in the Lake Chad Basin



Source: Brief on the Lake Chad Basin, Joint Workshop on Earth Observation and Capacity Development for IRM at River Basins in Africa. M., Bila.

The hydrology of Lake Chad is characterized by short-term and long-term variability, as reflected in the extreme changes observed in surface area over time. The lake is highly vulnerable to changes in the hydrology of its main tributary: A variation in about 10% of rainfall results in a change of around 30% in the total contribution of the Chari River on Lake Chad. Lake Chad is currently divided into three distinct areas (Figure 5): the open waters of the southern pool, the archipelago, made up of a series of sand dune islands on the northeastern edge of the lake, and the very irregularly flooded areas of the northern pool. A narrow ridge, referred to as the Great Barrier, separates the two pools. When the water level is high, water from the southern pool can flow into the northern pool. The Yobe River enters the northern pool of the lake on its western side. In recent decades, flow from the Yobe River system was inadequate to fill northern pool on its own. In 1996 the northern pool dried up completely, but was flooded again in 1999, when rainfall was higher (LCBC 2013, Pages 143–146).

Aside from Lake Chad and its tributaries, nearly all of the other surface water features are reservoirs impounded by dams. Most of the reservoirs are in the Komadugu – Yobe basin, with at least 20 on the Nigerian side, in the upper part of the basin (Figure 10). These reservoirs have a combined storage capacity of over 3.5 billion m³. There are far fewer reservoirs in the Chari – Logone basin. By far the largest is the Maga dam on the Logone River in Cameroon (625 million m³), but there are other, small impoundments as well.

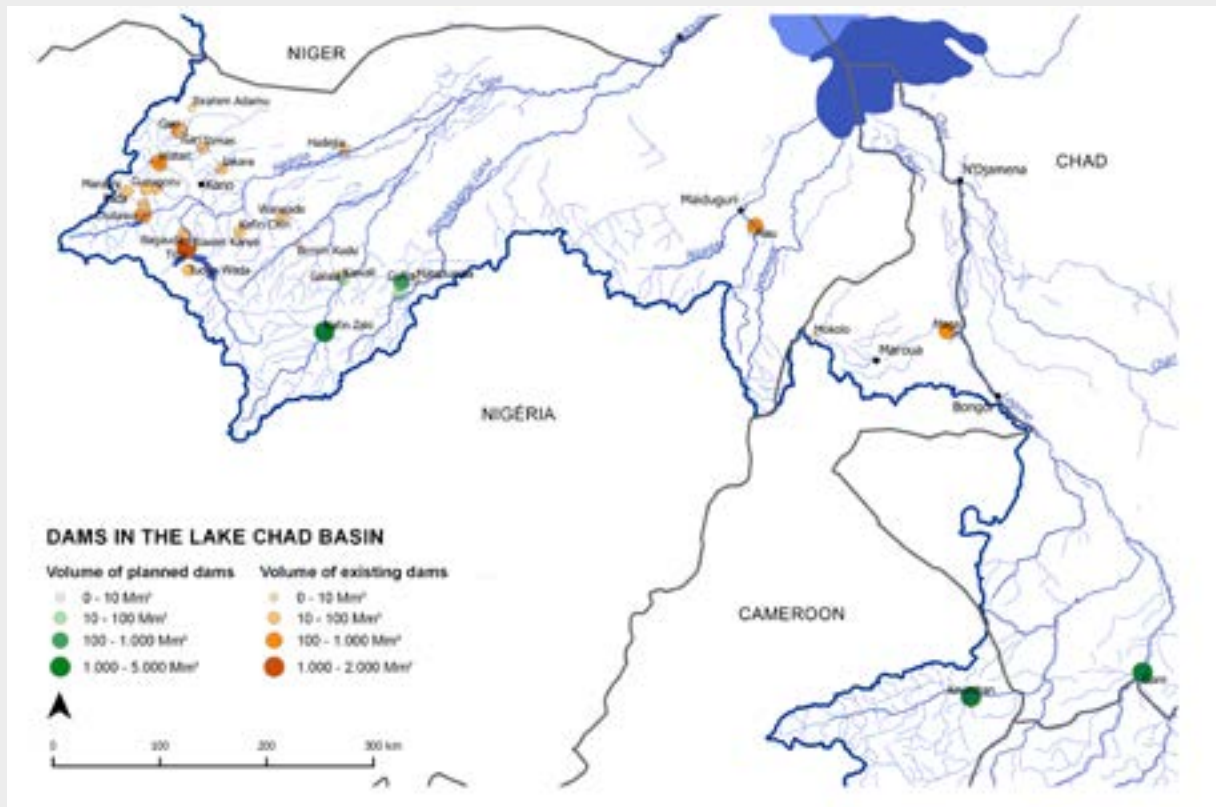
Additional Resources

The State of the Basin Report provides more information on hydrology and hydrologic modeling in the Lake Chad Basin, including:

- River discharge data
- Water Evaluation and Planning models for the basin
- Runoff into floodplains
- Overflow events which result in natural cross-basin exchanges

LCBC 2013, Pages 134–141

Figure 10 Dams and reservoirs in the Lake Chad Basin



Source: State of Basin, Page 148 (LCBC 2013).

Impoundments in the Lake Chad Basin were designed primarily to collect and distribute water to floodplains for irrigation and flood control. Hydropower is being considered for two dams on tributaries of the Logone River, but alteration in the hydrologic regime of the system may prevent these dams from being constructed. The existing dams affect the overall hydrology of the Lake Chad system. Evaporation from reservoir surfaces and water diverted in the tributaries for irrigation decrease the supply of water to Lake Chad.

Decisions to use limited water supplies in the upper basin, rather than letting the water flow to Lake Chad are part of a strategy of integrated management in the basin underway at the LCBC. Hydrologic modeling, and discharge planning and management, are components of the LCBC's Basin Observatory.

Strategies to regulate discharge from the rivers at the dams provide the capability to implement mandates in the Water Charter to maintain target minimum flows during dry periods and to manage wet-season high flows. Water collected

in the wet season can be directed to wetlands to assure their health and provision of ecosystem services and floodplains for irrigation and aquifer recharge. The existing system of dams, combined with the LCBC's modeling capabilities, can be effective in managing water resources and implementing the Water Charter. The ability to regulate how water is contained and released becomes additionally more important considering the changes to patterns of runoff expected in a changing climate for the region.

Additional Resources

The State of the Basin Report provides more information on surface water features in the Lake Chad Basin, including:

- Water balance of Lake Chad
- Surface area changes in Lake Chad from 1973-2012
- Other natural lakes in the basin
- Dams and reservoirs
- Hydropower potential in the basin.

LCBC 2013, Pages 141-148

4.4.2 Groundwater Resources

The aquifers of the Lake Chad Basin provide short-term and long-term storage of water in the system. The humid period of the last glaciation filled the aquifers of all of north Africa. Over the last ten thousand years or so since deglaciation, these aquifers have provided a steady supply of water first to rivers and oases, then for expanded human uses through wells and boreholes.

There are three relevant transboundary aquifer systems in the Lake Chad Basin (Figures 11 and 12):

1. The Quaternary sand aquifer system (all member countries);
2. The Pliocene multilayer sand aquifer system (Niger-Chad-Cameroon-Nigeria);
3. The Continental Terminal sandstone aquifer system, consisting of a northern part (Niger-Chad) and southern part (Nigeria and Chad);

Of these, the aquifer systems most relevant to the central Lake Chad Basin are the Quaternary and Pliocene formations. The Quaternary formation, consisting mostly of sands, sandstones, and clays,

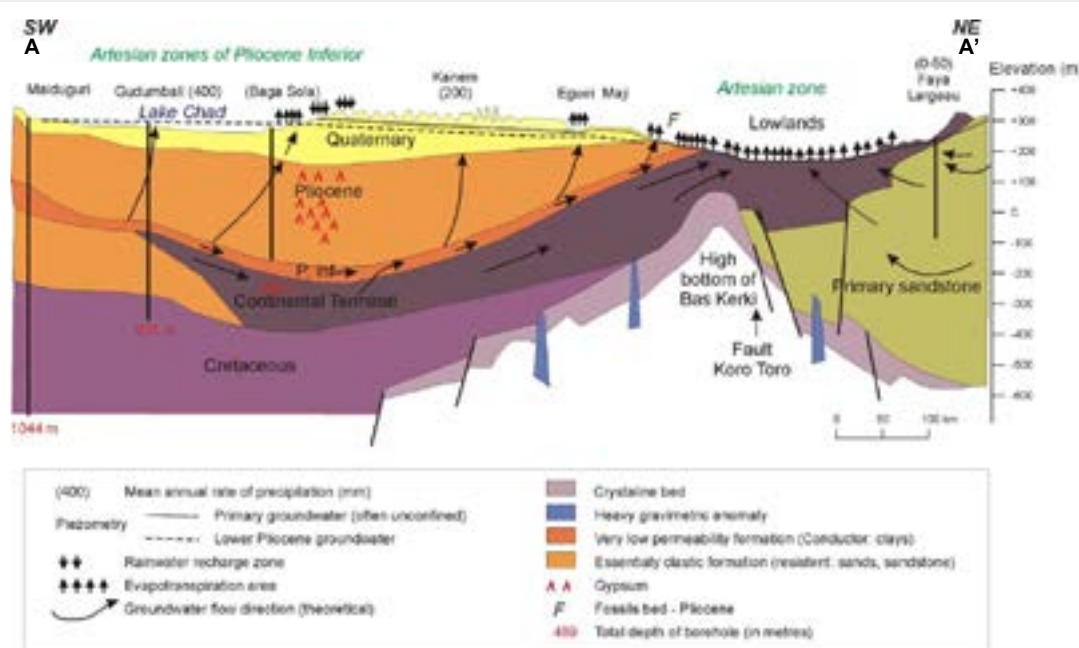
provide the surficial aquifer for the region and are heavily exploited in Chad, Niger, and Nigeria. Generally, the water table varies from depths of one to 60 meters below land surface near water bodies. The Pliocene formation underlies the Quaternary formation; is a confined, pressurized aquifer in most places; and consists of an upper unit referred to as the Pliocene, and a lower unit referred to as the Continental Terminal formation. The Pliocene aquifer is closer to the surface in Nigeria and is heavily exploited there, with resulting declines in the groundwater levels. Other aquifer systems exist in the region, including the Nubian Sandstone aquifer and the primary sandstone aquifer, both toward the north of the topographic basin. These are relevant locally in the northern basin, but are not hydraulically connected with the Lake Chad hydrologic system.

Additional Resources

The State of the Basin Report provides additional information on the geology, geomorphology, and soil characteristics of the Lake Chad Basin. Figures include topography, soils characteristics, and areas with potential for hydrocarbon recovery.

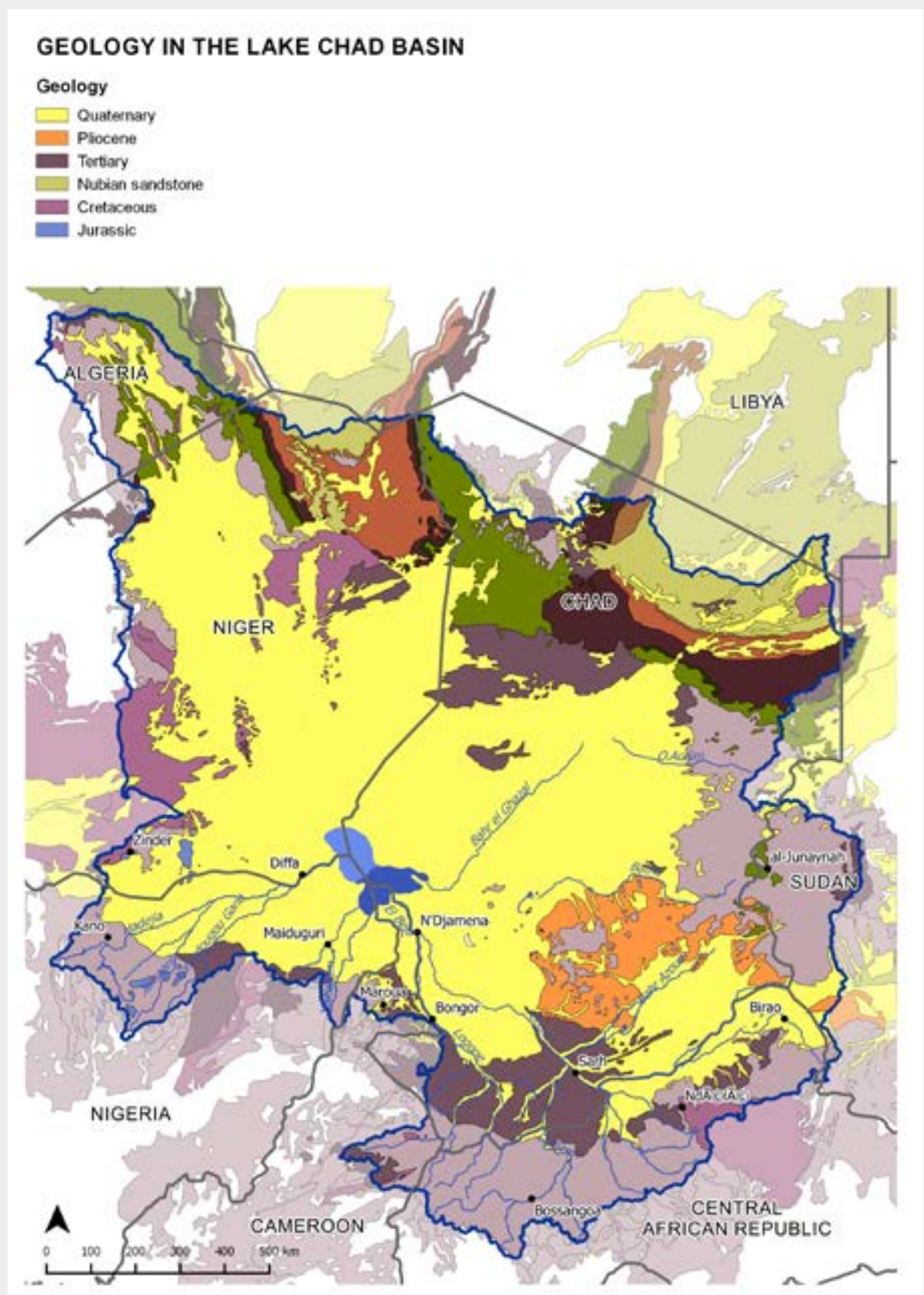
LCBC 2013, Pages 35-40, 182

Figure 11 Geology and aquifer systems along a southwest to northeast cross section of the Lake Chad Basin



Source: Sustainable Water Resources Management Lake Chad. Project Activities – Report No. 1 (BGR 2008).

Figure 12 Geology of the Lake Chad Basin



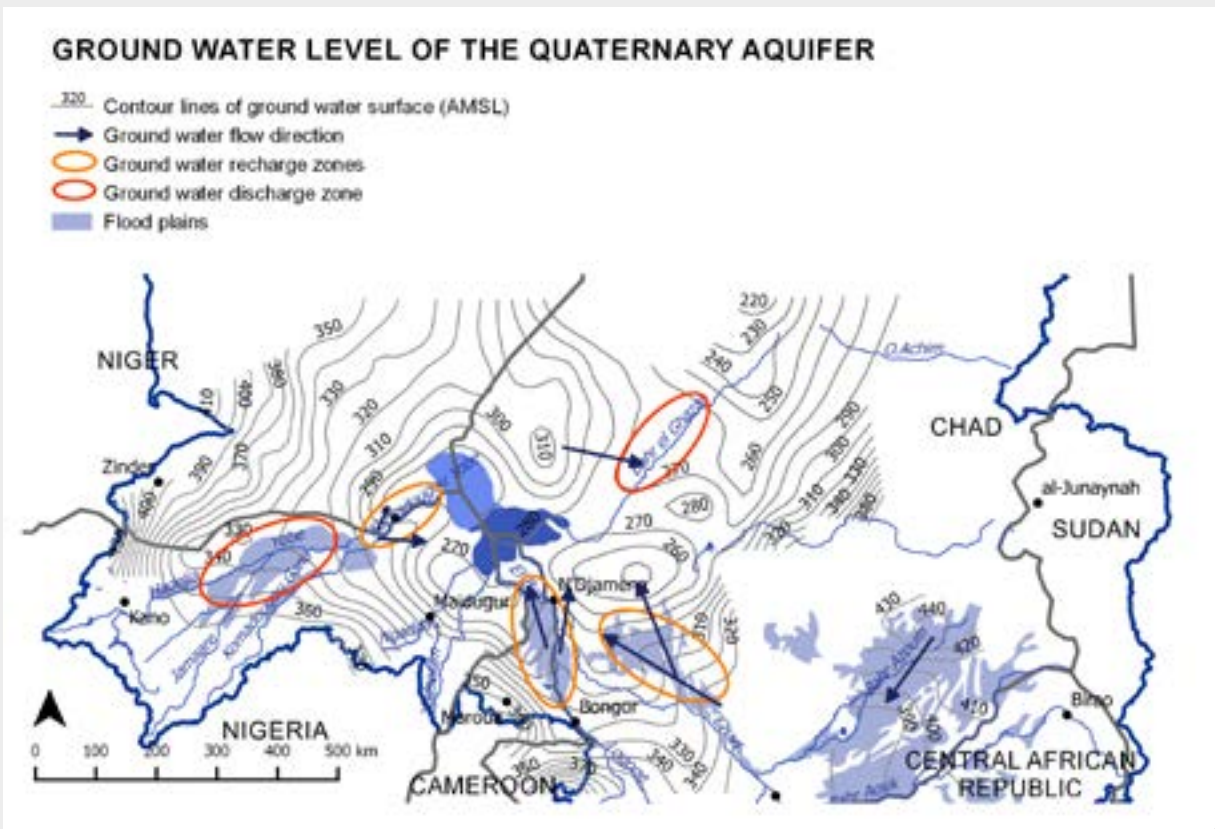
Source: Sustainable Water Resources Management Lake Chad. Project Activities – Report No. 1 (BGR 2008).

The general movement of groundwater in both systems is from the southwest toward the north-east toward an outcropping for both formations in the Chadian Lowlands. These lowlands create a sort of evaporative pump, which drives water movement through the systems. Recharge and discharge in the Quaternary aquifer occurs in river channels, wetlands, lowlands, and the margins of Lake Chad (Figure 13). Magnitudes, and even directions, of exchange between surface water and groundwater depend on whether rivers

are in flooding or low flow conditions. Figure 13 shows the major recharge and discharge zones in the surficial Quaternary aquifer.

Additional Resources
The State of the Basin Report provides more information on groundwater in the Lake Chad Basin.
LCBC 2013, Pages 148-154

Figure 13 Groundwater levels in the Quaternary Aquifer, Lake Chad Basin



Source: State of Basin, Page 150 (LCBC 2013).

Recoverable water reserves in the Quaternary aquifer are considerable and by some estimates exceed 600 billion m³. A noteworthy distinction are the estimates of renewable reserves, which amount to less than 5 billion m³ (Table 7). While extracting groundwater from the Quaternary

aquifer in excess of the rate of renewal is not sustainable in the long-term, it may be necessary to manage the depletion of this non-renewable resource as a short-term strategy to meet future demands associated with population growth in the region.

Table 5 Groundwater reserves in the Quaternary Aquifer

	Recoverable reserves (billions of m ³)	Renewable reserves (billions of m ³)	Infiltration (mm)	Estimation Method
Chad (BRGM, 1987)	66 to 141	3.5	15	Effective rainfall modulated for lithology
Niger (UNDP, 1991)	500	0.05	5	
Cameroon (Ngounou, 1993, 2007)	0.9 to 1.08	0.1 to 0.5	25 to 125	Thornthwaite water balance
Nigeria (Edmunds, Fellman, Goni, 2002)		0.25 to 0.88	4 to 49	Chloride mass balance
Total		4		

Source: State of Basin, Page 151 (LCBC 2013).

Exchange of groundwater with Lake Chad occurs around the margins of the lake, which is common among lacustrine systems. Lake beds tend to accumulate low-permeability clays. Around lake margins, these clays are constantly scoured away by wave energy and changes in lake level. Recharge and discharge alternates with lake level in this margin zone. The existence of this connection with the aquifer at the lake margin provides the capacity for salt regulation in Lake Chad. Salts accumulating in Lake Chad through evaporation are discharged into the aquifer through this exchange.

The Pliocene aquifer has received practically no recharge since deglaciation and can be consid-

ered a fossil aquifer, which will not be recharged until the next humid period and not within any human-scale planning horizon. Nonetheless, this formation contains considerable reserves, which can be exploited for socio-economic transformation, and as with the Quaternary aquifer, to meet the demands of population growth. Depth to the Pliocene aquifer varies depending on location, but Table 8 shows data from wells 200 to 430 m below land surface. Pressures in the confined aquifer at these locations were sufficient that little or no pumping has been necessary to bring water to the surface. However, it must also be noted that in the period between 1972 and about 2014, the static level in all of these four wells has decreased, indicating a measurable depletion of the aquifer.

Table 6 Piezometric levels of pressurized aquifers in the Lake Chad Basin

Well	Total depth of well	Static level after well built in 1972	Recent static level
Naala	427 m	5 m above the ground	2011: 1m above the ground
Bougoumene	302 m	0.8 above the ground	2014: 3.15 m below the ground
Logone Birni 3	298.6 m	2.74 m above the ground	2014: 5.10 m below the ground
Logone Birni 1	200.86 m	8.19 below the ground	2011: 10.80 below the ground

Source: State of Basin, Page 151 (LCBC 2013).

4.4.3 Water Quality

The natural processes that control water quality in surface waters can be characterized as follows: Mobilization of sediment-laden surface water in upstream reaches, followed by sediment deposition in wetlands, floodplains, and reservoirs. As water passes through wetlands some physico-chemical transformations occur, which include an increase in dissolved organic carbon and organic acids, and a decrease in dissolved oxygen.

Surface water quality threats include agriculture, industry, mining, petroleum development, and urbanization. Agricultural activity results in nutrient loading to surface waters. Industry, depending on the type, can discharge waste water with high levels of biochemical oxygen demand, nutrients, or toxic substances. Uncontained mining and petroleum activities can contribute sediment through erosion, high salt concentrations, and toxic metals. Urban discharges can include all of these pollutants as well as microbiological pathogens. The extent to which these pollutants occur is not well understood, due to a lack of coordinated monitoring programs. Surface water pollution is apparently not a sufficiently severe problem to cause obvious signs of collapse, such as fish kills or other chronic health problems to humans or fauna.

Groundwater quality varies depending on location, but is generally suitable as a drinking water supply or for irrigation. Exceptions are some salt-laden zones of the Pliocene aquifer and specific cases in which wells have been improperly installed or maintained. Total dissolved solids in most locations are below 1,500 mg/L, which is well within drinking water secondary standards. Sodium content in most locations is sufficiently low that groundwater can be used for irrigation. Exceptions are the area to the southeast of Lake Chad, where saline water from the lake recharges the surficial aquifer, and similar locations of recharge along the Bahr el Ghazal River to the northeast of Lake Chad. High nitrate concentrations occur in point locations throughout the basin, indicating contamination of the aquifer from human or livestock sources. Nitrate in excess of 50 mg/L has been observed in many locations, but concentrations less than 25 mg/L are most common. The drinking water standard for nitrate is 50 mg/L to prevent methemoglobinemia (blue-baby syndrome) and prolonged exposure to high concentrations of nitrate in adults is associated

Additional Resources

The State of the Basin Report provides more information on water quality in the Lake Chad Basin.

LCBC 2013, Pages 155-164

Additional Resources

Petroleum development in the Lake Chad Basin has the potential for several negative environmental impacts, including ecosystem damage, water quality impairments, and increased demands for water usage. The State of the Basin report provides a map of oilfields, existing pipelines, and planned pipelines (Map 35). The report also provides information on potential environmental challenges (Page 181).

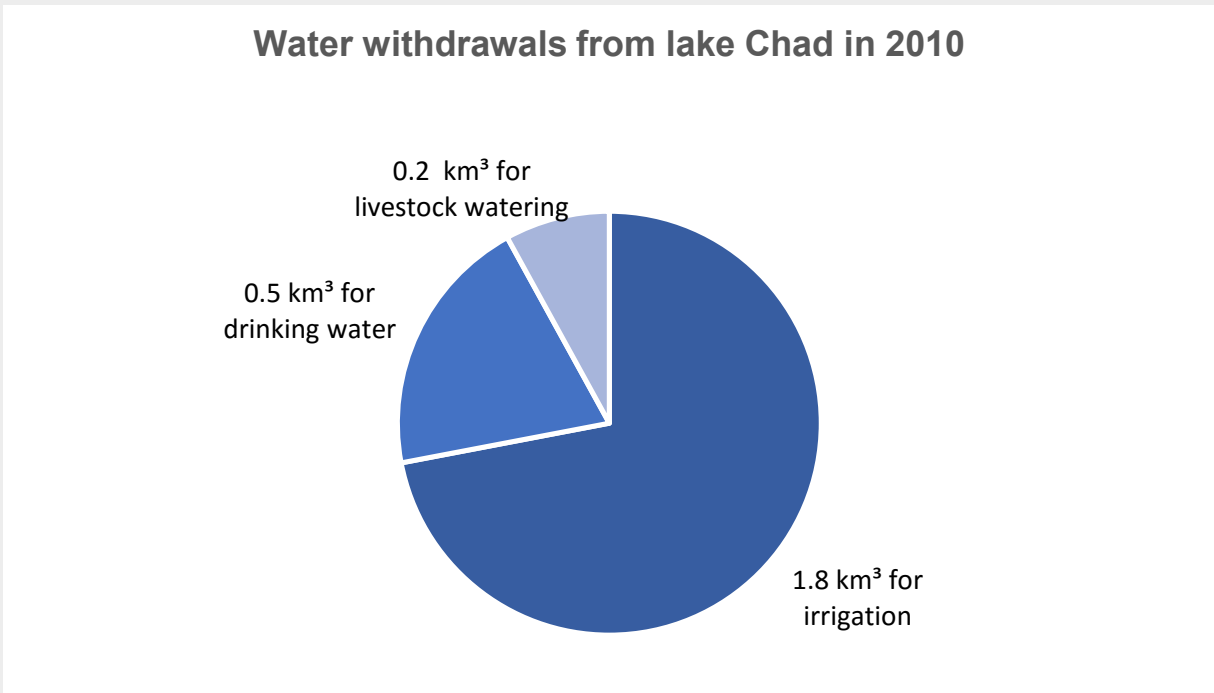
LCBC 2013, Pages 181-182

with cancer (WHO 2011). Naturally occurring fluorine occurs in concentrations greater than 5 mg/L in areas around the Borno Basins in Nigeria. The drinking water standard of 1.5 mg/L (WHO 2004) has been set to prevent damage to teeth and bones. Bacteriological problems have been observed in groundwater in urban areas and has the potential to be a significant health problem.

4.4.4 Water Demands

The water portfolio of the annually renewed surface water system, renewable groundwater resources, and fossil groundwater resources support ecosystem needs and a variety of human needs. A basin-wide estimate from 2010 indicates the total estimated withdrawals from surface water and alluvial aquifers approached 2.5 million m³, used mostly for irrigation and drinking water (Figure 14). The major categories of water demand are ecosystem needs, drinking water, and livestock and agriculture. Industrial water demands are currently low, however the petroleum industry is a significant water user and growth in petroleum extraction should be monitored carefully.

Figure 14 Water withdrawals from the Lake Chad Basin in 2010



Source: State of Basin, Page 167 (LCBC 2013).

Ecosystem Needs

Setting aside water for ecosystem needs is part of the low-flow mandates of the Water Charter. Article 3.3 establishes low-water environmental flows which limit water withdrawals in certain sections of rivers and streams. Twelve hydro-metric stations were established on eight separate river systems. Each of these stations has a defined minimum flow that needs to be maintained. Article 3.5 of the Water Charter establishes minimum high-water flows in wetlands. Five monitoring stations, each with a designated minimum high-water flow, were established along three river systems (Joint Environmental Audit, 2015, Pages 89-90). These mandates are not comprehensive, but indicate recognition of the need to support ecosystem and quantitative, regulatory mechanisms in place to achieve those mandates.

Drinking Water

As in most of the world, groundwater is the primary source of drinking water in the Lake Chad basin. Estimates from 2012 indicated that there are over 18,000 boreholes supplying drinking water in the basin, of which about 11,000 are in the Quaternary aquifer. As of 2000, the annual

drinking water demand for the basin was 80 million m³/year, mainly from groundwater and particularly concentrated in Nigeria.

Additional Resources

The State of the Basin Report provides more information on water uses in the Lake Chad Basin.

LCBC 2013, Pages 165-172

Additional Resources

The State of the Basin Report provides more information on the Kano River Irrigation Project, which supports agricultural development in the Komadugu-Yobe basin.

LCBC 2013, Pages 86-87

In 2010, groundwater resources potential in Hydrological Area 8 (Rivers that drain towards the Lake Chad) in the north east of Nigeria was estimated to be 4.3 billion m³/year (JICA 2014, Pages 2-29). The municipal water demand in Hydrological Area 8 was estimated to be 481 million m³/year. These demands were projected to rise to

1,381 million m³/year by 2030. These areas the highest for the drainage basins in the country. The per capita water demand for Nigeria is based on 120 liters/person/day for urban, 60 liters/person/day for semi-urban and 30 liters/person/day for rural supply (JICA 2014, Pages 2-12).

Demands on drinking water will of course grow with population. In Chad, drinking water needs were estimated in 2000 to be 20 liters/person/day in rural areas and 80 liters/person/day in urban areas. (These rates are low compared to worldwide demands. The UN threshold for water poverty is designated as 50 liters/person/day.) Considering a population growth rate of 2.3%, or a doubling by the year 2050, population pressure will place considerable burdens on groundwater supplies, particularly considering the limited renewability of groundwater resources (Table 7).

Livestock and Agriculture

Surface water provides nearly all of the water for crops and livestock in the basin. In Chad, agriculture consumes about 190 million m³/year. Increasing populations, and efforts to increase economic productivity place increasing demands on water. Some initiatives in the basin include:

- **Lake Chad:** Agricultural developments including construction of polder systems which provide controlled irrigation of dyked areas adjacent to the lake and irrigated with lake water (South Chad Irrigation Project and Baga Polder, for example).
- **Nigeria:** The Kano River Irrigation Project, drawing an estimated 25,000 m³/year of water.
- **Cameroon and Chad:** Diversion of water from reservoir systems to support rice cultivation with a combined demand of 1 million m³/year.

With increasing populations, the demand for water will not decrease. Drinking water demands will place pressure on groundwater resources and ecosystem and agriculture demands will place pressure on surface water systems. Improvement in efficiencies in all aspects of the water sector can help minimize demands. Integrated resource management using quantitative tools can help to optimize the allocation of resources, if properly supported with regulatory structures. Unexploited groundwater resources can assist in supporting sustained improvement in socio-economic conditions in the basin, but the allocation of non-renewable resources needs to be approached cautiously.

4.5 Natural Resources

There is great diversity in both biotic and abiotic resources in the Lake Chad basin. The biotic habitats of the Lake Chad basin, correspond with gradients in topography, moisture, and proximity to open water (Figure 4). The basic habitat types can be categorized as desert, lowland, upland, riparian, and wetland. The desert areas north of the conventional basin are devoid of vegetation, except in oasis areas. Lowlands are widespread in both the Komadugu – Yobe and the Chari – Logone basins. These are the floodplains that are dominated by grasslands and shrublands, with marshes in moist depressions. Rain-fed agriculture can be supported in these areas.

The upland regions of the Komadugu – Yobe basin are located in the Sahelian climate zone, but decreases in rainfall in recent decades has seen vegetation shift toward that of the drier Sahelo-

Additional Resources

The State of the Basin Report provides more information on vegetation and flora and fauna in the Lake Chad basin.

LCBC 2013, Pages 48-53

Saharan climate. Vegetation in the upland areas in the Chari and Logone basins varies depending on the location within the moisture gradient. Headland areas feature mosaics of open forest or dense dry forest interspersed with woodland and shrubland savannahs. Farther downstream, shrub-steppe, shrub savannah, and wooded savannah predominate.

Additional Resources

The BIOPALT project, currently underway, has recently completed an inventory of available knowledge on large and medium-sized mammals, avian fauna, plant resources, and the socio-economic situation of Lake Chad.

BIOPALT 2018, Annex 2

Riparian and wetland areas form extensive corridors of vegetation and habitat for wildlife (Figure 9). The Lake Chad Basin has 15 RAMSAR wetland sites comprising a total area of about 170,000 km². The constant or frequent supply of water necessary to support these wetlands is provided by the lake itself for lacustrine wetlands, surface water from rivers for riparian wetlands, and exchange with groundwater for the remaining lowland wetlands.

The habitats of the Lake Chad Basin support high levels of biodiversity. More than 200 mammal species and more than 500 bird species have been counted. Within Lake Chad and its tributaries, 140 species of fish have been counted. Surveys from the early 2000s indicate that a dozen and a half separate species of fish have been sold in the fish markets in Chad and Nigeria (LCBC 2013, Page 53). The macro-fauna of the basin includes hippopotamus, otters, and water bush-buck, an antelope that lives in the marshlands. The lake area has supported herds of elephants and supports the endemic Kouri cattle species.

A variety of stressors has pushed many species to the verge of extinction. In aquatic habitats, crocodiles and turtles are threatened with extinction. Other fauna under threat include the African wild dog, hippopotamus, and elephant. These stressors include displacement of habitats for development, sedimentation in aquatic systems, the use of pesticides and illegal fishing gear, invasive species and poaching.

Additional Resources

The State of the Basin report provides additional information on endangered species, including a listing of critically endangered species (Table 31, Page 191) and a map of threatened animal species in the basin (Map 38, Page 192).

LCBC 2013, Pages 189-193.

The abiotic resources within the basin include geologic settings conducive to petroleum exploitation and mining. Within the conventional basin, oilfields are currently operational in Niger, Nigeria, Chad, and CAR (LCBC 2013, Page 182). Historically there has been limited artisanal or commercial mining in the conventional basin. However recent discoveries of gold in eastern Chad at the Sudanese border have stimulated interest in both artisanal and commercial communities (Solomons, 2017).

4.6 Protected Areas

Protected areas have been set aside to preserve the biodiversity of the Lake Chad Basin (Figure 15). The basin has 30 protected areas, which have been validated by the International Union for Conservation of Nature (IUCN) and occupy an area of over 350,000 km². The color coding in Figure 15 refers to the IUCN designation for each park. These designations indicate the purpose and level of public access allowed in the park.

Protected areas face many of the same stressors as ecosystems outside of protected areas. These include non-authorized livestock grazing, poaching, brushfires, and deforestation for charcoal production. A relatively recent threat to protected areas has been their use as refuges in conflict situations. Boko Haram has taken advantage of the inaccess-

Additional Resources

The State of the Basin Report provides more information on protected areas and RAMSAR wetlands in the Lake Chad Basin.

LCBC 2013, Pages 55-59

sibility of protected areas to avoid capture. BHTs have used Sambissa, Gulumba and other forest reserves in Nigeria as operational bases. There is no record of refugees occupying protected areas so far. Military forces in Nigeria are still fighting to claim total control of the Sambissa forest to the exclusion of Boko Haram (Personal communication with LCBC staff, May 2018).

BIOPALT – Work Toward Biosphere Reserve and World Heritage Site Status

One of the main features of the BIOPALT project is the simultaneous and synergistic preparation of two Lake Chad proposal dossiers: as a biosphere reserve and as a World Heritage site. In general, for sites with a dual designation, dossiers are prepared and presented at different and consecutive times.

BIOPALT 2018

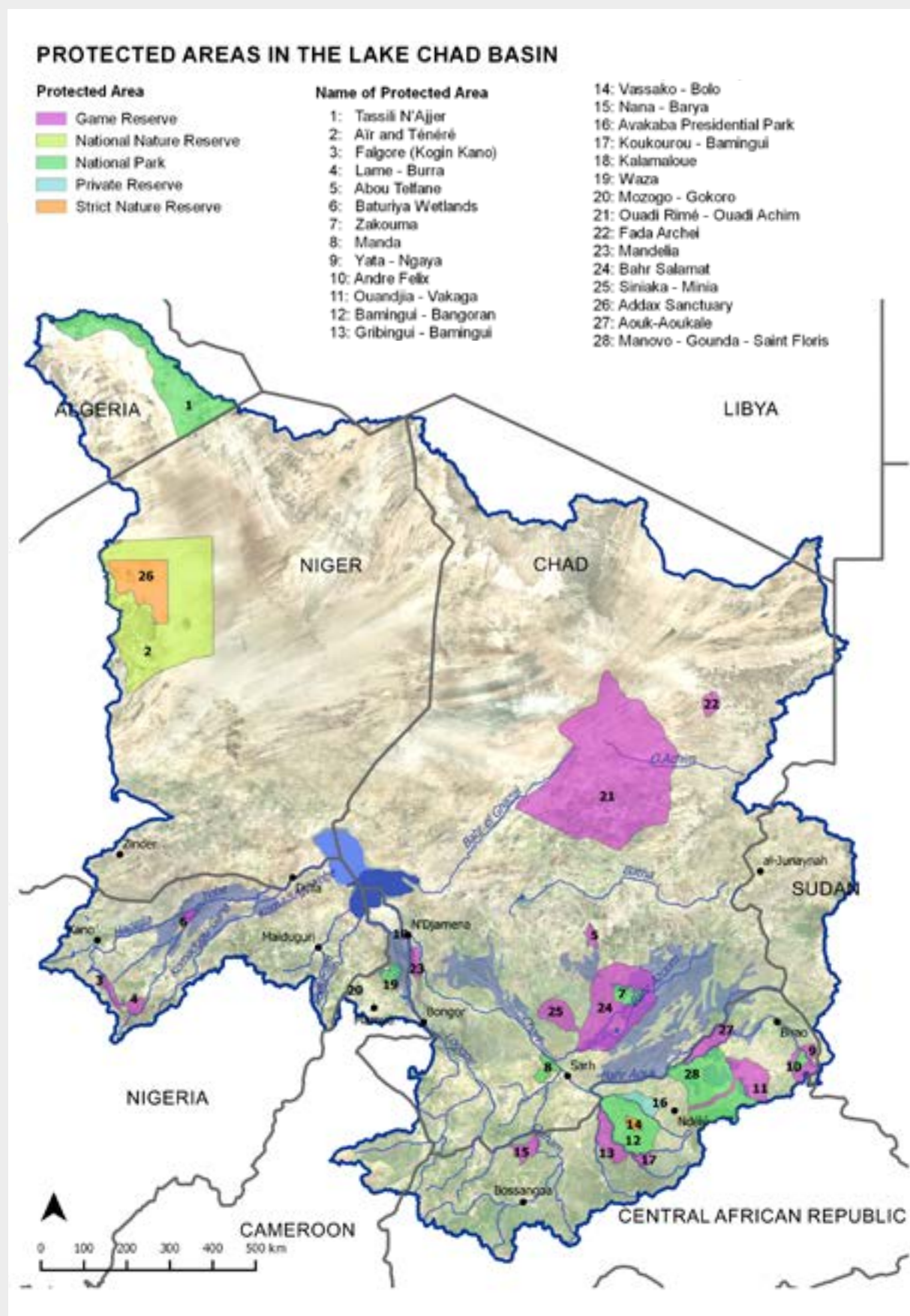
Although protecting biodiversity is a concern relevant to all areas of the Lake Chad Basin, the protected areas provide both a concentration of threatened biodiversity resources, as well as the recognition that these areas are set aside for protecting unique flora and fauna. As part of the 2003 GEF project, the LCBC developed a Regional Strategy of Protected Areas in the Lake Chad Basin (LCBC 2007). This study provides an analysis of the current conditions in each of the protected areas in the basin and proposes a regional strategy to achieve by the year 2025 the following objectives:

- Guarantee the protection of existing protected areas / wetlands and promote new initiatives with a view to improving their contributions to biodiversity conservation;
- Encourage a concerted, integrated management and increased involvement of communities with a view to boost their contribution to local protected area development;
- Encourage cooperation and promotion of initiatives on cross-border management in view of an integrated and sustainable management of the Lake Chad basin's ecosystems.

The five strategic aspects of the plan are biodiversity conservation; research and ecological follow-up; capacity building and sensitization; governance, equity and local development; and development and boosting of the cross-border management of protected areas.



Figure 15 Protected areas in the Lake Chad Basin



Source: State of Basin, Page 55 (LCBC 2013).

4.7 Socio-economic Activities

The most significant changes in the socio-economic profile of the Lake Chad Basin since the 2005 TDA relate to the impacts of climate variability and deteriorating security conditions in the region. This section starts with an overview of the security conditions in the region, followed by an analysis of the socio-economic status of the Lake Chad Basin and how climate and security have become threat multipliers in recent years and for the foreseeable future.

4.7.1 Security

The Rise in Security Threats

Boko Haram emerged in the early 2000s in north-east Nigeria as a fundamentalist Islamic movement in opposition to Nigeria's newly formed democratic government. The extra-judicial killing of its founder and a group of his followers in 2009 by state forces resulted in a temporary retreat of Boko Haram, with the ultimate outcome of an escalation in violence. Both military and civilian militia (Civilian Joint Task Force) forces opposed Boko Haram in these early years. The civilian JTF was an operational response by the military starting from 2013. Initially, they are made up of captured Boko Haram fighters that decided to support the military effort. Prior to that, there has been no civilian response to contain Boko Haram. By 2015 the intensity of attacks had increased and the areas of operation of Boko Haram had expanded to northern Cameroon, southern Niger, and western Chad.

In 2015, the Peace and Security Council of the African Union authorized the deployment of the Multinational Joint Task Force (MJTF), a cooperative effort of military units from Benin, Cameroon, Chad, Niger, and Nigeria. The mandate of the MJTF was to "create a safe and secure environment and contribute to stabilizing the situation in the areas affected by Boko Haram activities" (LCBC and AUC, 2018). Operations conducted by the MNJTF have led to militarily progress in reducing the movement of Boko Haram by pushing them back into their sanctuaries (Africa-EU Partnership, n.d.).

Boko Haram activities have resulted in significant civilian death and physical violence. This violence

has resulted in the displacement of over two and a half million people in the region, making this massive forced migration second only to the Syrian crisis as the largest involuntary displacement in the world (FAO 2017).

Violence and displacement related to Boko Haram are not the only security threats in the region. Civil war in the Central African Republic has resulted in political instability in the headwater regions of the Lake Chad Basin, with similar violence and internally displaced people (IDP) (FAO 2017). Separately, conflict between farmers and shepherds has resulted in excess of fifteen thousand deaths in recent years; a number comparable with that inflicted by Boko Haram (N'Dougou 2018, Taub 2017). There has also been increased criminality related to the high population densities and lack of resources brought about by this redistribution of the population. Other security issues include proliferation of small arms, human trafficking, and violent extremism not related to Boko Haram.

Secondary Impacts of Insecurity

Insecurity has had broad impacts on nearly every aspect of life in the Lake Chad area. Military evacuation of islands in Lake Chad has caused both displacement of civilians, but also a loss of livelihood. In one example, the use of boats was prohibited, because Boko Haram had used boats in their activities. In this case, the civilian residents were not evacuated, but their ability to fish for food and economic support was removed (Taub 2017).

Insecurity has three main impacts in the Lake Chad Basin: food security, economic security, and ecosystem stability. Food and economic security are considered in the following two sub-sections. The impacts of insecurity on ecosystem stability are complex, not easily monitored, and often covary with other factors, such as climate variability and demographic changes. Displacement of populations due to insecurity causes ecosystem stress related to the combination of high population density and poverty. As discussed above in Section 4.6, populations fleeing the BHTs have encroached on protected areas, causing environmental degradation. The BHTs themselves use protected areas as hideouts, causing similar damage to ecosystems.

It is also possible that some ecosystems benefit from insecurity. Worldwide, demilitarized zones, off-limits military bases, and other locations for which human access has been prevented usually see improved conditions in the absence of human impacts (Weisman 2007). Insecurity in the Lake Chad Basin has resulted in evacuations of islands in Lake Chad and other locations. It is not known whether these areas are sufficient in extent and in the duration of their protected condition to result in improvements in ecosystem quality.

Addressing Root Causes of Insecurity through Integrated Management Strategies

Poverty, discontent with the lack of responsiveness of state actors in addressing problems in the Lake Chad Basin, and a general lack of prospects for a secure economic future are root causes of insecurity in the region. The Lake Chad Risk Assessment Project, considers the interacting factors of climate change, insecurity, and economic stability (Vivekananda, 2017). This project follows up on the G7-commissioned report, A New Climate for Peace (G7 Germany 2015) (Schaller, 2017). The Lake Chad Risk Assessment Project has completed its first stage, the development of a Climate-Fragility Profile for the Lake Chad Basin (Nagarajan, 2018). At its completion in 2019, the project will provide recommendations for policy interventions and humanitarian aid investments (Nagarajan, et al., 2018).

The Lake Chad Risk Assessment Project recognizes that security is integrated in a systemic way with other stressors and actors in the region. In their analysis of integrated strategies for resolving environmental and socio-economic problems in the Lake Chad Basin, Okpara et al. (2018) refer to the adaptation-water-peace nexus, in which climate change adaptation measures undertaken by the region need to consider security in water governance planning. In their report on the Lake Chad Climate-Fragility Profile, Nagarajan et al. (2018) support this contention:

Additional Resources

The State of the Basin Report provides more information on the an analysis of the impact of conflict on natural resources.

LCBC 2013, Pages 186-187

In the context of global security, [climate change] is best understood as a ‘threat multiplier’ that interacts with and compounds existing risks and pressures. When climate change converges and interacts with other environmental, social, and political shocks and pressures, it can increase the likelihood of instability or conflict. This threat is particularly virulent in fragile and conflict-affected situations where governments and societal institutions already struggle to achieve security and equitable development. At the same time, conflicts and fragility often contribute to environmental degradation and undermine the ability to adapt to climate change, thus creating a vicious circle of increasing vulnerability and fragility.

Nagarajan et al., 2018

To analyze the degree to which interventions in the Lake Chad Basin have integrated climate, security, and water governance, Okpara et al. (2018) made a quantitative evaluation of 12 documents produced relating to the LCB, including PRODEBALT, the Water Charter, Lake Chad Vision 2025, and the Lake Chad Development and Climate Resilience Action Plan (LCDAP), and PRESIBALT. They determined that of the 12 documents, seven made explicit linkages among the themes of climate, security, and water governance. Of these, the LCDAP had the highest integration score, followed by PRESIBALT. The recently announced BIOPALT project, not yet launched at the time of the Okpara et al. (2018) publication, would certainly score high using their quantification method.

The Regional Stabilization Strategy

Adopting a systemic, integrated approach to addressing the root causes of insecurity are precisely the core values of the newly defined Regional Stabilization Strategy, developed by the LCBC and

the African Union Commission (AUC) and drafted in August 2018. The Regional Strategy for the Stabilization, Recovery and Resilience of the Boko Haram-affected areas of the Lake Chad Basin (LCBC & AUC 2018) is built around nine strategic pillars:

1. Political cooperation
2. Security and human rights
3. Disarmament, demobilization, rehabilitation, reinsertion and reintegration of persons associated with Boko Haram
4. Humanitarian assistance
5. Governance and the social contract
6. Socio-economic recovery and environmental sustainability
7. Education, learning and skills
8. Prevention of violent extremism and building peace
9. Empowerment and inclusion of women and youth.

The Stabilization Strategy is comprehensive and aims to address root causes of insecurity, as well as more immediate security needs. While the intended duration of the Strategy is five years, the plan recognizes that the time scale necessary to fully implement the plan is likely to be generational. In this sense, the Strategy sets a course for a series of fundamental reforms in governance, and civilian and military approaches to managing insecurity. These reforms are designed to correct the root causes of insecurity, identified as poor socio-economic conditions, inadequate education, and a lack of trust in governance authorities.

The Stabilization Strategy is consistent with the Climate Fragility approach in that it takes a broad, systemic view of insecurity in the region. Particularly relevant to the TDA / SAP process is the Strategy's recognition of climate change and other factors that contribute to degraded capacities for the basin's ecosystems to support a growing population. In fact, nearly every one of the nine pillars of the plan has a parallel concern in the TDA / SAP process. There appear to be excellent opportunities for synergies between the Stabilization Strategy and the upcoming SAP project.

4.7.2 Population, Demographics, and Migration

The Lake Chad basin is ethnically highly diverse, with around 70 ethnic groups who are by faith Christian, Muslim or Animist. Each group has its own specific economic activity, culture and language. Ethnic groups often straddle the region's international borders. Chad's population is composed of 12 ethnic groups, the largest of which are the Sara, mostly dwelling in the south and engaged in farming activities; the Buduma (fishers), the Arabs (herders), the Masa and the Moundang (sedentary livestock farmers) (LCBC 2013, Pages 61-62).

In Libya, the Tubu form the ethnic majority in the south of the country along the border with Chad. They are both sedentary and nomadic herders, inhabiting the Tibesti Mountains. As such, they reside across a huge 1,300,000-km² region and speak a Nilo-Saharan language close to the Kanuri language of Chad. The south of Niger and the north of Nigeria contain largely the same mix of ethnic groups, namely the Hausas and the Fula (Fulbe or Fulani), who are predominantly Muslim. Comprising around 30 million individuals, they form the majority throughout the entire pastoral area. However, the Kanuri are a dominant ethnic group in the Nigerian state of Borno (LCBC 2013, Pages 61-62).

In the north of Cameroon, a large variety of different ethnic groups and religions live alongside each other (Muslims, Christians and Animists). These communities grow millet and sorghum and rear goats, sheep and zebu. The largest ethnic group in the region remains the Fula. The north-ern tip of Cameroon also shares with Chad populations of Arabs, Kotoko, Masa and Sara, as well as other ethnic groups. There are more than 20 ethnic groups in the Central African Republic, the main ones being the Gbaya, who live in the centre and west of the country and across into eastern Cameroon, and the Banda living in the north-eastern Aouk region. These groups are mainly Christian by faith. The Sara (Ngama, Mbaye and Kaba) are northern peoples who dwell along the northern border with Chad and are linguistically distinct from the two previously mentioned groups. The Wodaabe (Fula), who are mainly Muslim by faith, are found in the rangelands in the north and centre of the country (LCBC 2013, Pages 61-62).

The population structure and demographics of the Lake Chad Basin are dominated by rapid population growth and redistribution of the population as a result of Boko Haram terrorism. Since the 1960s the population in the region has quadrupled¹ and another doubling is expected by the year 2050 (Magrin and Pérouse de Montclos, 2018).

The 2012 population of the Lake Chad Basin was estimated to be about 45 million. Population density is highest in the Komadugu – Yobe basin of Nigeria; the region to the southwest of Lake Chad in Nigeria, Cameroon, and Chad; and along the Logone River in Cameroon and Chad. There are extremely low population densities north of the conventional basin (Figure 16).

The demographic characteristics of this population reflect a young and growing population. An

Additional Resources

The State of the Basin Report provides more information on the population structure and demographics.

LCBC 2013, Pages 66-69

average of 45% of women are of child-bearing age, leading to a high fertility rate in all basin countries. Life expectancy at birth is low, with an average of 48.5 years in CAR and about 58 years in Niger, compared with average life expectancies in Egypt (71.3 years) or Morocco (74.29 years). Life expectancy estimates have fluctuated in recent decades, but has increased from an average life expectancy basin-wide of around 37 years in 1960 to a 2014 basin-wide average of about 53 years.



¹ Regional Stabilization Strategy draft, Page 11.

Seasonal migration to follow cycles of resource availability has always been part of the culture of the region, particularly close to Lake Chad. How-

ever several factors have led in recent decades to changes in demographic and migration patterns:

Growing Population: The population living within 300 km of the Lake Chad is expected to grow from 13 million to at least 35 million by 2050. Population growth near the lake is associated with the development of the fishing sector and lack of family planning.

Increasing Urbanization: High population densities combined with high birth rates lead to proportionally greater populations in urban areas. In addition, poverty, conflict, and resource limitations draw populations from rural areas to urban areas. The three largest cities in the basin, N'Djamena, Chad and Maiduguri and Kano, Nigeria have a combined 2012 population of over 5.5 million.

Attractive Economic Hubs: Improved transportation links between cities, towns, and rural areas has boosted rural migration, particularly to the market hub of Maiduguri. Lake Chad has become a second economic hub with the development of polder farming and increased fishing activities.

Harsh Weather Conditions: Droughts in the 1970s and early 1980s caused movement of herders and their cattle toward wetlands along Lake Chad and sometimes southward, leading to conflicts over resources and water. Variability and decline in lake level caused fishermen to move from the north pool area to the south pool. Also, there has been a general movement of pastoralists southward to the neighboring Ubangi watershed, although social tensions, political insecurity and water insecurity led to tensions between newcomers and local populations.

Conflict: Armed rebellions in the border area of Chad and CAR in the 1990s caused relocations northward toward Lake Chad. The wars in Darfur and South Sudan in the 2000s also caused movement of refugees into Chad and the CAR. More recently, Boko Haram terrorist campaigns have resulted in depopulation of regions in the northwestern Lake Chad areas and other areas within the basin. To date, an estimated 2.5 million people within the conventional basin have undergone involuntary migration (Figure 17, Magrin and Pérouse de Montclos, 2018, Page 156).

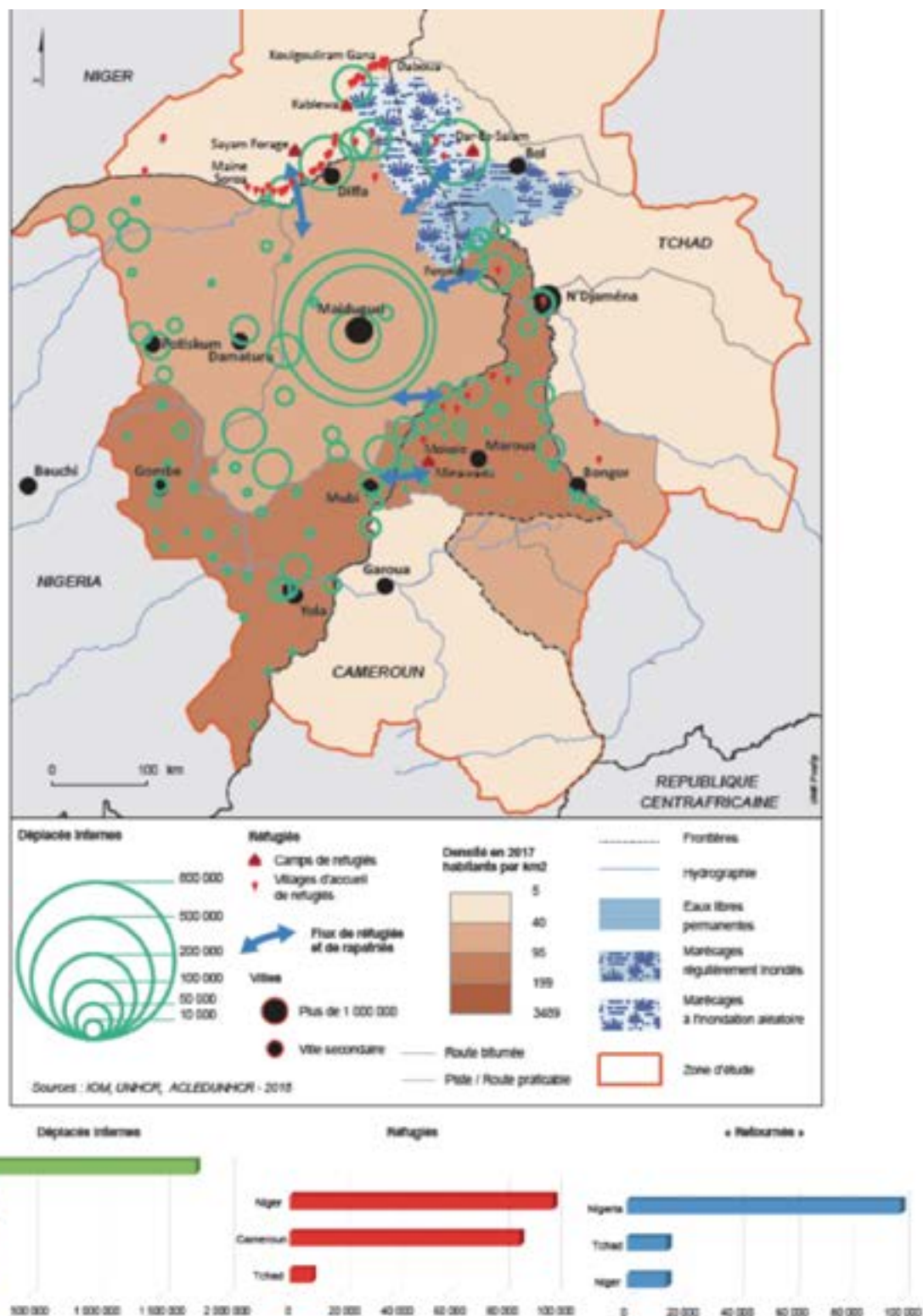
The combination of population growth and migration has placed pressure on economic and natural resources, and has increased tensions in locations in the basin most acutely affected by these two factors.

Additional Resources

The State of the Basin Report provides more information on migration for economic opportunity.

LCBC 2013, Pages 72-76

Figure 17 Distribution of displaced persons and refugees in the Lake Chad Region, 2016.



Source: Magrin and Pérouse de Montclos, 2018, Page 157.

4.7.3 Poverty, Economic Structure, and Market Sectors

The countries of the Lake Chad Basin are some of the poorest in the world. In Nigeria almost 70% of the population lives on less than \$US 1.25/day. In the CAR, Chad, and Niger, almost half of the population lives on less than \$US 1.25/day. The Human Development Index (HDI) measures poverty using life expectancy at birth, education levels, and standard of living. Under these criteria, Niger, Chad, and the CAR are in the bottom ten countries worldwide.

Additional Resources

The State of the Basin Report provides more information on education and literacy in the Lake Chad Basin.

LCBC 2013, Pages 70-71

Associated with poverty are problems with HIV and malnutrition, health education, access to health services, prenatal consultation. Efforts by States to combat the HIV/AIDS pandemic through health programmes and awareness-raising campaigns have increased people's levels of awareness of the disease and attitudes to combat it. The level of people's knowledge of this pandemic differs from one country to another. For the population whose age range varies from 15 to 49, 15% of women and 30% of men in Niger have knowledge of the disease, 61% of women and 74% of men in Cameroon and 88% of men and 80% of women in Chad. The prevalence of HIV/AIDS for the population aged 15 to 49 years is 1.6%. It is slightly higher for women (1.8%), than for men (1.3%) in Chad, and 0.4% for Niger. The level of access to health services for women of reproductive age differs from one country to another. It is 64% for women who received prenatal care from trained staff in Chad, 83% in Niger and 54.6% in the Far North of Cameroon (Citations).

Education rates vary across the basin countries, but are generally low. Adult literacy (2008 – 2012) varied from just under 30% in Niger to 57% in the CAR. These conditions have the potential to improve in future years due to reforms in national education policies. The education infrastructure, however, may not be able to keep up with population growth. Unemployment remains a problem,

even for those completing school. The public sector is the largest employer, but is limited in its ability to employ the available workforce. In response, there has been a rise in various informal work sectors, such as brick-making and services such as motorcycle taxi operations.

Demographic growth and low education rates result in a growing population of youth in need of occupations. Currently about 300,000 individuals per year become old enough to enter the workforce (Expert Meeting on the Lake Chad, 2019). Managed properly, this human resource can help transform the socio-economic structure of the region. The Regional Stabilization Strategy dedicates Strategic Objectives 26, 27, 28, and 30 to improving the education and training of youth in the basin (LCBC and AUC, 2018, Page 35). Youth engaged in meaningful and productive occupations works toward building sustained socio-economic stability, and provides an alternative to the enticements of criminality and participation in extremist organizations.

Additional Resources

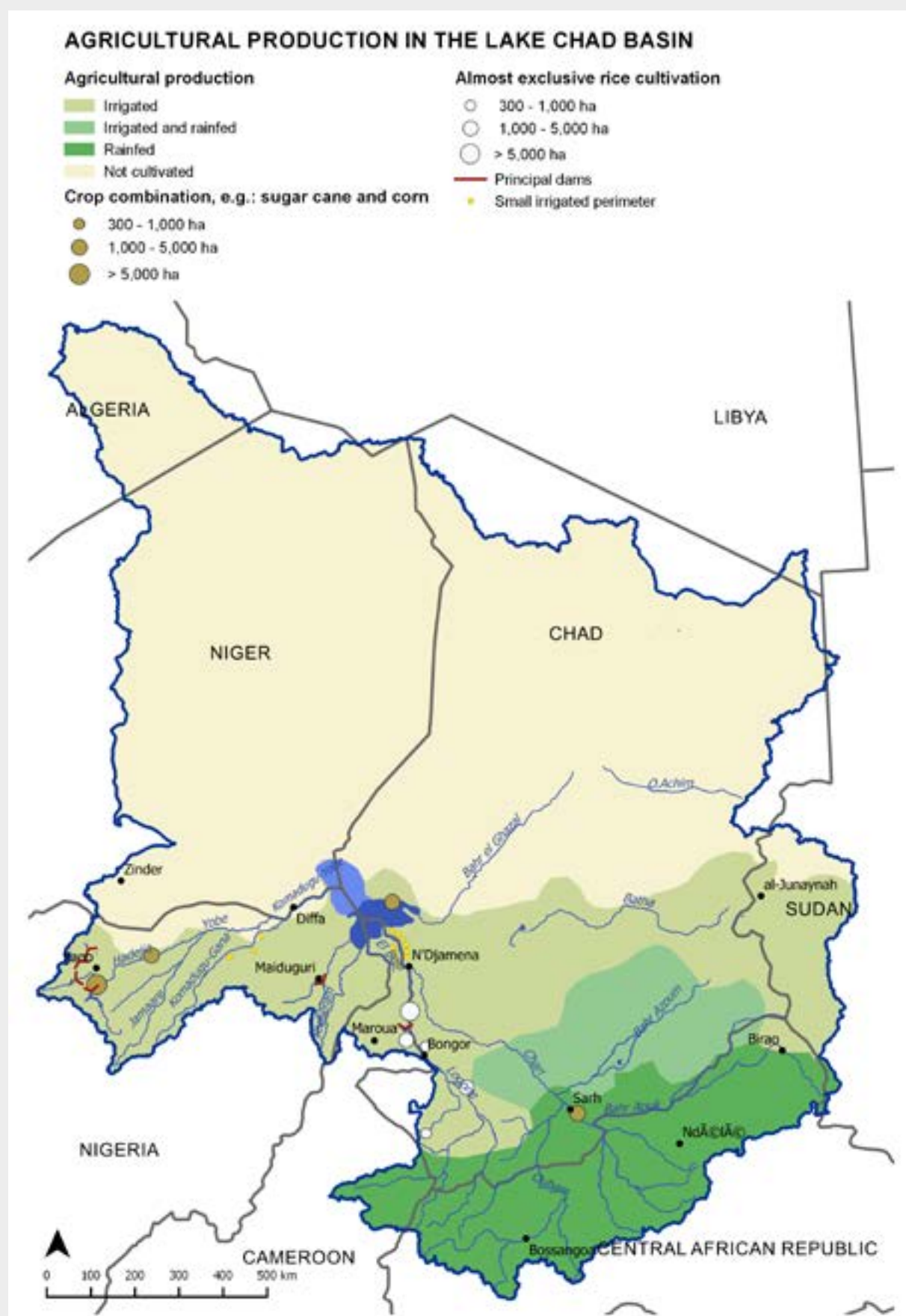
The State of the Basin Report provides more information on income, poverty, and national production in the Lake Chad Basin.

LCBC 2013, Pages 76-79

At a national level, the economic structure of the basin consists primarily of agriculture, fishing, industry, and services. Agriculture is the greatest contributor to Gross Domestic Product in the CAR and Chad, while services has the highest GDP in Cameroon, Niger, and Nigeria. These statistics are at the national level, rather than within just the Lake Chad Basin.

Within the basin, economic activities are centered primarily around agriculture, livestock, and fishing. Metal ore extraction and petroleum development exist, but are not economic drivers at this point. Agricultural activities are supported in all areas roughly south of Lake Chad, however high intensity irrigated agriculture is limited to parts of the Komadugu – Yobe basin and Chari – Logone system in locations with access to irrigation water from reservoirs (Figure 17) or groundwater.

Figure 18 Agricultural production in the Lake Chad Basin



Source: State of Basin, Page 83 (LCBC 2013).

Agriculture

Both food crops and cash crops are grown. Food crops include millet, sorghum, wheat, cocoyam, taro, maize, cassava, and sweet potato. Cash crops include cotton, rice, sesame, and dates, which are generally produced in large-scale farming systems. In the Sudanian zone (Figure 2), production systems are diversified and rely on manual, animal-powered, or mechanized production techniques. The Sudano-sahelian, and Sahelian zones feature production systems structured according to rainfall patterns and water sources.

Agricultural production systems can be classified according to water sources. Rainfed farming does not rely on direct irrigation and is practiced primarily for food crops in the floodplain areas of the Komadugu – Yobe and Chari – Logone basins (Figure 7 and Figure 8). Flood-recession farming takes place along seasonally exposed water-courses such as the Salamat in Chad, the Waza-Logone in Cameroon, and around Lake Chad. Irrigated agriculture is practiced in the southern part of the basin where direct access to surface

Additional Resources

The State of the Basin Report provides more information on economic activities, and agricultural production in the Lake Chad Basin, including information on polder systems around Lake Chad.

LCBC 2013, Pages 80-96

water or groundwater is available. Investments in irrigation infrastructure make higher density agriculture possible and larger scale production of commodities such as rice and cotton are possible. And as discussed previously, polder systems are used around Lake Chad as a form of irrigated agriculture.

The amount of land under cultivation in the basin is about 2.8 million hectares in Niger, Nigeria, Chad, and Cameroon. Additional land exposed by the drying of Lake Chad brings the total land available for cultivation to 7 million hectares (GIZ 2015b, Page 9).

BIOPALT – Documentary Film Project: Building Capacity and Markets for Spirulina

Among the project's flagship activities is the conservation and enhancement of spirulina. This edible algae (*Spirulina platensis*) is a strong socio-economic and cultural characteristic of Lake Chad. Also known as Dihe, spirulina is consumed in the Kanem region as a sauce, but is also exported, particularly for therapeutic use in neighboring countries. It has been harvested and exploited in a traditional way by women in the Kanem and Lake Chad region for several generations. However, its production has declined considerably following the drastic reduction in the surface area of Lake Chad. In order to promote information and awareness of the importance of this exceptional algae and the challenges of its sustainable conservation, the BIOPALT project is producing a documentary film on spirulina.

BIOPALT 2018

Livestock

Transhumance, or pastoral, livestock herding is an ancient practice in the basin, with camel and cattle herding in the north of the basin and cattle herding in the southern basin. True nomadism is disappearing in some areas. Emerging practices reflect more sedentary livelihoods, with farmers and fishermen raising livestock as strategies for adaptation to changing conditions. Currently, cattle, sheep, goats, camel, and horse are raised in the basin's rangelands (GIZ 2015b). The numbers of livestock in the basin are roughly 4.5 million cattle, 7.4 million goats, and 150 thousand camels (GIZ 2015b, Page 11).

Additional Resources

The State of the Basin Report provides more information on the livestock and fishery sectors in the Lake Chad Basin. This includes:

- The potential of the native Kouri cow as a livestock resource
- Livestock populations by nation
- Maps of fishing grounds by basin
- Economic data on fisheries
- Potential impacts of climate change on fisheries.

LCBC 2013, Pages 97-105

Fishing

Fishing is practiced for subsistence and commercial purposes in Lake Chad and essentially all impounded or flowing water in the basin. The fishing sector is comprised of professionals who mostly operate on Lake Chad and larger reservoirs using seine fishing, non-professionals who augment their livestock herding or agricultural activities with fishing, and occasional fishers. Fishing in the Lake Chad Basin is completely artisanal, with motorized craft comprising less than one percent of the fishing fleet. Regulation of fishing practices is overseen by some combination of local traditional authorities and modern system managed exclusively by governmental authorities, depending on location. The total commercial value of catches in the year 2003 was \$US 55 million, and in 2012, the total value was assessed to be \$US 220 million.

4.7.4 Market Circuits, Conflict, and Food Security

Prior to the onset of terrorist activities in the region, the fish, agricultural products, and livestock produced in the Lake Chad areas that were not consumed on site or nearby were transported to local markets (Figure 6). Fresh fish and smoked or dried fish from the northern basin of Lake Chad were transported to Markets in Maiduguri. Fish caught in the southern basin also found markets in Maiduguri but also N'Djamena. Fish are also transported to smaller communities to the northwest and northeast. Agricultural products follow similar market routes as fish. Live animals are almost exclusively transported to Maiduguri. Improvements to roads has both increased the potential for broader reach of market products from the Lake Chad Basin and has also improved access of imported goods in the basin.

In spite of well-developed systems of farming, fishing, and livestock herding, and the support of market circuits for the exchange of goods, food security remains a critical concern in the region. Problems of poverty, unemployment, climate vulnerability, population pressure, and insecurity conspire to maintain constant threats to food security. In the fisheries sector, for example, 20 to 30 percent losses have been observed post-harvest (LCBC, 2014). Nearly 46% of the population's diet consist of cereals and 20% of tubers. These products provide energy, but not nutrients, resulting in malnutrition. The countries of the Lake Chad Basin depend heavily on imported goods and lack national food reserves, increasing their vulnerability to food shortages. Insecurity in the region related to Boko Haram terrorists, has created several compounded problems affecting food security. BHT activities have caused forced migration. Internally displaced people (IDPs) are faced with limited economic resources and competition with indigenous people for food and water resources. Additionally, BHT activities have disrupted market circuits in parts of the Lake Chad region, causing further economic hardship. In their recent book, *Crisis and Development: The Lake Chad Region and Boko Haram*, Magrin and Pérouse de Montclos (2017) provide a graphical representation of the effects of insecurity in the disruption of market circuits (Figure 19).

Hunger remains an imminent threat in the region. According to recent food security assessments, more than 6.9 million people are currently food insecure in affected areas of the four countries bordering Lake Chad (FAO 2017, Page 6). Staple food (cereal) prices have increased in areas affected by 50 to 100 percent mainly due to insecurity and increased transport costs. Border closures and disruptions in traditional transhumance flows and livestock markets are affecting food security and livelihoods, and straining water resources and grazing areas, in the four countries. Livestock prices in Chad and Cameroon have dropped by 30 to 50 percent because the countries are unable to export to neighboring markets in Nigeria.

Additional Resources

The State of the Basin Report provides more information on hunger and food security in the Lake Chad Basin.

LCBC 2013, Pages 105-109

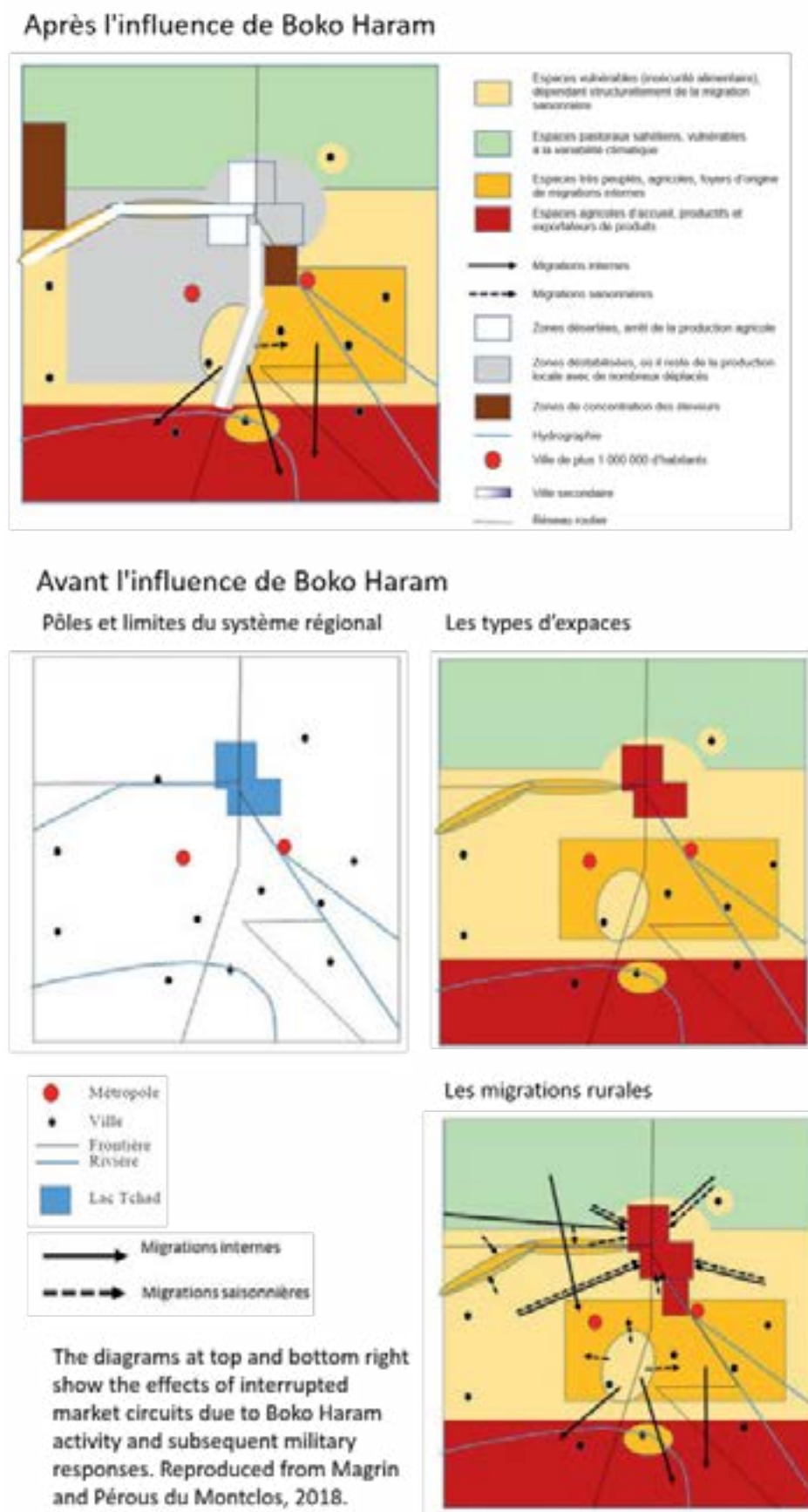
The food insecurity situation in some areas causes malnutrition among children under five years of age. As a result, 40% of children who are stunted suffer from chronic malnutrition, 18% in the moderate form and 22% in the severe form in Chad. In Niger, about 15% of children are under-

weight. In rural areas, 19% of children suffer from this form of malnutrition compared to 8% in urban areas. Among children whose mothers have no education, 28% are underweight, compared with 12% for those whose mothers have primary education, and only 6% for those whose mothers have secondary education. Nearly 32% of children suffer from chronic malnutrition, and 13% suffer severely from it. It should be noted that children in rural areas are more affected than those in urban areas with 38%. Nearly 15% of children under five in Cameroon have a deficiency moderate or severe weight and 4% are classified as severely underweight (citations).

In 2017, the FAO proposed a response strategy to address food security in the region. Their Response Strategy (2017 – 2019) identified four strategic outcomes designed to 1) enhance food production and improve nutrition; 2) improve income and livelihood diversity; 3) work toward conflict resolution; and 4) conduct food security analysis (FAO 2017). Although the food security situation in the Lake Chad basin is indeed dire, the basin does have among its advantages the inherent resilience of the Lake Chad Ecosystem; investments in quantitative tools for managing water resources in the basin; and established systems for agricultural, livestock, and fisheries.



Figure 19 Disruption of Market Circuits in the Lake Chad Basin due to insecurity.



Source: Reproduced from Magrin and Pérouse de Montclos (2017)

4.7.5 Gender

Inequality between men and women is a global, deep-seated problem, and which endures despite the many international conferences organized by the United Nations. In parallel with gender concerns, are the inequities in the treatment and inclusion of minorities and persons with disabilities. Advances in the promotion of women's rights are perceptible, but efforts are still needed to narrow the gap between men and women. The UN dedicated an entire Sustainable Development Goal to gender issues -- SDG 5: Achieve gender equality and empower all women and girls. SDG 5 has nine targets, which include removing barriers that prevent women from fully participating in civil society, eliminating violence and exploitation toward women, and promoting gender equality in policies and legislation (UN Sustainable Development, 2018, p. 5).

Additional Resources

The State of the Basin Report provides more information on gender issues in the Lake Chad Basin.

LCBC 2013, Pages 113-115

The states of the Lake Chad Basin are making efforts to meet SDG 5. The Gender Inequality Index provides a quantitative measure based on reproductive health, empowerment, and economic status (UNDP, 2018). In a 2011 ranking of 187 countries, none of the five countries in the conventional basin ranked higher than 156th place (LCBC 2013). Each country is making progress, however. The Report on the State of the Lake Chad Basin Ecosystem (LCBC 2013, p 115) identified successful initiatives in all five countries to reduce gender inequality.

Manifestations of gender inequality in countries with low HDIs translate into high maternal and infant mortality rates. They are 520 deaths per 100,000 births in 2015 in Niger, 860 deaths per 10,000 births in Chad in 2015. In the field of education, 78% of women against 46% of men in Chad are illiterate, 54% of boys against 48% of girls attend primary schools and 57.5% of boys and 26.9% of girls are in secondary school in Chad. In Niger, the gross primary school enrollment rate is 80.2 percent for boys and 68.0 percent for girls. In Cameroon, in the Far North, 69.2% of girls and 98.3% are in primary school. The social and economic responsibilities of women living in rural areas have not changed significantly. Rural women are alone in charge of acquiring water and fuel for cooking and subsistence. Stress on the supplies of water and fuel place hardship on women and often children, and limit their capacity to contribute, participate, and be recognized in other sectors of family and community life (WEDO 2007, cited in NEST 2011). This is also true in the Lake Chad basin, however there are far more complex dimensions to consider as well, such as the effects of insecurity. A study on gender and climate change adaptation in Nigeria observes that, "an increase in pests and disease due to climate change can affect the productivity of Nigeria's labor force and increase women's workload as they are largely responsible for the burden of caring for the sick" (NEST 2011). This study, published by the Building Nigeria's Response to Climate Change Project, provides case studies and gender-sensitive approaches to climate change adaptation (NEST 2011). The newly drafted Regional Strategy to address insecurity in the Lake Chad region recognizes the importance of gender issues and places gender mainstreaming as one of its nine principles (LCBC & AUC 2018).

Gender Considerations in Conflict Zones

Violent conflict has affected and changed gender roles in areas affected by violence in northeast Nigeria. Men of fighting age are often the first to flee insecure areas, deliberately targeted and killed by armed opposition groups, viewed with suspicion, arrested and detained by security agencies and involved in fighting (Mercy Corps 2016). As a result, women make up the vast majority of the adult population in many areas. Consequently, they have taken on new types of economic activities and decision-making roles. Even if present, men are no longer able to provide for families, forcing women to find ways of earning incomes, including through survival sex. There is concern from both women's and men's groups about women's economic empowerment leading to disrespect in the home and taking women away from domestic concerns (Nagarajan 2015).

Nagarajan, et al., 2018

Gender Impacts of Changing Conditions on Transhumance Pastoralists

Among the impoverished herders, the disappearance of dowries of cows for women, which secured them their own capital, and the higher frequency of divorce has left some women in economic straits: the men's transhumance periods can become longer, forcing women to take on a larger share of the work without being compensated by higher status or more decision-making power.

Magrin & Pétrouse de Montclos, 2018, page 47

The Regional Stabilization strategy has identified gender equity as a priority. Pillar 9, Empowerment and inclusion of women and youth, has established four strategic objectives related to gender:

Strategic Objective 37: Protecting Women and Girls

Strategic Objective 38: Promoting Women Participation, Empowerment and Socio-Economic Rights

Strategic Objective 39: Youth Empowerment, Participation, and Protection

Strategic Objective 41: Monitoring and Accountability

Further progress on reducing gender inequality will require deliberate and focused efforts at gender mainstreaming. In 2017, the GEF adopted a Policy on Gender Equality that introduced a set of new principles and requirements to mainstream gender in the design, implementation, and evaluation of GEF programs and projects. The policy marks a distinct shift in GEF's approach to gender mainstreaming, from a gender-aware "do no harm" approach to a gender-responsive "do good" approach (GEF, 2016). This gender-responsive approach has four main elements:

Gender-responsive Stakeholder Consultations: Efforts to ensure equal opportunities in terms of consultations, participation and decision-making throughout the project cycle;

Gender Analysis: Collection and analysis of sex-disaggregated data and information on the situations between men and women to inform project design, implementation and monitoring and evaluation.

Gender-responsive Actions: Measures to address gender differences, gender-differentiated impacts and risks, and opportunities to promote gender equality and women's empowerment.

Gender-responsive Monitoring and Evaluation: Use of sex-disaggregated and gender-sensitive indicators, and targets to measure results of project activities on women and men.

To implement this policy effectively, the GEF developed a guidance document² in 2018 (GEF 2018). This document is organized around the GEF project cycle, and outlines detailed and practical steps needed to meet requirements set out in this policy.

2 <https://www.thegef.org/council-meeting-documents/guidance-advance-gender-equality-gef-projects-and-programs>

4.8 Regional and National Institutional Bodies and Legal Aspects

The LCBC was established in 1964 with mandates to coordinate and promote regional cooperation for the sustainable and equitable management of the Lake Chad Basin, the preservation and protection of its ecosystems, and the promotion of peace and security in the region. Within the original mandate, the LCBC had limited authority to implement transboundary regulations. Progress in transboundary management of the basin was further impeded, because national legal and institutional instruments required harmonization. This section describes some of the advances made in the basin since the 2005 TDA with regard to restructuring of the LCBC, ratification of the Water Charter, and relevance to national governing bodies.

Additional Resources

The State of the Basin Report provides more information governance at the national, regional, and international levels in the Lake Chad Basin.

LCBC 2013, Pages 116-122

At the continental level, the countries of the Lake Chad Basin are closely integrated into the work of the Economic Community of West Africa (ECOWAS), the Economic Commission for Africa (ECA) and the African Union. In addition, the countries are signatories to various global conventions and agreements summarized below in Table 7 Summary of relevant multi-lateral environmental agreements.

Table 7 Summary of relevant multi-lateral environmental agreements

Agreement	Cameroon	Central African Republic	Chad	Niger	Nigeria
UNFCCC ²⁸ Convention on Climate Change	1994/30	1995	1994	1995	1994
Submitted UNFCCC National Adaptation Programmes of Action (GEF, 2018)	No Record	2008	2010	2006	No Record
Paris Agreement ³²	2016	2016	2017	2016	2017
Kyoto Protocol ³³	2002	2008	2009	2004	2004
Convention on Wetlands (RAMSAR) ³⁴	2006	1990	2006	1987	2001
UN Convention to Combat Desertification ³⁵	1997	1996	1996	1996	1997
Convention on Biological Diversity ³⁶	1994	1995	1994	1995	1994
Convention on International Trade in Endangered Species of Wild Flora and Fauna ³⁷	1981	1980	1989	1975	1974
Convention on the Conservation of Migratory Species and Wild Animals ³⁸	1983	Non-Party	1997	1983	1987
Vienna Convention for the Protection of the Ozone Layer ³⁹	1989	1993	1989	1992	1988
Stockholm Convention on Persistent Organic Pollutants	2009	2008	2004	2005	2004

4.8.1 The Water Charter in Regional Governance

Limitations in the ability of the LCBC to meet its mandates were addressed with the development and ratification of the Lake Chad Basin Water Charter. Work began on the Water Charter in 2009 and, as described previously (Section 3.2) the Water Charter has now been ratified and is ready for implementation. The Water Charter provides for the following functions to be coordinated at the LCBC and may require additional capacities to manage responsibilities when fully implemented. These functions are detailed in Chapters 2 through 16 of the Water Charter and elaborated upon in Articles 10 through 93 of those chapters. Three of the key functions are:

- Manage abstractions from surface and ground-water systems.
- Emergency planning and preparedness to ensure the protection of the people, the environment, and water resources.
- Common facilities, facilities of common interest, and infrastructure asset management and ownership.

Ratification of the Water Charter authorizes implementation to begin. The LCBC has significant responsibilities associated with monitoring the effectiveness of the charter and the primary objective for the recent restructuring of the LCBC was to prepare for implementation of the charter. At this point, it is up to the member countries to make the Water Charter effective.

4.8.2 National Governing Bodies

With the ratification of the Water Charter, member countries are now obligated to harmonize their laws and policies to protect the natural resources of the basin. As is common in environmental and water legislation, relevant acts and policies occur across a wide range of legal instruments under the general categories of water, land, and environmental codes. These are summarized for each country in Table 8 and described below.

The water codes: These cover resource-sharing issues, environmental protection and sometimes decentralized management. These codes were developed in the 1990s based on the key IWRM principles emerging at that time. These key principles are the management of resources at the river basin level, taking into account the social and economic value of water, cross-sectoral and coordinated management, the principle of subsidiarity, environmental sustainability and participatory governance.

The land codes: The land codes of all the basin states are considerably older than the water codes but their implementation remains challenging, and the coexistence of customary law and traditional law is sometimes problematic.

The environmental codes: All basin states now have environmental codes in place.

Much work is ahead for each of the member countries working individually and in coordination with LCBC and partner countries, to complete the process of aligning laws, policies, and regulations. From the national side, the counterparts for coordination will be the relevant governing bodies responsible for the monitoring and enforcement of laws and policies, as well as the many other activities involved in managing the affairs related to the water, environment, and ecosystems of the Lake Chad Basin (Table 9).

An example of the coordination necessary in regulations that affect IWRM is the licensing of hydropower dams. In 2018, a private company received Water Use licenses from the government of Nigeria to operate the 10 megawatt Tiga Hydroelectric Power Plant on the Kano River and the six megawatt Challawa Hydroelectric Power Plant on the Challawa River (Vanguard News, 2018). To be fully compliant with the Water Charter, the issuance of this type of permit would require coordination with riparian countries and consideration of hydrologic impacts of hydropower generation.

Table 8 Overview of national water management policies

Cameroon	Water governance falls to three ministries in Cameroon: Mines, Water and Energy; Agriculture; and the Centre for Hydrological Research (Ministry of Scientific and Technical Research). Since the irrigation and water sector was privatized following the crisis in the 1980s, productivity has fallen. In response, the state is now directing its policy towards the farming of existing schemes, small-scale irrigation and the promotion of private sector investment in irrigation. Since 1998 Cameroon has had a law in place aimed at protecting against pollution and preserving water resources and drinking water quality (Law No 98/005 of 14 April 1998).
Libya	With regard to agricultural irrigation, the Ministry of Agriculture and Livestock is responsible for implementing major irrigation projects. The Ministry of Municipalities is in charge of urban water supplies. The General Water Authority (GWA) is responsible for monitoring and evaluating/estimating water resources, particularly with regard to irrigation and drainage projects.
The Niger	Ordinance No. 2010-09 of 1 April 2010 establishing the Water Code in the Niger sets out the ways in which water will be managed throughout the country. It specifies the conditions pertaining to the organization of water supplies for people and livestock on the one hand, and pertaining to irrigation schemes on the other. It also defines the mission and responsibilities of the National Water and Sanitation Commission (CNEA) and the Regional Water and Sanitation Commissions (CREA). Regarding water governance, the Ministry of Hydraulics and the Environment, the Ministry of Agriculture and the Ministry of Livestock direct water policy in the Niger. The Niger set out its IWRM vision in two founding texts: the Economic and Social Development Plan 2012, which aims to strengthen service provision in terms of access to drinking water, hygiene and sanitation at the local authority level, and the 3N Plan (Les Nigériens Nourissent les Nigériens – the people of the Niger feeding the people of the Niger), which aims to ensure the food security and self-sufficiency of the country by increasing the amount of land under irrigation to 125,000 ha by 2015.
Nigeria	The Ministry of Water Resources is the principal coordinating body with regard to water policy in Nigeria. It handles irrigation, hydrological and meteorological statistics and studies, as well as legislation. Other Nigerian institutions are involved in the formulation of water policies, particularly the National Council of Water Resources, the National Technical Committee on Water Resources, the Ministry of Agriculture and Rural Development and the River Basin Development Authorities. The key feature of water management in Nigeria is that its administration is decentralized but lacks adequate co-ordination. Integrated water resource management has not been enshrined in a single founding policy instrument, but is instead embedded in a range of legislation relating to irrigation, agriculture, decentralization and navigation.
Central African Republic	The Central African Republic has placed water resource governance under different central government ministries: Agriculture and Livestock; Public Works; Environment and Ecology; Water, Forests, Hunting and Fishing; Mines, Energy and Hydraulics; and Rural Development. There are also three regional directorates for hydraulics, which come under the Ministry of Mines, Energy and Hydraulics and its General Directorate of Hydraulics. The IWRM approach was defined in 1995 through the National Policy and Strategies for Water and Sanitation, which were produced with the assistance of the project supported by the National Committee for Water and Sanitation.
Chad	Water governance in Chad is distributed among several ministries and public and quasi-public institutions, some which operate regional services. They comprise: ■ The Ministry of the Environment and Water, which is responsible for managing and developing water resources; ■ The Ministry of Agriculture's Directorate of Rural Engineering and Agriculture Hydraulics (DGRHA), which is responsible for the development of irrigation; ■ The National Office of Rural Development (ONDR), which is the quasi-public implementing agency for agricultural development programs; ■ The Lake Chad Development Company (SODELAC); ■ The Ministry of Livestock. The water sector remained fairly unregulated up until the National Assembly's adoption in 1999 of the Water Code (Law No. 016/PR/99). This aims to regulate the sector and at the same time deliver decentralization and substantially involve the private and voluntary sectors as well as end-users. Legislation approving irrigation schemes has come into force, but is being poorly implemented.

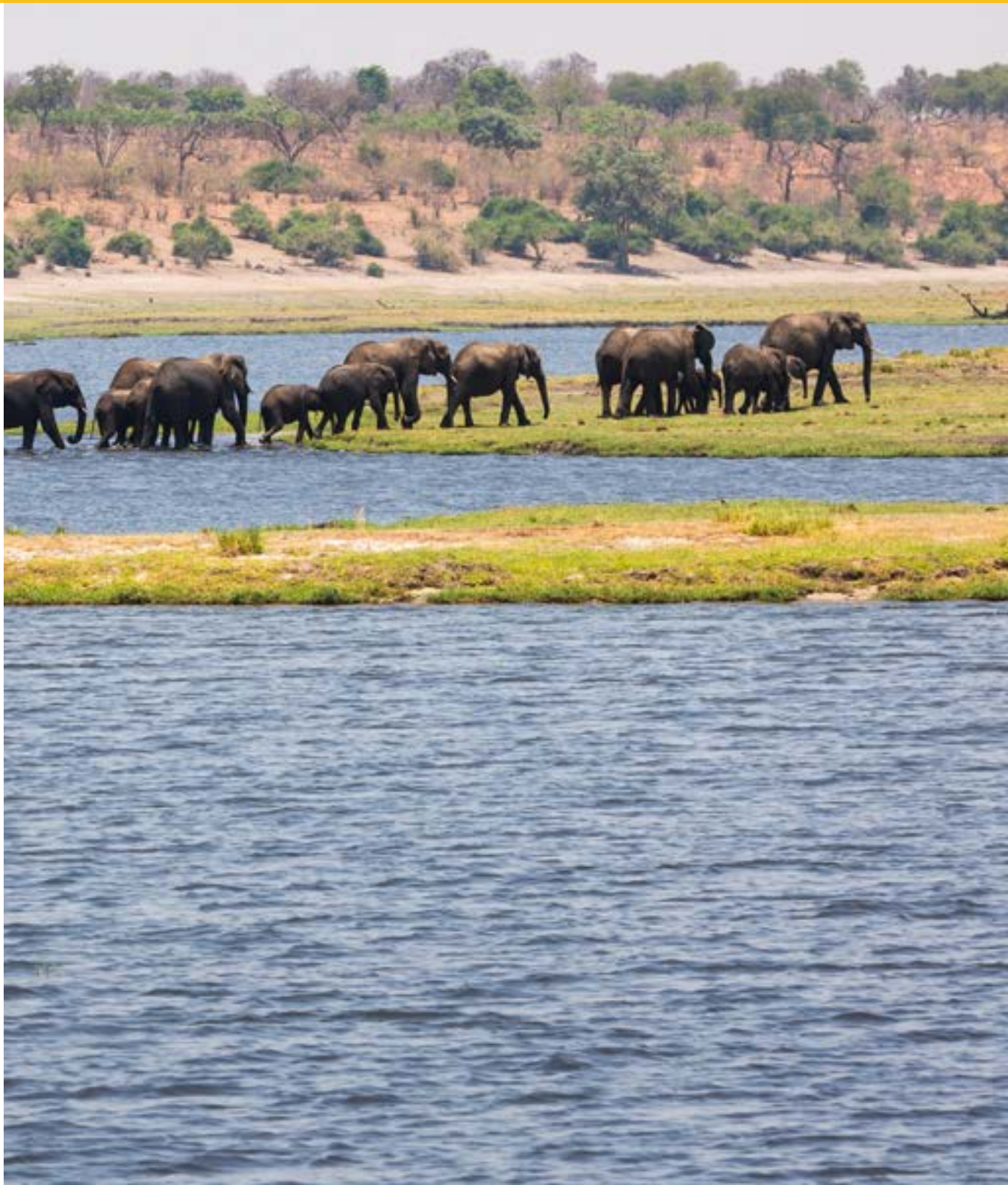
Source: State of Basin, Page 116 (LCBC 2013).

Table 9 Organizations and ministries involved in water resources management of the Lake Chad basin in the riparian countries

Country	Principal ministries and national organizations in charge of water management	Role/Tasks
Cameroon	Ministry of Energy and Water Resources (MINEE)	In charge of the management and mobilization of water resources throughout the country
	Ministry of the Environment, Nature Protection and Sustainable Development (MINEPDED)	In charge of defining the modalities and principles of rational natural resources management
	National Water Committee (NWC)	In charge of studying and proposing to the government any measures or actions that might contribute to the conservation, protection, and sustainable use of water
Niger	Ministry of the Environment, Urban Health and Sustainable Development	Monitors the impacts of the degradation of natural resources accelerated by climate change and for restoration measures and the implementation of environmental conventions
	Ministry of Animal Husbandry and Animal Industries	Implements pastoral hydraulics policy, in collaboration with other ministries and institutions concerned
	Ministry of Agriculture	Concerned with the use of agricultural land and hydro-agricultural development
	Ministry of Planning, Spatial Planning and Community Development	In charge of action planning
	Company for Water Utilities (SEEN)	Ensures the production, transportation and distribution of water in urban and semi-urban areas.
	Niger Water Assets Holding Company (SPEN)	Ensures the management and development of water resource assets, and the contracting and project management of new constructions and infrastructure extensions
Nigeria	Federal Ministry of Water Resources	Responsibility of overall water resources management and development
	State Ministries and Agencies in charge of water resources	Ensures the supply of drinking water
	Local Government Authorities (LGAs)	Ensure the development of agriculture and natural resources
	Federal Ministry of Environment	Securing a quality environment conducive for good health and well-being of fauna and flora and promoting sustainable use of natural resources including water
Chad	Ministry of the Environment and Agriculture	Executing government policies and strategies in relation to hydro-agricultural facilities and construction of the associated infrastructure
	Ministry of Hydraulics and Animal Husbandry	Coordinates, orchestrates, conceives, implements and monitors policy regarding pastoral development and live-stock production, and planning and capacity-building
		Formulates and implements policies and strategies in relation to hydro-agricultural facilities and construction of the associated infrastructure
	National High Committee for the Environment (HCNE)	Ensures environmental sustainability for all development challenges, including those relating to the water sector

Source: Environmental Audit, Pages 23-24 (LCBC 2013).

5 Priority Transboundary Problems



5.1 Introduction to Main Problems

The Priority Transboundary Problems identified in the 2005 TDA were revisited at a January 2018 workshop at LCBC headquarters in N'Djamena with LCBC, representatives from LCBC's member countries, GIZ, and an external consultant (Section 2.1). A result of the workshop was the revision of this list, reducing the number from the original seven to a revised list of four:

- Variability in hydrological and hydrogeological regime
- Biodiversity degradation
- Sedimentation
- Climate variability and change

This list formed the basis of causal chain analysis exercises conducted at a second workshop, convened at LCBC headquarters in N'Djamena in May 2018. Participants in the exercise were LCBC staff and the exercise was coordinated by GIZ staff and facilitated

by external consultants. The complete results are provided in Annex 4 and summarized below. The approach for conducting the causal-chain analysis followed GEF IW:LEARN guidance and the topics were expanded to consider the following:

- Goods and Services at risk
- Impacts on socio-economic conditions and ecosystems
- Sectors involved
- Immediate causes
- Underlying cause
- Root causes

The following sections describe each problem, identify the main ecosystem and socio-economic impacts and linkages with other primary transboundary problems, presents the causal chain analysis, and discusses relevant knowledge gaps.

5.2 Problem 1: Variability in hydrological and hydrogeological regime

This is similar to a primary transboundary problem in the 2005 TDA, but also includes groundwater considerations.

5.2.1 Description of Problem

High frequency and magnitude of hydrologic variability have been part of the Lake Chad system for millennia. However, in the decades following the last high water condition in Lake Chad in 1963, lake levels have diminished and the size of the lake has decreased by as much as 90%. Since 2000 this trend has reversed somewhat, and the lake has been increasing in area by about 3.5% per year. However, several factors point toward concern for the long-term hydrologic regime in the system. Abstractions in the tributaries to Lake Chad are expected to increase, with increasing population density and climate forecasts predict higher temperatures, and consequently higher evaporation / evapotranspiration, as well as higher variability in rainfall. Preliminary hydrologic modeling

Additional Resources

The State of the Basin Report provides more information on variability of the hydrological regime and fresh-water availability as a primary transboundary problem in the Lake Chad Basin.

LCBC 2013, Pages 179-180

(GIZ 2015a) suggests that the lake will not extend beyond the Small Lake Chad size category.

With respect to groundwater, exchanges with the surficial aquifer are closely linked to the hydrology of tributary rivers, so decreases in river flow will reduce recharge to the aquifer. Increases in temperature will result in evaporation / evapotranspiration, which will further reduce recharge to surficial aquifers. This is of particular concern in riparian wetlands which are known to be recharge zones.

5.2.2 Main Ecosystem and Socio-economic Impacts

Variability in hydrological regimes reduces the predictability that water will be available. Prolonged periods of low water availability can cause shifts in ecosystems, impairing or potentially eliminating their ability to support human populations. The causal chain analysis identified goods and services at risk to include both aquatic and terrestrial ecosystems, groundwater recharge, drinking water, and water for irrigation and other uses.

The most direct socio-economic impacts of hydrologic / hydrogeologic variability relate to the success or failure of fisheries, agriculture, and livestock. Lower quantities of available water reduce the output of these goods. Variability in the hydrologic regime will alter the patterns of flooding and drying of floodplains and the margins of rivers and of Lake Chad, thereby upsetting the patterns of land use in those areas. While the predictable flooding and draining of these areas can have the benefit of providing naturally fertilized agricultural areas, highly variable flooding and drying can result in failed crops or otherwise compromise the economic utility of these areas.

5.2.3 Linkages with other Transboundary Issues

Variability in hydrologic and hydrologic regimes is closely linked with all of the other three primary transboundary problems, as well as many other secondary transboundary issues.

Biodiversity: Variability can damage biodiversity in a variety of ways. Changes in water availability can destabilize ecosystems, making them vulnerable to invasive species, or produce a complete shift in ecosystems, isolating or fragmenting preserves of biodiversity, or destroying them completely.

Sedimentation: Hydrologic variability can also result in increased erosion through pulses of higher velocity flow causing sediment redistribution.

Climate Variability and Change: Are likely a core driver of hydrologic variability. Adaptation strategies for climate change need to address variability or long-term alteration in the availability of surface water and increased demands on groundwater.

Security: Unpredictable water supplies and the impacts of prolonged low availability of water can be related to migration and resulting conflict over competition for resources between displaced and indigenous populations. Economic declines resulting from hydrologic variability worsens unemployment and availabilities of opportunities for youth, who may become easily recruited by terrorist organizations.



5.2.4 Causal Chain Analysis

The results of the causal chain analysis exercise for variability in hydrologic and hydrogeologic regime are listed in Table 10 and summarized below.

Goods and Services at Risk: It is considered self-evident that changes to hydrological and/or hydrogeological regime, in particular the decrease in available water resources, will have a significant negative effect on all biological resources in the region and will threaten water resources used for drinking or the irrigation for food commodities.

Impacts: As indicated above, decreases in water resources will have negative impacts on both biodiversity loss and food security. In addition, decreases in water resources will increase migration pressures resulting from lower water availability. The potential impacts from excess water (floods) could

lead to destruction of settlements and increasing risks from sediment transport and pollution entering the water course from land-based sources.

Causes: The CCA identified a range of immediate, underlying and root causes that lead to variability of hydrological and hydrogeological regime. The main root causes (e.g. climate change, poverty, demographic growth, etc.) are generally beyond the scope of the updated SAP to address however, the issues identified as immediate/underlying causes are clearly within the expected focus of the SAP. In particular the issues resulting from poor governance (in particular the lack of appropriate policies and low/poor enforcement of these) and inadequate management of physical structures (e.g. dams) should be fully addressed through actions to be developed and implemented under the SAP and NAPs.

Table 10 Causal chain analysis for Variability in Hydrological and Hydrogeological Regime

Effects and causes of the variability of hydrological and hydrogeological regime		
Goods and Services at risk	■ Aquatic and land-based ecosystems ■ Groundwater recharge	■ Drinking water ■ Water for irrigation, industry etc.
Impacts (ecosystem and socio-economic)	Floods and droughts leading to: ■ Biodiversity loss ■ Loss of socio-economic benefits (fishing, agriculture, industry)	■ Loss of groundwater resources (droughts) ■ Migration pressure ■ Reduced availability (and/or pollution from floods) of water sources for humans
Sectors	■ Agriculture: grazing, livestock, forestry ■ Industry (including mining) ■ Energy	■ Transport ■ Settlements/villages (e.g. damage to housing from floods)
Immediate Causes	■ Climate variability (changes in rainfall) ■ Increasing pressure on water resources	■ Increase of hydraulic structures (affecting flow) ■ Poor management of dams
Underlying Causes	Poor governance including: ■ Low application of water policies, ■ Low enforcement, ■ Absence of available policies on groundwater/surface water management	
Root Causes	■ Climate change ■ Poverty	■ Demographic growth ■ Insufficient financial resources

5.2.5 Knowledge Gaps

Compared with the 2005 TDA, hydrologic monitoring, through both on-the-ground data collection and remote sensing, is far more advanced and the analytical capabilities are more sophisticated. Nonetheless, better and more complete data and more advanced hydrologic modeling are

necessary to provide effective decision support in this complex watershed. A better understanding of the groundwater systems in the region is also necessary. Detailed knowledge of the extent of recoverable water in aquifers is essential for planning abstractions in a rational way, to meet the drinking water needs of a growing population.

5.3 Problem 2: Biodiversity Degradation

This priority transboundary problem combines the following priority transboundary problems from the 2005 TDA: Decreased viability of biological resources, loss and modification of ecosystems, and invasive species.

Additional Resources

The State of the Basin Report provides more information on biodiversity in the Lake Chad Basin.

LCBC 2013, Page 60

Additional Resources

The State of the Basin Report provides more information on invasive species in the Lake Chad Basin.

LCBC 2013, Page 194-195

5.3.1 Description of Problem

Biodiversity can be degraded through a wide range of ecosystem impairments. Land degradation (including deforestation, overgrazing, desertification, etc.) can result in losses in terrestrial biodiversity, but also in the reduction or lack of availability of fuel wood and result in excess erosion leading to sedimentation issues. Overfishing and pollution can result in depletion of fish populations and an alteration of aquatic food webs. Invasive plant species can displace native plants with resulting overgrowth and blockage of waterways. Improper farming and grazing can degrade soil conditions, resulting in erosion. Improper management of protected areas and poaching, can push endangered species of flora and fauna to extinction. But, at its most basic level, improper management of ecosystems can be a stressor that impairs ecosystem function.

5.3.2 Main Ecosystem and Socio-economic Impacts

Ecosystem impacts include a reduction in the extent and viability of wetlands, diminishing vegetation cover, reduced availability of medicinal plants, and degradation in soil quality and habitat conditions. Socio-economic impacts include a loss in food security from losses in arable land and, in particular, fisheries, increases in insecurity, and the loss of opportunities for ecotourism.

5.3.3 Linkages with other Transboundary Issues

Variability in Hydrologic and Hydrogeologic Regimes: Can cause direct pressure on ecosystems by creating unstable conditions that could favor competition by invasive species, or by creating hydrologic regimes that are unfavorable for ecosystem resilience.

Sedimentation: Alters habitats and can create conditions favorable for invasive species. Sedimentation can also reduce water depths, making conditions unfavorable for native fish species. Reduced water depths can also result in higher water temperatures, causing ecosystem impairments.

Climate Variability and Change: Can be a driver in biodiversity alterations. More intense storms can lead to erosion and thereby alter terrestrial habitats. Changes in the timing of rainfall availability can affect both terrestrial and aquatic ecosystems and cause loss of biodiversity in ecosystems with low resilience.

Security: Refugees evacuated from insecure locations cause increased population density in localized areas, placing pressure on ecosystems for fuel wood and placing pressure on water supplies and other ecosystem services. Both refugees and terrorists have sought refuge in protected areas, causing damage to sensitive ecosystems and placing endangered species at risk.

5.3.4 Causal Chain Analysis

The results of the causal chain analysis exercise for biodiversity degradation are listed in Table 11 and summarized below.

Goods and Services at Risk: Loss in biodiversity will have a direct impact on ecotourism with the loss of protected areas as attractions. Most other impacts will be indirect, with reduced wetlands, loss of food security, and diminished vegetation cover.

Impacts: Relate to the loss in resilience and ecosystem services. These impacts will be observed as a loss in arable lands and pasture, decrease in habitat value, and a resulting loss in income. Secondary impacts will be decrease in ecotourism, increase in poverty, and deterioration in security conditions.

Causes: Immediate causes were identified as drought and temperature variability, floods over-exploitation of flora and fauna, brushfires, deforestation, and human pressure on land resources. Underlying causes were identified as inadequate enforcement of water policies, absence of harmonized legislation and policies, and poor awareness of best practices. Root causes were population growth, climate change, poverty, insecurity, and political instability.

Additional Resources

The State of the Basin Report provides more information on loss of biodiversity as a primary transboundary problem in the Lake Chad Basin, including:

- Increased demand for fuel wood
- Impact of conflict on natural resources
- Fishery impacts
- Endangered species
- Invasive species

LCBC 2013, Pages 185-195

Table 11 Causal chain analysis for Biodiversity Loss

Effects and causes of Biological Degradation	
Goods and Services at risk	Ecosystem loss resulting in: ■ Reduced wetlands ■ Diminishing vegetation cover ■ Loss of food security ■ Reduced availability of medicinal plants ■ Reduced soil quality ■ Reduced habitat conditions ■ Ecotourism ■ Industry
Impacts (ecosystem and socio-economic)	■ Decrease in ecosystem/habitat value ■ Loss of arable/pasture ■ Increase in insecurity ■ Decrease in ecotourism ■ loss of income ■ Decline in local business (related to ecotourism??)
Sectors	■ Agriculture: grazing, livestock, forestry ■ Fisheries ■ Industry/handicrafts ■ Ecotourism ■ Health (loss of medicinal plants??)
Immediate Causes	■ Drought /temperature variability ■ Floods ■ Over exploitation of flora/fauna (including overgrazing) ■ Bushfires ■ Deforestation ■ Human pressure on land resources
Underlying Causes	Poor governance including: ■ Low application of water policies, ■ Low enforcement ■ Absence of harmonised legislation/policies ■ Low application of Water Charter ■ Poor awareness of best practices
Root Causes	■ Population growth ■ Climate Change ■ Poverty ■ Insecurity ■ Political instability

5.3.5 Knowledge Gaps

Inventories are necessary to quantify the spatial extent of biological diversity and the overall condition of ecosystems. Once inventories have been estab-

lished, ongoing monitoring to track the trajectory of change will lead to an understanding of biodiversity changes in the basin. Impacts of migration and the re-distribution of populations need to be studied to assist in the development of management plans.

5.4 Problem 3: Sedimentation

This transboundary problem is unchanged from the 2005 TDA and includes the causes (e.g. desertification, overgrazing, deforestations) of land-degradation leading to sedimentation.

Additional Resources

The State of the Basin Report provides more information on sedimentation as a primary transboundary problem in the Lake Chad Basin.

LCBC 2013, Pages 184-185

5.4.1 Description of Problem

Redistribution of sediment through erosion in aquatic systems, and wind erosion of terrestrial soil have been problematic in tributary rivers and streams, as well as in small lakes, impoundments, and wetlands in the Lake Chad Basin system.

5.4.2 Main Ecosystem and Socio-economic Impacts

Filling in of water courses reduces the channel cross sections and can result in diversion of flows and channel alterations under flood conditions. Sedimentation in reservoirs decreases the storage capacity of reservoirs, can decrease the lifespan of the reservoirs, and can damage water conveyance structures. Sedimentation can also create habitats conducive to colonization of invasive species.

5.4.3 Linkages with other Transboundary Issues

Variability in Hydrologic and Hydrogeologic Regimes: Erosion through variable hydrologic conditions increases the supply of sediment in aquatic systems from terrestrial sources. Erosive flows in these aquatic systems results in the redistribution of sediment.

Biodiversity Degradation: Primary linkage is the risk of invasive species in sediment-laden systems resulting from land degradation (loss of habitats) and increased erosion

Climate Variability and Change: Similar linkages as variability in hydrologic and hydrogeologic regime.

5.4.4 Causal Chain Analysis

The results of the causal chain analysis exercise for sedimentation are listed in Table 12 and summarized below.

Goods and Services at Risk: Fisheries and infrastructure are the main goods and services at risk.

Impacts: Include flooding and generally changes in hydroperiod and routing of water courses, invasive species, and loss of income due to fishery loss.

Causes: Immediate causes are water and wind erosion, deforestation, and inappropriate agricultural practices. Underlying causes are weak enforcement of regulations, absence of harmonized regulations, insufficient awareness of best practices, and lack of environmental education. Root causes are population growth, poor governance, institutional instability, climate variability, and poverty.

Table 12 Causal chain analysis for Sedimentation

Effects and causes of sedimentation	
Goods and Services at risk	Lake Chad and tributaries including: ■ Aquatic habitats (incl. fauna and flora) ■ Ponds/oases ■ Infrastructures ■ Biological diversity
Impacts (ecosystem and socio-economic)	■ Floods ■ Degradation of habitats / loss of biodiversity ■ Development of harmful species (?) ■ Migration / transhumance (seasonal migration) ■ Loss of income
Sectors	■ Agriculture /livestock ■ Water abstraction facilities ■ Fisheries ■ Vegetation cover
Immediate Causes	■ Water / wind erosion ■ Deforestation ■ Inappropriate agricultural techniques (including overgrazing)
Underlying Causes	■ Poor governance including: • Weak application/ enforcement of regulations • Absence and/or lack of harmonise of regulations/policies • Low application of Water Charter ■ Over production ■ Insufficient awareness of best practices ■ Lack of environmental education
Root Causes	■ Population growth ■ Institutional instability ■ Climate variability ■ Poverty

5.4.5 Knowledge Gaps

The 2005 TDA identified gaps that included poor monitoring and documentation of human-induced changes to river channel geomorphology; a lack of reliable data on sediment loads, dune reactivation and dune formation; and no map-

ping of down-cutting or gullyng on valley slopes. Since the 2005 TDA, several projects have been conducted through the PRODEBALT project in the Komadugu – Yobe basin to address sedimentation. The results of these projects and adoption of best practices from them would be useful to fill knowledge gaps.

5.5 Problem 4: Climate Variability and Change

As a cross-cutting issue, the impacts of climate variability and change have been discussed in relation to the other three primary transboundary issues. Along with insecurity, climate variability and change can act as a threat multiplier (Nagaran, et al., 2018). The Lake Chad basin is vulnerable to several interacting stressors: population growth and poverty result in high demands placed on ecosystems. A changing and variable climate further de-stabilizes ecosystems. Insecurity can result in direct damage to ecosystems and indirect impacts through factors such as displacement of refugees causing concentrations of populations in ecologically vulnerable areas.

Addressing the primary transboundary problems in the Lake Chad basin will require a system-

ic approach that considers these cross-cutting problems. The Stabilization Strategy, proposed by the LCBC and AUC, take precisely this systemic approach and recognize that “climate proofing” the basin is a necessary component of sustainable, long-term management and prevention of insecurity in the region.

Additional Resources

The State of the Basin Report provides more information on climate change as a primary transboundary problem in the Lake Chad Basin.

LCBC 2013, Pages 195-197



6 Stakeholder Analysis Update



As part of the 2005 TDA process, national stakeholder analyses were conducted by separate experts for Nigeria and the Francophone countries. Only the Nigerian stakeholder analysis was ready in time for the publication of the 2005 TDA. The stakeholder analyses for Francophone countries were published in 2007 and while these are more than a decade old now, they remain the only stakeholder analyses available in the basin. An early effort in SAP implementation should be an update to these national evaluations, and the preparation of regional analyses. The national stakeholder analyses for the Francophone coun-

tries, were comprehensive surveys of the general environmental situation; specific analyses of water, forest and wildlife resources; an assessment of biodiversity; an overview of environmental policy; as well as a stakeholder analysis for each country. Each stakeholder analysis also evaluated conflicts between actors and priorities for interventions.

This section provides an overview of the stakeholder analysis for Cameroon, CAR, Chad, Niger, and Nigeria, and makes recommendations for a regional stakeholder analysis.

6.1 Stakeholder Analysis for Cameroon

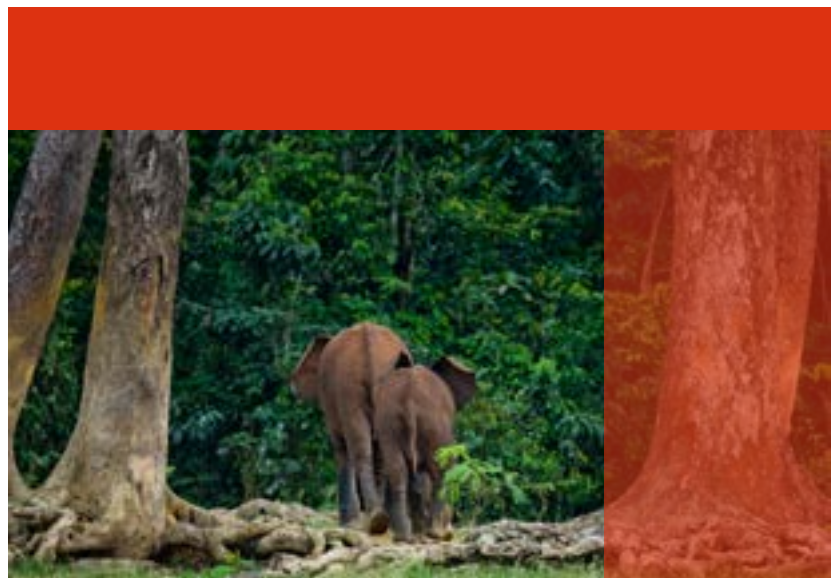
The primary stakeholders in Cameroon (and in the other countries with direct access to Lake Chad) are groups and individuals whose livelihoods depend directly on Lake Chad. These were identified as fishermen, pastoralists, and farmers. Other primary stakeholders with interests both close to Lake Chad and farther to the south were traders and operators of wildlife and forest resources. All of these livelihoods require oversight to prevent unsustainable practices. For example, pastoralists need to limit herd sizes to prevent overgrazing. Collection of wood for fuel, in many cases, needs to be eliminated completely, to prevent deforestation.

Other stakeholders were identified as administrative authorities, which consisted of provincial delegations of the central government. These included the Provincial Delegation of Livestock, Fisheries, and Animal Industries, Forest and Wildlife, Agriculture and Rural Development, and Environment and Nature Protection. The remaining stakeholders identified by the Cameroon national report were decentralized authorities (mayors), traditional authorities (Maguivini and Blama traditional leaders), religious authorities, NGOs, development projects, and donors.

6.2 Stakeholder Analysis for Central African Republic

Stakeholders for CAR differ somewhat from other countries in the conventional basin, in that CAR does not have direct access to Lake Chad. The national report for CAR made distinctions between the northern and southern zones of the watershed. Primary stakeholders in both zones consisted mainly of individual-scale farming, herding, hunting, wood collection, and artisanal mining. A significant concern has been the influx of foreign immigrants.

The national report for CAR identified actors grouped within associative structures. These were economic operators (farmers, pastoralists, artisanal miners), marginal groups (women, the young, Fulani, Pygmies), religious communities, and refugees and the displaced.



6.3 Stakeholder Analysis for Chad

Primary stakeholders were identified as farmers, pastoralists, fishers, traders, transporters, forest resources operators, and craftsmen. Other stakeholders were identified as traditional authorities (Sultans, chiefs of the Cantons, village leaders, tribal leaders, and heads of districts), decentralized

authorities (prefects, sub-prefects, mayors, and postmasters), State technical services (e.g., breeding; agriculture; waters and forest; trade, industry, and craft; health; and education), NGOs, development projects, and donors.

6.4 Stakeholder Analysis for Niger

Primary stakeholders consisted of farmers, pastoralists, fishers, wood collectors, transporters, traders, and artisans. Other stakeholders included customary authorities (traditional chiefs of townships, chiefs of tribes and groups, and heads of villages), mayors, donors and international in-

stitutions, development projects, and NGOs. The national report for Niger provides an in-depth analysis of the demographic characteristics of populations within the basin, activities of primary stakeholders, and potential conflicts among the primary stakeholders.

6.5 Stakeholder Analysis for Nigeria

The stakeholder analysis for Nigeria identified the parties involved in or affected by environmental problems or their solutions in the Lake Chad basin. They categorized these actors in two ways: first according to their role in the basin and second in terms of their supportiveness and influence. The first category identified whether stakeholders were Primary (directly impacted), Secondary (intermediaries) or Key (decision-makers) Stakeholders. The second categorization assists in the design of engagement strategies for stakeholders. Each stakeholder was assigned quantitative values in terms of their Supportiveness and their Influence (powerfulness).

Primary stakeholders were identified as transhumance pastoralists, irrigation farmers, fishers, water vendors, and produce-dealers and traders. Secondary stakeholders included service providers (e.g., transporters, police), development agencies, donors, NGOs, and projects. Key stakeholders included national and state assemblies and legislatures, federal ministries of water, environment, and agriculture, and various state and local ministries and councils.

6.6 Toward a Regional Stakeholder Analysis

National stakeholder analyses were prepared in 2003 for Nigeria and 2007 for the Francophone countries. These should be updated using the Francophone stakeholder analyses as templates. While many if not all of the actors probably remain the same, an update can capture changes in the relative influence of stakeholders in light of changes underway in the region, in national and regional governance, and in the activities of international organizations and donors. An example

of the need for updating the stakeholder analysis is that since the original national stakeholder analyses were conducted, private enterprises have emerged as important primary stakeholders. Once national reports have been updated, a regional stakeholder analysis can be prepared. The graphic depiction of stakeholder engagement and influence employed in the Nigeria analysis, as well as other graphical analyses presented in their report, can be useful at the basin level.

7 Governance Analysis Update



The Lake Chad Basin has reached a turning point in governance. At the regional level, the Water Charter has been ratified and is ready for implementation. The LCBC is implementing its reorganization plan and as of May 2018 welcomed staff to start filling positions in its new organizational structure. Reorganization is a key step in preparing the LCBC to address its duties to oversee Water Charter responsibilities. At the national level, governance structures and legal instruments need to be harmonized for effective implementation of the charter. Synergies between LCBC and member states need to be developed to overcome challenges in the regional organization. Transformations in local, national, and regional governance may also be realized through the launch of the Stabilization Strategy for the long-term management of insecurity in the region (LCBC & AUC 2018). Of its nine core principles, several relate to improved governance, and one is specifically dedicated to significant governance

reform. Although the goals of the Strategy relate to security, the benefits of institutional reform would directly improve ecosystem conditions in the basin.

This section evaluates the national and regional governance structures at this transition point, cites the results of the 2016 Joint Environmental Audit on the Drying Up of Lake Chad (GIZ 2015b), and provides updates on progress since the audit report. Detailed information on governance at national and regional levels can be found in the State of the Basin Report (LCBC 2013, Pages 116-119), the Joint Environmental Audit report (GIZ 2015b, Pages 19-24) and in the TDA (Pages 73 – 80 and 126 – 128). Excellent descriptions of the participating of the LCBC and Lake Chad Basin nations in international agreements are provided in the State of the Basin Report (LCBC 2013, Pages 120 and 121) and in the 2005 TDA (Pages 128 and 129).

7.1 National Governance

The Environmental Audit commented on the following specific areas of governance at the national level:

- Policies and strategies for water resources management
- Regulation of water withdrawal
- Data collection and sharing
- Enforcement of regulations
- Capacity to ensure proper governance

The audit found that the roles and responsibilities of the ministries and organizations involved in water resource management are not always clearly defined or divided. The general observation was that the four riparian countries have established a variety of administrations and public organizations involved in resource management, without ensuring a clear definitions of their roles and responsibilities. All four countries have measures in place for controlling users of water resources, but these controls are not implemented. This has resulted in a wide range of violations which vary in scale from water withdrawal to support nomadic herders to the construction

of large-scale dams which divert significant proportions of river water for irrigation.

Effective implementation of water and resource regulations has been prevented by several key factors:

- Clear delineation of duties and responsibilities by regulatory ministries has not been established.
- The absence of hydrometric monitoring networks and data management facilities prevent detection of water use violation.
- Water users are not aware of the rules governing water use or the adverse effects of poor water management practices.
- Sanctions for water use violations have not been imposed.

Nearly all of these concerns have been recognized and addressed in the Water Charter. It remains the responsibility of the nations, however to make the necessary changes to national legal and institutional frameworks and governance practices to implement the Water Charter effectively.

7.2 Regional Governance

The LCBC was established in 1964 with the following mandates

- Sustainable and equitable management of the Lake Chad waters and other transboundary water resources of the Lake Chad basin;
- Preservation and protection of ecosystems of the catchment area; and
- Promotion of integration and preservation of peace and security in the conventional basin

The environmental audit found this mandate to lack clarity and precision and does not reflect the expectations, needs, changes, or major challenges that have occurred in the Lake Chad basin since the LCBC was established. While the mandate may be broad in its wording, the LCBC does address the issues raised by the audit. The combination of the development and adoption of the Water Charter and the restructuring of the LCBC have brought focus to the roles and responsibilities of the LCBC.

The audit commented on the following areas of regional governance:

- Strategic and operational planning
- Mandate and missions
- Regulation of water withdrawal
- Data collection and sharing
- Enforcement of regulations
- Capacity to ensure proper governance

Many of the audit findings at the regional level were similar to concerns with national governance. Regulation of water withdrawal and enforcing those regulations, linked with the need for data-collection networks to monitor for violations, were a significant part of deficiencies identified by the audit. The Water Charter provides solutions to these problems, at least on paper. The commitment of nations to implement the charter and of the LCBC to provide responsible oversight remains to be exercised.

The audit team identified a concern which is not unprecedented in transboundary basins: The lack of effective data collection agreements. Progress has been made on hydrometric monitoring capabilities, and the Lake Chad Basin Observatory

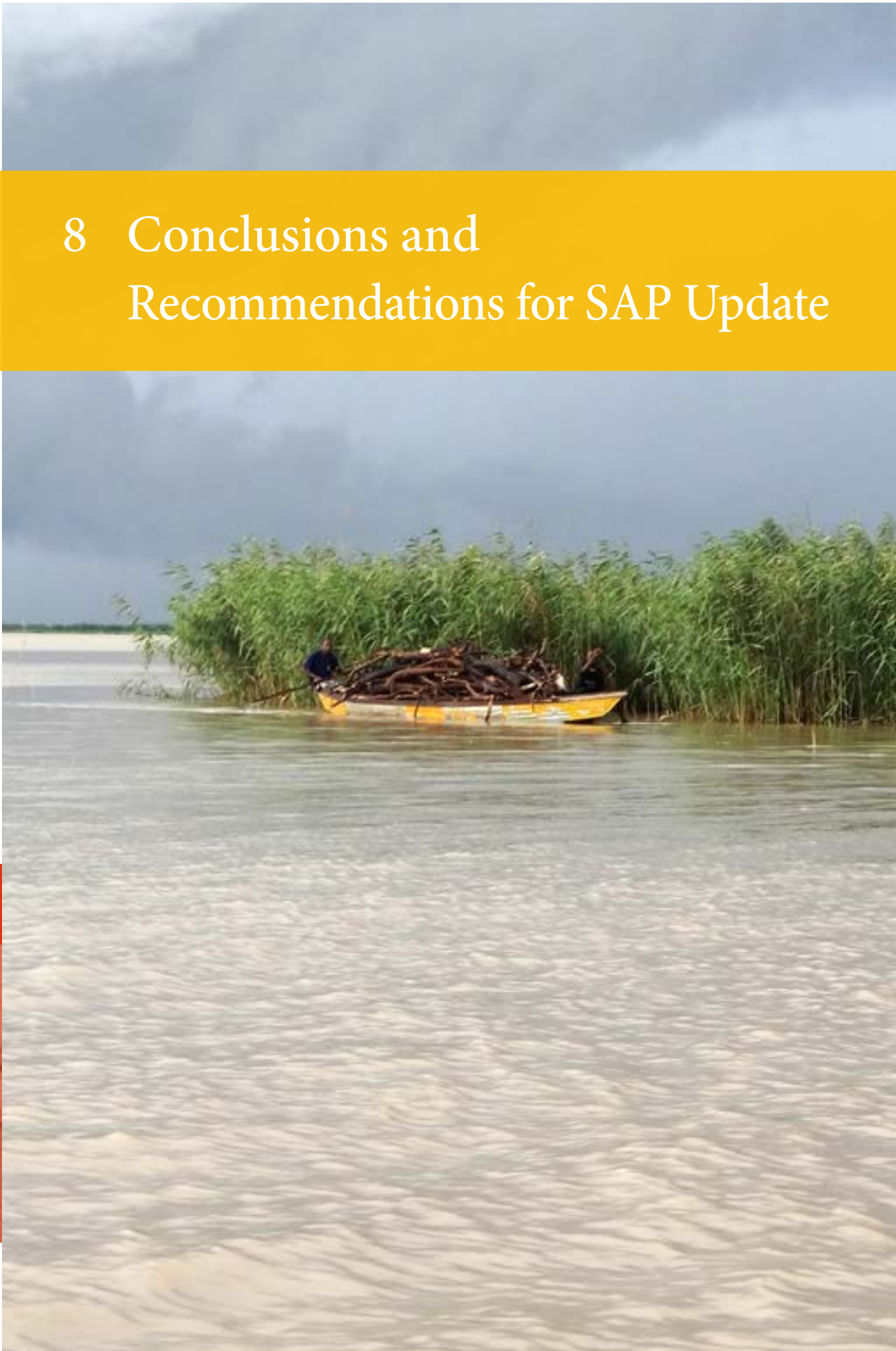
has been established to collect, analyze, and curate these data. However, developing a sufficiently comprehensive network will require the cooperation of the four riparian countries.

A data sharing agreement and protocol were approved by the Summit of Heads of State in 2008. This agreement was reviewed and made part of the Water Charter. The commitment to share data was one of the six commitments agreed during the negotiation on the Water Charter. In practice, the agreement proves to be difficult to implement due to technical issues unrelated to a lack of cooperation between the countries. These include the lack of data collection and management networks and inadequate funding for station maintenance.

Audit findings specific to the LCBC related to its scope of mandate and problems with internal organization and financing. Most if not all of these concerns have been addressed with the reorganization of the LCBC. The reorganization is recent and ongoing, but the LCBC has demonstrated its commitment through the implementation of a wide range of recommendations for restructuring. It has adopted the organizational chart proposed through the Institutional Assessment. Terms of reference were prepared for new positions in the organization and many have been filled. Much work remains, with the two primary fronts of activity being completion of LCBC reorganization and implementation of the Water Charter. Both will require the continued commitment and cooperation among the riparian nations and the LCBC.



8 Conclusions and Recommendations for SAP Update



The years since the adoption of the 2005 TDA have seen change in the ecosystems, institutions, and perspectives of the Lake Chad Basin. Climate variability has been recognized as a threat and countries have started to develop adaptation strategies. Insecurity, which was recognized as a potential problem in the 2005 TDA, has become a focal point in the basin. Best practices for the TDA / SAP process have evolved. Investments have been made based on the SAP and institutional change has made progress toward realization. LCBC reorganization is underway and the Water Charter is in force and ready for implementation. This TDA update reflects some of the progress made by the LCBC and within the Lake Chad Basin. The resources available to compile this report are far more extensive than for the original TDA. The scientific data available are more comprehensive and reliable. The analytical capabilities of the LCBC have increased substantially. For example, our understanding of the hydrogeologic systems and their importance in the basin is much better than in 2005.

The LCBC also has the advantage of evolving perspectives in basin management. For example, the climate-fragility approach being pursued by Chad Risk Assessment Project examines the inter-relationships among climate change, security, and development. Elements of this work can integrate synergistically with SAP implementation. Systemic approaches are appropriate in the Lake Chad basin, in which a diverse set of interventions are now underway to manage humanitarian and environmental concerns. A systemic approach can help assure that the resources being invested in the basin are used with the greatest impact possible.

The Lake Chad basin continues to support its ecosystems and the services they provide to its inhabitants. The basin's ecosystems have evolved to be resilient and so far, have resisted threats. Even in its Small Lake Chad state, the system still supports the socio-economic welfare of much of the basin's population. With population growth and the forecast for an increase in climate variability, the resources of the basin need to be managed carefully. SAP implementation will work toward that possibility.

Recommendations for continued future activities, particularly with regard to SAP implementation are the following:

- It is worth noting for the updating of the SAP that there are several common underlying causes that were identified by the TDA CCA. For example, poor governance (including absence of adequate policies, low enforcement, etc.), lack of adequate awareness amongst all stakeholders on environmental aspects and the need for improved capacity at all levels. In the updating of the SAP it is expected that these 'causes' will be prioritized in short, medium and long-term management actions to best both integrate addressing the solutions to the transboundary problems and utilizing the available resources at national and regional level effectively, whilst seeking supplementary international donor funds.
- SAP actions should be oriented around a "no regrets" approach to considerations of climate variability, change, and adaptation.
- SAP formulation should include more information on stakeholder roles and their engagement during SAP implementation at regional, national, and local levels. This will also assist in the sustainability of interventions.
- SAP planning should include measurable outcomes for gender mainstreaming. These outcomes should also include considerations of children and the disabled.
- LCBC should ensure that databases and analyses are continually updated and maintained to enable new basin assessments to be completed readily. This includes information on all ecosystem and socio-economic aspects.
- LCBC should conduct basin assessments, similar in scope and scale to the 2016 State of the Basin Report, every five years or so. These assessments can provide the data necessary to support TDA updates and provide information relevant to other national and regional commitments, which include reporting for Sustainable Development Goal (SGD) progress and climate adaptation plans.
- LCBC should be prepared for emerging concerns by periodically re-evaluating monitoring needs and priorities. For example, water pollution is not currently identified as a priority transboundary threat, but as conditions change in the basin, this problem could emerge. Specific examples are pollution caused by petroleum exploration and gold mining in the conventional basin, and eutrophication threats from wastewater discharges and agricultural sources.
- LCBC should adopt a schedule for updating the TDA and reviewing SAP Ecosystem Quality and

Water Resource Objectives. As part of this, the LCBC should plan now for the next TDA update to be produced internally, rather than with the assistance of external consultants.

- LCBC should undertake an initiative to track all interventions underway in the basin and evaluate the relevance of those interventions to the objectives of SAP implementation and other LCBC initiatives. These may include national and regional climate adaptation strategies and implementation of the Stabilization Strategy.

- If approved and launched, the Stabilization Strategy (LCBC & AUC 2018) could have a significant impact on both TDA data collection and management, and on strategic actions being developed for upcoming SAP implementation. Close attention should be paid to the progress of this plan and opportunities for synergies at all levels should be considered. Emerging UN initiatives in climate security³ should also be monitored and acted upon as necessary for positive synergy with SAP implementation activities.



³ <https://news.un.org/en/story/2019/01/1031322>

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Annex 1. Questionnaires for LCBC and National Experts

Information Request I

This list of questions was based on the assessment of the 2005 TDA and was intended to address specific sections of the TDA.

Section 1.2: What is the LCBC motivation for updating the TDA/SAP?	
Three main reasons for the motivation to update the TDA/SAP 1. The SAP document mentioned that the process of the TDA/SAP could be done every five years. 2. The lack of focus to issues of groundwater and climate change in the existing TDA/SAP. 3. The new funding from GEF for the implementation of the SAP provides an opportunity to revisit the SAP prior to further investment.	M. Bila (e, doc 1)
1. Evolution of the socio-economic situation, following the attacks and the displacement of the populations by the Boko Haram sect in the basin of Lake Chad. The islands of the lake are evacuated from their population following military security measures. This category of displaced people requires specific development actions for their sustainable re-installation in their initial production area. This is new data to integrate in the update of the ADT. 2. The description of the socio-economic part should differentiate the situation of men and women from the basin (gender language).	Fatime (f, doc 2)
Section 2.1: What recent regional and national reports are we using for source data?	
1. Creation and Extension of The Lake Chad Basin Water Charter Phase 1 - Assessment A - The common challenge - Managing shared water resources and ecosystems 2. Creation and Extension of The Lake Chad Basin Water Charter Phase 1 - Assessment B - Assessment of the legislative and institutional framework 3. Development of Lake Chad Current Situation and Possible Outcomes, Expert group review under the IRD 4. Study to Establish the Five-Year Investment Plan (2013-2017) 5. Joint Environmental Audit on the Drying up of Lake Chad, African Organization of Supreme Audit Institutions (AFROSAT) 6. GEERKEN, R., VASSOLO, S. & BILA, M. (2012): Impacts of climate variability and population pressure on water resources in the Lake Chad Basin. In: BOGARDI, J., LEENTVAAR, J. & NACHTNEBEL, H-P. (eds.): River Basins and Change. - Contrib. to the intern. conference on "The Global Dimensions of Change in River Basins" organised within the Global Catchment Initiative of the Global Water System Project (GWSP), December 6 - 8, 2010, Bonn, Germany. 7. GEERKEN, R., VASSOLO, S. & SCHIMMER, R. (2012): Monitoring variations of Yaere Wetlands to understand effects of inter-annual climate variations. Poster presented at the IWRM conference 2012, Karlsruhe 8. KREKELER, T. & SEEGER, K. (2013): Discharge Measurements at Chari, Logone and Koulambou River, Chad. - Technical Report No 5, prepared by LCBC & BGR: 40 p.; Hannover. 9. KREKELER, T. & SEEGER, K. (2013): Mesure des débits sur les fleuves Chari, Logone et Koulambou au Tchad. - Rapport Technique No 5, préparé par LCBC & BGR: 40 p.; Hanovre. 10. SEEGER, K. (2013): 2nd Mission on Discharge Measurements at Chari, Logone and Koulambou River, Chad. - Technical Report No 6, prepared by LCBC & BGR: 39 p.; Hannover. 11. SEEGER, K. (2013): 2ème mission de mesures de débits sur les fleuves Chari, Logone et Koulambou, Tchad. - Rapport Technique No 6, préparé par LCBC & BGR: 39 p.; Hanovre. 12. SEEGER, K., DAIRA, D., BALA, A.M. & VASSOLO, S. (2014): Groundwater Quality Investigations in the Lower Logone Floodplain in April - May 2013. - Technical Report No 7, prepared by LCBC & BGR: 47 p.; Hannover. 13. SEEGER, K., DAIRA, D., BALA, M. & VASSOLO, S. (2014): Études de la qualité des eaux souterraines dans la plaine d'inondation du Logone inférieur en avril - mai 2013. - Rapport Technique No 7, préparé par LCBC & BGR: 48 p.; Hanovre. 14. SEEGER, K. & WILCZOK, C. (2014): Microbial and Chemical Drinking Water Analysis in N'Djamena. - Technical Report No 9, prepared by LCBC & BGR: 37 p.; Hannover. 15. SEEGER, K., WILCZOK, C., DAIRA, D. & BALA, A. (2016): Groundwater - Surface Water Interaction in the Lower Logone Floodplain. - Technical Report No 10, prepared by LCBC & BGR: 55 p.; Hannover. 16. VASSOLO, S. & DAIRA, D. (2012): Lake Chad Sustainable Water Management, Project Activities. - Technical Report No 4, prepared by LCBC & BGR: 24 p.; Hannover. (PDF, 3 MB) 17. VASSOLO, S., SEEGER, K. & WILCZOK, C. (2014): Groundwater Quality Investigations in the Kanem and Bahr el Ghazal Regions, Chad. - Technical Report No 8, prepared by LCBC & BGR: 41 p.; Hannover.	M. Bila (e, doc 1)

1. République du Tchad, UNFCCC, PNUD et FEM. Programme d'Action National pour l'Adaptation aux changements climatiques, juillet 2010 ; 2. République du Tchad, UNFPA et UNICEF. Enquête par grappes à indicateurs multiples, Rapport final, Mai 2011 ; 3. République du Tchad, PNUD, CCNUCC et GEF. Seconde communication nationale sur les changements climatiques, Juin 2012 ; 4. Republic of Chad. Intended Nationally Determined Contribution (INDC) for the Republic of Chad, September 2015; 5. République du Niger. Le Niger en Chiffres 2014, Novembre 2014 ; 6. République du Niger, FEM et PNUD. Seconde communication nationale sur les changements climatiques, 2009 ; 7. République du Niger, PNUD et FEM. Programme d'Action National pour l'Adaptation aux changements climatiques, juillet 2006 ; 8. République du Cameroun. Seconde communication nationale sur les changements climatiques, septembre 2014 ; 9. République du Cameroun. Contribution prévue déterminée au plan national (CPDN), Septembre 2015 ; 10. République Centrafricaine, UNFCCC, UNEP et GEF. Programme d'Action National pour l'Adaptation aux changements climatiques, juillet 2008 ; 11. République Centrafricaine, Contribution Prévue Déterminée au niveau National de la République Centrafricaine – CPDN, septembre 2015 12. Federal Ministry of Environment and Canadian International Development Agency. National Adaptation Strategy and Plan of Action on Climate Change for Nigeria (NASPA-CCN), BNRCC, NEST, CUSO-VSO, ICF Marbeck, November 2011; 13. République du Cameroun, UNICEF, UNFPA et BM. Enquête Démographique et de Santé et à Indicateurs Multiples (EDS-MICS) 2011. ICF International Calverton, Maryland, Septembre 2012 ; 14. RÉPUBLIQUE DU NIGER, UNFPA, BM, UNICEF et OMS. Enquête Démographique et de Santé et à Indicateurs Multiples (EDSN-MICS IV) 2012. ICF International, Calverton, Maryland, Septembre 2013 ; 15. Federal Republic of Nigeria, Multiple Indicator Cluster Survey, 2011, SUMMARY REPORT 16. Federal Republic of Nigeria. Nigeria Millennium Development Goals. 2013 report. www.mdgs.gov.ng; 17. Federal Republic of Nigeria, Nigeria's Second National Communication under the United Nations Framework Convention On Climate Change, FEBRUARY 2014.	A. Chetima (f, doc 1)
1. Schéma Régional d'Aménagement du Territoire de Zinder pour la période : 2012 – 2037 2. Plan de Développement Régional de Zinder pour la période : 2016 – 2020 3. Analyse Diagnostique Régionale, Vol 1 : milieu physique 4. Analyse Diagnostique Régionale, Vol 2 : milieu Humain 5. Analyse Diagnostique Régionale, Vol 3 : Organisation et gestion de l'espace 6. Analyse Diagnostique Régionale, Vol 4 : Activités Economiques 7. DIAGNOSTIC_SRAT_DIFFA 8. PRD et PDCs Diffa	N. Mamane (f, doc 2)
Section 2.2: We need an agreed statement on the security situation in the region, the role of the LCBC, and the impact of the security concerns on the ecosystem and socio-economic conditions.	
■ Impact of refugees and IDPs ■ Regional stabilisation strategy ■ Food insecurity ■ Human security ■ Insecurity in the south of Chad and CAR	Unknown (f, doc 2)
Section 2.3: Report on the meeting held in LCBC in January where the TB problems were revised. Again we need a short statement on why this revision was necessary (e.g. no information to support pollution, new information on climate change, etc.)	
1. The TB problems were similar in reality and could be collapse into four area of focus than the previous 7 priority areas. 2. Conform to the best practice in GEF TDA/SAP methodology.	M. Bila (e, doc 1)
Section 3.1: Feedback on the TDA assessment report.	
Agreed with the assessment.	M. Bila (e, doc 1)
Weakness: the chain of causation was based on no sound analysis, no tools, no causal analysis approach was used.	A. Chetima (f, doc 1)

Section 3.2 : We need short reports on each country – what has happened with the TDA/SAP (and NAPs) in terms of changes (Progress on NAPs/SAP implementation).	
Nigeria: The HJKYBTF implemented most of the items in the KYB CMP. The institution continues to provide leadership in the KYB including sourcing donor finance from AfDB for the development of a strategic action plan for the sub-basin. The AfDB financed KYB SAP final report is expected in July 2018. The agency was able to maintain monitoring of river discharges in 12 -15 stations for the period 2011 – 2015. Nigeria was also able to begin the process of reforming for implementation of IWRM. A federal department, the Integrated Water Resources Management Commission was established and the KYB and the Cross River sub-basins are pilot demonstration basins.	M. Bila (e, doc 1)
REPUBLIQUE DU NIGER, Rapport d'évaluation à mi-parcours du projet PANA Résilience, Rapport Final Juin, 2012. Bilan de la mise en œuvre de l'AMCC Tchad : 1ères expériences et leçons apprises Building Nigeria's Response to Climate Change (BNRCC) Project, Gender and Climate Change Adaptation: Tools for Community-level Action in Nigeria, final edition.	A. Chetima (f, doc 1)
Section 3.3 : What would the LCBC like to see from the updating of the TDA/SAP ?	
The mainstreaming of climate change and gender actions in the updating of the TDA/SAP and the opportunity for investment in GW exploitation as a means for climate change adaptation and to support SDG.	M. Bila (e, doc 1)
Sections 6 and 7: Because we will be conducting a new Causal Chain Analysis, we seek any information that can update or add to the 2005 TDA with regard to the Stakeholder and Governance Analyses.	
The following stakeholder analysis reports in French from Cameroun, Niger, Chad, CAR and a regional report are available from the previous GEF project. 1. Analyse des parties prenantes, Rapport National République Centrafricaine 2. Analyse des parties prenantes, Rapport National Cameroun 3. Analyse des parties prenantes, Rapport National Niger 4. Analyse des parties prenantes, Rapport National Tchad 5. Complete Inception Phase Stakeholder Analysis, Nigeria 6. Analyses des parties prenantes, Rapport Régionale No specific report on Governance Analysis. The following reports could provide some data. 1. Strategic Study on The Sustainable, Autonomous Financing of the LCBC, 2010 2. Joint Environmental Audit on the Drying up of Lake Chad, African Organization of Supreme Audit Institutions (AFROSAI) 3. Creation and Extension of The Lake Chad Basin Water Charter Phase 1 - Assessment B - Assessment of the legislative and institutional framework 4. Water Charter for the Lake Chad Basin, 2011 5. Lake Chad Sustainable Water Management, Institutional Development Report, Mission from 16 August to 22 September 2005, AHT 6. Study to Establish the Five-Year Investment Plan (2013-2017)	M. Bila (e, doc 1)
Documents: 1. Information request_Bila_Chétima.docx 2. 180601_Information request_TDA_demande_information_ADT_B_C_N_F.docx	

Information Request II

This information request, submitted to the LCBC Working Group, solicited information on specific topics.

Security	
Overview of security situation in Lake Chad area. Generally, the security situation in the Lake Chad area has significantly improved. The situation is calm but unpredictable. The Multinational Joint Task Force (MNJTF) intensive operations in coordination with national armies of the affected countries have greatly degraded Boko Haram combat power. However, the terrorist group remains a major concern in some of the Lake Chad islands and other remote locations. Additionally, Person Bond Improvised Explosive Devices (PBIED) and vehicle Bond Improvised Explosive Devices (VBIED) remain the most potent weapon of Boko Haram terrorists (BHTs). Recently, BHTs have been surrendering to military locations and local authorities nearest to them on individual basis and at other times in groups. Insecurity drivers: Boko Haram, poverty and unemployment, others? In addition to the Boko Haram plight, poverty and youth unemployment, other drivers of insecurity are poor/bad governance, economic crisis and the side effects of climate changes. Security issues that affect Lake Chad basin in places other than Lake Chad area (CAR?, Libyan border?) Security issues that affect Lake Chad basin in places other than Lake Chad area: Proliferation of small arms, human trafficking, violent extremism. Criminality not related to terrorism Criminality not related to terrorism is characterized by trans-border banditry and trafficking, poaching, drug trafficking as well as cyber crime. Other forms of insecurity? Other forms of insecurity: conflicts between shepherds and farmers, severe drought, poor management of electoral processes, social tension, food insecurity (famine). Security planning in near future	Col Ndougou (e, doc 2)
Groundwater	
Recommend good summary maps showing unconfined and confined aquifers. To my knowledge, summary maps of confined aquifers are almost non-existent, because most of the countries exploit the unconfined aquifer of the Quaternary with some boreholes exploiting the Pliocene. Summary of abstractions from surface water, surficial aquifer, and confined aquifer sources. For the state of the samples in the basin, it will be necessary to give me the time to inform my colleagues. If these detailed data are not available, then how important are surface water sources relative to less renewable (or non-renewable) aquifers for current and projected water demands? In the event of unavailability of these data, the importance of surface water sources compared to refillable or non-refillable aquifers for current and future water demand is almost equal. Because, the use of the groundwater resource is also very important especially for the populations which are not directly on the banks of the rivers or the lake. In the State of Basin Report, on Map 28, why does the Quaternary aquifer have such high head to the northwest? Is this an artifact of the last glacial period, or is there recharge? If recharge, where from? Indeed there is a recharge that comes from the runoff of the base area of GUERA. Rainwater falling on the basement area flows west and south east to recharge the Quaternary free-surface aquifer.	A. Hamid (f, doc 2)
Section 2.2: We need an agreed statement on the security situation in the region, the role of the LCBC, and the impact of the security concerns on the ecosystem and socio-economic conditions.	
■ Impact of refugees and IDPs ■ Regional stabilisation strategy ■ Food insecurity ■ Human security ■ Insecurity in the south of Chad and CAR	Unknown (f, doc 2)
Section 2.3: Report on the meeting held in LCBC in January where the TB problems were revised. Again we need a short statement on why this revision was necessary (e.g. no information to support pollution, new information on climate change, etc.)	
1. The TB problems were similar in reality and could be collapse into four area of focus than the previous 7 priority areas. 2. Conform to the best practice in GEF TDA/SAP methodology.	M. Bila (e, doc 1)

LCBC Reorganization	
Brief summary of reorganization process and timeline. Selected Chronology of the Reorganisation of the LCBC. In 1998 the LCBC approached the GEF for support to confront the environmental degradation problems currently faced by Lake Chad. Key project components include a Trans-boundary Diagnostic Analysis (TDA) and preparation of a Strategic Action Programme (SAP). The full implementation of the SAP is expected to be conducted during a subsequent Project phase. In 2000 the LCBC developed Vision 2025, a framework for action and the realization of the objectives of the LCBC and, by extension, the Member States. It complements activities supported by the GEF such as development of a TDA and longer term 25-year SAP framework for Integrated Resources Management, to be implemented across the region. In 2002, the LCBC member States decided to restructure the LCBC. In this framework, the LCBC/GEF financed an institutional assessment (IA) to find solutions to the various problems the institution was facing. The Institutional assessment produced three reports with the final report issued on the 11 June 2008. In 2005 the German Technical Assistance (GTZ) began providing assistance to LCBC through an institutional strengthening project titled, 'Lake Chad Sustainable Water Management and Institutional Strengthening'. The project aims to strengthen information and data management capacity at LCBC. In 2007 the GTZ issued a fact sheet announcing its intent to sponsor a project the central objective of which would be to provide the LCBC with technical and methodological advice on establishing a sound knowledge-management system. In 2008, the Strategic Action Programme was adopted at the Summit of Head of States held at Abuja on 12 June 2008. In 2010, The first stage in the restructuring process was carried out with new staff according to the new organisation chart recommended in the institutional assessment report. The new organisational chart was design to support the implementation of the SAP. In 2013, the second phase of the restructuring commences and was completed in 2018. How can the reorganization improve the effectiveness of LCBC in TDA updating and SAP implementation? The reorganization created the Lake Chad Basin Observatory and created new Experts positions to facilitate the collection and analysis of basin-wide information. Other reform elements include the publication and dissemination of regular reports that captures the status of the environment in the Lake Chad Basin. The reports are a vital source of information for the subsequent conduct of the TDA and the updating of the SAP as the need arise.	M. Bila (e, doc 1)
Water Charter	
As the Water Charter becomes implemented, will increased capacity be required at LCBC to manage its responsibilities? The Water Charter provided for the following functions to be coordinated at the LCBC and may require additional capacities to manage the responsibilities when fully implemented. ■ Abstraction Management ■ Emergency Planning and Preparedness to Ensure the Protection of People, The Environment and Water Resources ■ Common Facilities, Facilities of Common Interest and Infrastructure Asset Management and Ownership. How will the Water Charter affect policies and processes at LCBC? The Water Charter will have an impact on all LCBC business processes and could be the basis for developing specific policies for ensuring effectiveness of the LCBC.	M. Bila (e, doc 1)
Climate Change	
Does the climate forecast in Section 2.5 of the Lake Chad Development and Climate Resilience Action Plan accurately reflect the most current knowledge of the situation in the Lake Chad basin? These forecasts do not present in part the current knowledge on the state of the basin of Lake Chad in this matter. What is the best source of information on climate change forecasts for the Lake Chad Basin? ■ GIZ, 2015a. Africa Supraregional. Adaptation to Climate change in the Lake Chad Basin. Climate Change Study (5.4, 5.5 et 6.1) ■ RCA (2013). Deuxième Communication Nationale de la République Centrafricaine Sous la Convention-Cadre des Nations Unies sur les Changements Climatiques (paragraphe 1.1.2) ; ■ Niger (2009). Seconde Communication Nationale sur les Changements Climatiques (paragraphe IV.2.3) ; ■ Tchad (2012).la Seconde Communication Nationale du Tchad sur les Changements Climatiques (paragraphe 4.2.2) ■ Nigeria (2014).Nigeria's Second National Communication under the United Nations Framework Convention on Climate Change (paragraph 4.3)	A. Chetima (f, doc 2)

Gender

How have the LCBC and countries mainstreamed gender into water and environment planning?

Country NAPs conduct stakeholder analysis in water resources and environmental planning. These analyzes made it possible to define the public policies covering the domains of environmental management, water management, adaptation to climate change etc. However weaknesses in the analysis of an integration of the gender perspective are observed.

Fatime
(f, doc 2)

(translated
by Annika in
doc 2)

What are some of the most pressing challenges in mainstreaming gender issues?

The different actors: managers and users of water resources and other natural resources that make up the environment (pastures, land, etc.) are numerous: public and private institutions and the different categories of the population composed of men and women.

Often during the planning of different interventions, diagnostic analyzes do not integrate the gender dimension. Yet some categories of actors such as women and girls are often the main users, providers and managers of water in households but also the guardians of hygiene standards in homes. The absence or mismanagement of water supply infrastructure, the scarcity of firewood due to climate change, often causes a lot of trouble for this category of population.

Also in the context of water used for agricultural production (irrigation), its access and control often exclude women in certain communities. This situation of exclusion does not facilitate the attainment of the objectives of improving the living conditions of the population.

What are the best opportunities for improving gender as a core value in water and environmental planning?

The revision of the TDA provides an opportunity to develop a gender-sensitive strategy in water and environmental planning. This strategy will lay the groundwork for ensuring the participation of women as beneficiaries, decision-makers and managers of natural resources.

The integration of a gender-based approach will create a framework for cooperation between men and women so as to make use of each other's knowledge and skills in the design of policies and programs and for achievement of sectoral objectives.

Gender mainstreaming is a process of assessing the implications of women and men in planning an action: policy development, program and project design in all areas and at all levels. This strategy integrates the concerns and experiences of women and men as an integral component of the design, implementation, monitoring and evaluation of policies and programs in all political, economic and social spheres so that women and men benefit equitably and inequity is not perpetuated.

Impact of 2005 TDA/SAP

Mr. Bila Comments, with correctionsM. Bila
(e, doc 1)

- In 1994 there was a Master Plan for the LCBC.
- However, LCBC was not particularly effective. Studies indicated three reasons:
 - Each member state plans water projects in isolation
 - There was no common legal framework
 - Absence of public participation
- The original GEF TDA project provided opportunity to address these weaknesses:
 - Ensure joint identification of problems
 - Joint planning to solve the problems at each ecosystem level.
- In 2008 the SAP was adopted. That same year, Vision 2025, a major agreement, was adopted by the Council of Ministers and the Summits of Heads of State as the working document for the LCBC.
- Next, an institutional study was conducted, which recommended the organizational structure necessary for the LCBC to implement the SAP. (M. Bila comment: See chronology above.)
- It took until now, but the reorganization of the LCBC has been achieved, with new staff reporting for duty at LCBC this week on 21 May.
- Now we have the SAP and the staff to implement it. Partners have been working with LCBC since 2008 to achieve this.
- GIZ has been supporting LCBC by assisting with:
 - Technical procedures for water and environmental management.
 - Organizational structures and how new organizations can function.
- BGR assists LCBC to build capacity for environmental monitoring and assessment
- AFD – provides studies and databases
- ADB – Funding for the Implementation of the SAP. The The PRODEBALT and PRESIBALT projects, for example.
- Other achievements. A National Action Programme was developed for each country and key ecosystem management plans were jointly developed with stakeholders within each country.
- A catchment management plan for the Komadugu – Yobe basin in Nigeria was implemented. The Hadejia-Jama'are-Komadugu-Yobe Basin Trust Fund was setup by the six Nigerian riparian States and the Federal Government to implement the catchment management plan. Every country is expected to implement its own management plan..
- The Water Charter
 - Work on this started in 2009.
 - In 2012 the Summit of the Heads of State approved the Water Charter.
 - The Water Charter harmonizes the laws and policies of the LCBC nations.
 - Has been ratified by Niger, Chad, Cameroon, and Nigeria.
 - At any moment now, the Water Charter can start implementation.
 - Member countries need to act to make the Water Charter effective.
 - The LCBC is the arbitrator in the Water Charter.
- Finally, the GEF funded the SAP implementation project after much work. \$5million in 2017.
- This necessitates us to revise the TDA and update the SAP.
- This is where we are.

Other impacts of 2005 TDA / SAP?

The Five-Year Investment Programme 2013-2017 was developed and is the source of the current LCBC projects with funding from BMZ, AFD and AfDB.

Documents:

3. Information Needs 2018-05-25_10_06_2018_Bila.docx
4. Information Needs 2018-05-25_Chetima_Hamid_Col_bila_Fatime.docx

Information Request II

Request for information from national experts. The text of the request is provided below and the responses are included by country in the following sections.

Request for National Expert Support

The updating of the regional TDA would greatly benefit from specific national knowledge on the situation of legislation/policies, institutions, the role of stakeholders, etc. Specifically:

In each country of the Lake Chad Basin we would like brief summaries (bullets or short sentences are sufficient) on the changes within the last 10 years on the following topics:

1. Legislation/policies related to environment /water (including pollution, use of water, etc.), gender relations, climate change, noting agricultural policies etc. that make reference water.
2. Institutions changes (ministries, technical agencies, academic institutions etc.) engaged in water/environment
3. Key national stakeholders involved in water / environment at governmental (national and local), NGOs, communities, academics, private sector etc.
4. Impacts of enforced migration and security related issues on water and environment

Contribution attendue des Experts nationaux

L'actualisation de l'Analyse Diagnostique Trans-frontalière (ADT) régionale devra s'appuyer sur les connaissances nationales spécifiques (politiques/législations, institutions, rôle des parties prenantes, etc.)

En effet, chaque pays du bassin du Lac Tchad devra présenter brièvement la situation (à travers des puces ou des phrases courtes) des changements intervenus au cours des dix dernières années dans les domaines ci-après:

1. Législations/politiques liées à l'environnement/eau (y compris la pollution, l'utilisation de l'eau, etc.), rapports hommes-femmes, changement climatique, politiques agricoles, etc. ;

2. Instabilité institutionnelle (Ministères, agences techniques, institutions universitaires, etc. œuvrant dans les secteurs de l'eau/environnement ;
3. Parties prenantes concernées par les secteurs de l'eau/environnement au niveau étatique (local et national), des ONG, des communautés, des universitaires, du secteur privé, etc. ;
4. Impacts de la migration forcée et du défi sécuritaire aussi bien sur l'eau que sur l'environnement.

Cameroon

Legislation/policies related to environment /water (including pollution, use of water, etc.), gender relations, climate change, noting agricultural policies etc. that make reference water.

Title	Objects or Provisions with Respect to Water and the Environment
Legislations	
Law No. 96/06 of 18 January 1996 amending the Constitution of 2 June 1972.	Consecration in the preamble to the Constitution the right of all citizens to a healthy environment.
Law No. 96/12 of 5 August 1996 on the Framework Law on environmental management.	Prescription to any promoter or master developer of any development project, project, equipment or installation that risk, because of its size, its nature, harm the environment, achieve as prescribed specifications, an impact study to assess the direct and indirect impacts of the project on the ecological balance of the settlement area or any other area, the environment and quality of life populations and impacts on the environment in general.
Law No. 98/005 of 14 April 1998 concerning the water regime	Securing the legal framework for water and provisions for its protection, its management and the protection of public health. Consecrate the public ownership of water
Law No. 90/016 1990 regime mineral water and sources of Cameroon	
Law No. 98/015 of 14 July 1998 relating to establishments classified as dangerous, unhealthy or obnoxious	
Law No. 2004/018 of 22 July 2004 laying down the rules applicable to councils, Law No. 2004/019 of 22 July 2004 laying down rules for regions and Law No. 2004/017 of 22 July 2004 concerning orientation law decentralization	The government's power to intervene and is nationally and locally. If a catastrophic situation affects the entire country, it will be the Minister in charge of water, to take the necessary measures. If it affects only a part of the country, he will return to the territorially competent authority to deal with under the powers conferred to decentralized communities in the texts on decentralization, although in practice the decentralized administrative authority always refer to his superiors before taking any important decision
Decree No. 2001/164 / PM 08 May 2001 specifying the terms and conditions of withdrawal of surface water or groundwater for industrial or commercial purposes	Allocation of available resources is governed by a priority because when resources are limited and that there is competition between particular applications for agriculture, industrial / commercial or household, the available resources will be allocated in priority to households for home consumption. Article 3 Paragraph 1 defines domestic use of follows: "are considered affected for domestic and delivered accordingly authorization, withdrawals of surface water or groundwater, exclusively for the needs of individuals owners of sampling facilities as well as those people usually living with them, within the quantities of water needed for human consumption, hygiene needs, and plant or animal products reserved for family consumption."
Decree No. 96/0050 of 12 March 1996 on the promotion of agricultural development, animal, fisheries, forestry and the environment	
Decree No. 2012/2808 / PM of 26 September 2012 laying down the conditions for carrying an inspector and environment controller	
Decree No. 2012/2809 / PM of 26 September 2012 fixing the sort conditions, collection, storage, transportation, recovery, recycling, treatment and final disposal of waste.	
Decree No. 2011/2582 / PM of 23 August 2011 fixing the atmospheric protection arrangements	
Decree No. 2011/2583 / PM of 23 August 2011 on the regulation of noise and smells.	

Title	Objects or Provisions with Respect to Water and the Environment
Decree No. 2011/2584 / PM of 23 August 2011 fixing the soil protection arrangements and Basement	
Decree No. 2011/2585 / PM of 23 August 2011 fixing the list of harmful or dangerous substances and the regime of discharge into inland waters	
Decree No. 2010/0242 / PM of 26 February 2010 laying down certain powers transferred by the State to the Commons in the promotion of agricultural production and rural development activities.	
Decree No. 2006/1577 / PM of 11 September 2006 amending and supplementing certain provisions of Decree No. 2001/718 / PM of September 3, 2001 the organization and functioning of the Inter-ministerial Committee for the Environment	
Order No. 001 / MINEPDED of 15 October 2012 fixing the conditions for obtaining an environmental permit waste management matters	
Decree No. 002 / MINEPDED of 15 October 2012 laying down specific conditions of industrial waste management (toxic and / or dangerous)	
Order No. 0070 / MINEP of 22 April 2005 laying down the different categories of operation whose realization is subject to an Environmental Impact Assessment.	
Order No. 001 / MINEP of 3 April 2013 on the organization and operation of monitoring Departmental Committees of the implementation of the Environmental and Social Management Plans (ESMP).	
National Policies and Strategies	
The long-term proactive vision of Cameroon with as one of the strategic priorities for Phase I (2010-2019): Develop and initiate implementation of an ambitious policy to preserve the environment and the fight against adverse effects of climate change.	
Created in 2009 by Decree of the Head of State of the National Observatory on Climate Change (ONACC).	
The preparation of National Communications on Climate Change.	
Eligibility for the Adaptation Program Climate Change (PACC) and the Cameroonian component of the "Cool Earth Partnership" initiative funded by the Japanese government since 2009 (Cameroon's eligibility year at the initiative).	
Implementation of CDM (Clean Development Mechanism) in Cameroon by a ministerial decision of 16 January 2006.	
Operation Green Sahel stimulus.	
Creation within the National Assembly of a cluster of parliamentary and a network of action on the issue of Climate Change and Sustainable Forest Management.	
Creation of two specialized departments on the environmental issue (MINEPDED and MINFOF).	
Implementation of the Framework Law on the Environment and Sustainable Development in charge of education stakeholders (state, large social groups, households, etc.).	

In Cameroon, the law takes into account any customary laws and practices relating to water resources, through the power given to traditional authorities in the settlement of disputes. Thus, Article 24 of the 1998 Act provides that, "Traditional authorities have jurisdiction to settle disputes related to the use of water resources on the basis of local customs, without prejudice to the right of

the parties to 'seize the competent courts' ". After the traditional authority has settled the dispute on the basis of customary law in accordance with Article 24 of the 1998 Act, a report of the dispute is then compiled, which is co-signed by the authority administrative the territory of the village community in which the dispute takes place.

Institutional changes (ministries, technical agencies, academic institutions etc.) engaged in water/environment.

Types of institutions	Designations	During the development of the SAP in 2008
Ministries	Ministry of Economy, Planning and Regional Development (MINEPAT)	
	Ministry of Finance (MINFI)	
	Ministry of Water and Energy (MINEE)	
	Ministry of Agriculture and Rural Development (MINADER)	
	Ministry of Livestock, Fisheries and Animal Industries (MINEPIA)	MINEPIA
	Ministry of Forestry and Wildlife (MINFOF)	MINEFOF
	Ministry of Environment, Nature Protection and Sustainable Development (MINEPDeD)	Ministry of Environment and Protection of Nature (MINEP)
	Ministry of Decentralization and Local Development (MINDEDEL)	Ministry of Territorial Administration and Decentralization (MINATD)
	Ministry of Territorial Administration (MINAT)	Ministry of Territorial Administration and Decentralization (MINATD)
	Ministry of Tourism and Recreation	
	The Ministry of Housing and Urban Development (MINDUH)	MINUH
	Ministry of Estate and Land Affairs (MINDAH)	MINUH
Technical Agencies	Cameroon Water Corporation (CAMWATER)	
	Equipment Fund for Mutual interference (FEICOM)	
	Development of Integrated Mission Mandara Mountains (MIDIMA)	
	Company Expansion and Modernization of Rice Yagoua (SEMRY)	
	Cotton Development Company (SODECOTON)	

Types of institutions	Designations	During the development of the SAP in 2008
University Institutions	University of Maroua (Polytechnic Normal University Maroua Normal Superior School, Institute of Mining and Petroleum)	Not existing in 2008
	University of Ngaoundere,	
	University of Dschang	

Key national stakeholders involved in water /environment at governmental (national and local), NGOs, communities, academics, private sector, etc.

Degrees of Interest and Influence (Power) in the Water / Environment Sectors	Actors and level		
	Primary (Directly Affected)	Secondary (Intermediate)	Key (Key Decision Makers).
low interest + small influence	5. Women		
low interest + high impact		Traditional authorities: 6. Chief of 1st degree 7. Chief of 2nd degree 8. Chief of 3rd degree Hotel establishments and modern housing Cities Projects and Programs: ■ PULCI ■ IRDP	
High interest + small influence	Operators of natural resources: ■ pastors ■ fishermen ■ farmers ■ artisanal tannery ■ Carriers (Dugout engine) ■ local communities Companies producing mineral water	Communes or local decentralized communities	International organisations ■ IUCN ■ WWF Decentralized technical services of the State CTD Not lead ministries: ■ Ministry of Transport; ■ Ministry of Public Works ■ Ministry of Land Affairs
High interest + high impact		Development companies and agribusiness: ■ Modernization of Society of Rice (SEMRY) ■ Cotton Development Company (SODECOTON) National NGOs and platforms ■ CSCTA ■ GWP ■ PLACODEPIL	"Lead" Ministries ■ MINEPAT ■ MINEE ■ MINADER ■ MINEPDED ■ MINEPIA ■ MINFOF ■ MINFI UN Agencies: ■ UNICEF ■ UNHCR

Information on planned Interventions.

Title	Affected Areas	Observations / Locations
Rehabilitation facilities SEMRY.	Southern part of the Logone sub-basin.	Maga Guirvidig, Yagoua, Pouss and Tekele.
Landscaping around 13 000 ha of hydro-agricultural perimeters in certain areas of Logone and Chari.	Sub Basin Logone and Serbouel.	Zina Logone birni, Dolé, Biamo, Dewoul-kyo-Kale, Ndou, Goulfey, Hilele, Goulfey -Gana, Moulouang Mara.
Rehabilitation of the dam Ouazzang.	Sub-basin of the Mayo Tsanaga.	Ouazzang.
Construction of a water supply canal from the Elbéid River.	Sub-basins of the Logone and Serbouel.	Logone and Chari
Construction of eight water retention structures in some localities in the Far North Region.	Sub-basin of the Mayo-Tsanaga.	Mokolo, Gazawa, Maroua Tokombéré, Meri Maroua 2 Pette, Tchevi, Maboudji, Balda, Adatz Tala Mokolo.
Arrangements of 7200 ha of irrigation perimeters.	Sub-fasin Serbouel.	Kobro, Kobro and Chaoé, Maradi Makary, Dougoumsilio and Ngouma, Ngouma Bodo, Digam, Soueram, Damboré-Came-roon, Sagmé.
		Kabe and Maham, kalakafra and Tilde, Taltaf (Kobro and Nganatir)
Arrangements of 26100 ha of irrigation perimeters in the department of Mayo-kani.	Under basin Mayo-Tsanaga.	Boboyo, Poukalé, Guétalé and Moulvou-day.

Central African Republic

Legislation/policies related to environment /water (including pollution, use of water, etc.), gender relations, climate change, noting agricultural policies etc. that make reference water.

The Central African Republic has in the implementation framework of its water and sanitation sector policy:

- Law No. 06.001 on the Water Code;
- Two National Policy and Strategy documents for the water, sanitation and hygiene sector setting out the main directions for this sector;
- At the CAR level, there is no institutional instability in the water sector, but all the structures created by the Water Code are not operational.

The institutional framework is composed of:

- The Directorate General of Hydraulics (DGH) which deals with the implementation of the sector's policy
- The National Agency for Water and Sanitation in Rural Areas (ANEA), which is the executing agency for water and sanitation works and advisory support. It is operational;
- The National Council for Water and Sanitation (CONEA), guidance body;
- Basin Agencies (AB) that are not operational;
- The Regulatory Agency for the Water and Sanitation Sector (ARSEA) which remains non-operational;
- The National Fund for Water and Sanitation (FNEA): not operational;
- The Company of Water Distribution in Central Africa (SODECA), is a company operating systems.

Institutional changes (ministries, technical agencies, academic institutions etc.) engaged in water/environment.

It must be said that the institutional and legal framework in full reform now. However, despite the liberation of the sector by the Law on the Water Code to attract the private sector, this sector is not attractive. In urban areas, we have only one structure, which is SODECA, a semi-public company that provides water supply in eight cities, including Bangui. Hence, the Public-Private Partnership must be greatly encouraged.

Key national stakeholders involved in water /environment at governmental (national and local), NGOs, communities, academics, private sector, etc.

Stakeholders in the water and sanitation sector are:

- The DGH;
- SODECA;
- The Regional Departments of Energy and Hydraulics
- ANEA;
- ARSEA;
- The University;
- Municipalities
- NGOs;
- Construction companies and design offices

Impacts of enforced migration and security related issues on water and environment.

Given the abundance of water resources, the impact of forced migration because of crises or others is not felt and can be considered almost nil.

Information on planned Interventions.

- Development of infrastructure and water and sanitation facilities in rural and urban areas through construction but also rehabilitation;
- Establishment of community structures for the management of boreholes and latrines;
- Institutional capacity building through training, provision of means of implementation for governance, planning and management of holdings such as legal and regulatory texts, the plan of action and the master plan and the development of policy documents, monitoring equipment / protection of resources or works and execution of works;
- Communication and awareness;
- Advocacy

Also:

Documents:

5. Sector Information CAR FOTO English.docx

Niger

Legislation/policies related to environment /water (including pollution, use of water, etc.), gender relations, climate change, noting agricultural policies etc. that make reference water.

I am sending you herewith ten (10) main documents of our policies and legislation related to water and the environment. Admittedly, they do not constitute the entirety of the documentary collections available; there is also a myriad of application texts that follow these documents

Institutional changes (ministries, technical agencies, academic institutions etc.) engaged in water/environment.

On institutional instability, I would say that the main institutions (ministries) have been in place since 2000; but the landscape has gradually been enriched by new institutions in view of new issues that have emerged. Thus, from the only University that Niger had until 2011, we now have eight (8) national universities spread throughout the national territory: one (1) university per region! Each is autonomous in its management; and each university has new infrastructures to house it and to supervise students. A doctoral school exists in the field of water within the University of Niamey (Licenses, masters, doctorates).

Key national stakeholders involved in water /environment at governmental (national and local), NGOs, communities, academics, private sector, etc.

These are the same classic actors that are also encountered in Niger. We have 256 municipalities installed and operational. It is to tell you that the communalisation is integral in Niger. These communes are grouped into departments and then regions. The country has 8 regions. In each region, there is a regional assembly that we call "Regional Council". These regional councilors are elected just like the mayors. Just like the national deputies, Regional Councilors and mayors are excluded in the conquest of public markets whether it is at the national, regional or communal level.

Impacts of enforced migration and security related issues on water and environment.

In terms of emigration to Europe, despite the prevailing poverty, curiously our country is not a country of emigration to Europe. However, Niger is indeed a transit country. And a large part of the nationals of the countries of West Africa and even of the center pass by the Niger following the terrestrial way and reach Europe through the Sahara and the Mediterranean. Our compatriots mostly migrate to the other ECOWAS countries of which we are member countries (free movement of people and goods) and to Chad (the only country in ECCAS where border harassment is minimal due to bipartite agreements since 'independence).

Notwithstanding these verifiable findings, there are in addition to these climatic shifts (?) The presence, in the region of Diffa, of many Nigerian brothers who are forced to move because of the despicable abuses of Boko Haram in their country.

Information on planned Interventions.

No direct response.

Also:

I come back again to inundate you in addition to the first 10 documents, a second set of fourteen (14) attached documents attached files. They affect all sectors of rural development: water, livestock, agriculture, environment and mines.

Thus, you received from me a total of twenty-four (24) policy documents or legislation on water, environment, agriculture, livestock (in short, rural development) and mines.

Documents:

1. Email from Abdou Moumouni MOUSSA
2. Director General of Water Resources (MH / A)
3. Niamey, NIGER

Nigeria

Legislation/policies related to environment /water (including pollution, use of water, etc.), gender relations, climate change, noting agricultural policies etc. that make reference water.

At present, the following are the only legislations /statute in the development and management of the nation's water resources:

- Water Resources Act. CAP W2. LFN.2004.
- Nigerian Minerals and Mining Act Cap N162, LFN 2004
- National Inland Waterways Act N. 47 LFN 2004
- River Basins Development Authority Act. R9, LFN, 2004
- Nigeria Hydrological Services Agency (Establishment) Act, Cap N110A, LFN 2004
- The National Water Resources Institute Act, Cap N83 LFN 2004.
- The Land Use Act, Cap L5 LFN 2004
- Nigerian Environmental Standards and Regulations Enforcement Agency Act, Cap N164, LFN 2004
- Hadeija Jamaare Komadugu Yobe Trust Fund based in Damaturu with membership of all the six riparian states of the basin (Borno, Yobe, Jigawa, Bauchi, Kano and Plateau States)

In pursuant of the above, the 2016 edition of National Water Resources Policy of the Federal Republic of Nigeria has the following policies:

- Water Resources assessment and Planning
- Water Resources Conservation, protection and Use
- Data and Information Systems
- Human Resources and Knowledge Management
- Trans boundary Issues
- Dam and Reservoirs
- Drainage and Irrigation
- Water Supply and Sanitation
- Water Resources Regulation and Pricing
- Flood, Drought and Climate Change
- Monitoring and Evaluation
- Institutional framework
- Private Sector participation
- Sector Funding
- National Gender Policy which cut across all departments of life of the Country.

Nigeria has formulated a National Water Resources Master Plan 2013 (MP/2013) by reviewing and updating the 1995 Master Plan. A hard copy of the MP/2013 has been delivered to Mr. Bila.

Institutional changes (ministries, technical agencies, academic institutions etc.) engaged in water/environment.

What is known today as Federal Ministry of Water Resources today was formerly Federal Ministry of Agriculture and Water resources. In 2010, the two ministries were demerged; hence Federal Ministry of Water Resources was separated from the Federal Ministry of Agriculture and Rural Development. After the demerger the Ministry has the following Agencies and Parastatals:

- Integrated Water Resources Management
- Nigeria Hydrological Agency (NIHSA)
- River Basin Development Authorities (RBDA)
- National water Resources Institute

Other relevant agencies are:

- National Environmental Standards and Regulations Enforcement Agency (NESREA)
- The Nigerian Meteorological Agency (NIMET)
- The National Inland Waterways Authority
- National Bureau of Statistics (NBS)
- National Boundary Commission (NBC)
- Science & Tech.

Key national stakeholders involved in water /environment at governmental (national and local), NGOs, communities, academics, private sector, etc.

- WaterAid Nigeria
- USAID
- Rock of Fountain of Water Foundation
- Society for Water and Sanitation (NEWSAN)
- Society for Community Development
- Society for Water & Sanitation
- Environmental Protection and Care Support
- Youth Water Sanitation & Hygiene Network
- Fresh & Young Brains Development Initiative Network
- Universities across the Basin states

Impacts of enforced migration and security related issues on water and environment.

- Boundary Demarcation Problem between the member states not yet finalized;
- Uncontrolled borders resulting to influx of different types of ammunitions across member countries;
- Emergence of BOKO HARAM;
- Recruitment of idle communities to partake in criminal activities across all the member states;
- All the above was as a result of the reduction of Lake leading to forced migration of communities;
- LCBC's Programme of PRODEBALT which is closing could not reach out to some deserving communities in states like Nigeria and CAR due to insecurity.

Information on planned Interventions.

- Lake Chad Basin Climate Change Resilience Adaptation Program (LCB-CRAP) ;
- International Conference on Saving Lake Chad, held from 26th – 28th, February; 2018. LCBC member countries and funding partners came up with a robust communiqué with a clear Road Map on how to address the degradation trend of the Lake Chad ecosystem through TRANS-AQUA water Transfer Project COPY OF COMMUNIQUE AVAILABLE WITH LCBC while the reviewed Road Map will be sent to BILA.
- Nigerian National Action Plan (NAP) with reviewed priorities available with LCBC.

Also:

Documents:

6. Wakil REQUEST FROM LCBC.docx

Annex 2. Bibliography of Reports and Studies Provide by LCBC Experts

Introductory statements ...

Background documents for the update of the ADT / Documents de référence pour la mise à jour de l'ADT

No	Name and Date of the Document / Nom et date du document	Why is this document relevant for the update of the TDA / Pourquoi est-ce que ce document est pertinent pour la mise à jour de l'ADT?	Which Chapters and pages of the documents are relevant for the update of the ADT / Quels chapitres et pages des documents sont pertinents pour la mise à jour de l'ADT	Name of Expert suggesting reference/ Nom de l'expert suggérant une référence
1	EXAMPLE / MODÈLE: Lake Chad Development and climate resilience action plan 2015	EXAMPLE / MODÈLE: ■ Details on hydrology and ecosystems ■ LCBC and the governance of natural resources	EXAMPLE / MODÈLE: Chapter 2 page 4 Chapter 2 page 19	EXAMPLE / MODÈLE: Peter Whalley
2	Creation and Extension of The Lake Chad Basin Water Charter Phase 1 - Assessment A - The common challenge - Managing shared water resources and ecosystems	Managing shared water resources and ecosystems (WATER CHARTER)	Chapter 2:page 16 à 20	Rohallati
3	Creation and Extension of The Lake Chad Basin Water Charter Phase 1 - Assessment B - Assessment of the legislative and institutional framework			
4	Development of Lake Chad Current Situation and Possible Outcomes, Expert group review under the IRD	Relevant information on the people and their socio-economic activities	Analysis ■ People and their activities	Aminu Magaji Bala
5	Study to Establish the Five-Year Investment Plan (2013-2017)			
6	Joint Environmental Audit on the Drying up of Lake Chad, African Organization of Supreme Audit Institutions (AFROSAI)			
7	GEERKEN, R., VASSOLO, S. & BILA, M. (2012): Impacts of climate variability and population pressure on water resources in the Lake Chad Basin. In: BOGARDI, J., LEENTVAAR, J. & NACHTNEBEL, H-P. (eds.): River Basins and Change. - Contrib. to the intern. conference on "The Global Dimensions of Change in River Basins" organised within the Global Catchment Initiative of the Global Water System Project (GWSP), December 6 - 8, 2010, Bonn, Germany			

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8	GEERKEN, R., VASSOLO, S. & SCHIMMER, R. (2012): Monitoring variations of Yaere Wetlands to understand effects of inter-annual climate variations. Poster presented at the IWRM conference 2012, Karlsruhe			
9	KREKELER, T. & SEEGER, K. (2013): Discharge Measurements at Chari, Logone and Koulambou River, Chad. - Technical Report No 5, prepared by LCBC & BGR: 40 p.; Hannover.			
10	SEEGER, K. (2013): 2nd Mission on Discharge Measurements at Chari, Logone and Koulambou River, Chad. - Technical Report No 6, prepared by LCBC & BGR: 39 p.; Hannover.			
11	SEEGER, K. (2013): 2ème mission de mesures de débits sur les fleuves Chari, Logone et Koulambou, Tchad. - Rapport Technique No 6, préparé par LCBC & BGR: 39 p.; Hanovre.			
12	SEEGER, K., DAIRA, D., BALA, A.M. & VASSOLO, S. (2014): Ground-water Quality Investigations in the Lower Logone Floodplain in April – May 2013. - Technical Report No 7, prepared by LCBC & BGR: 47 p.; Hannover.			
13	SEEGER, K., DAIRA, D., BALA, M. & VASSOLO, S. (2014): Études de la qualité des eaux souterraines dans la plaine d'inondation du Logone inférieur en avril – mai 2013. - Rapport Technique No 7, préparé par LCBC & BGR: 48 p.; Hanovre.			
14	SEEGER, K. & WILCZOK, C. (2014): Microbial and Chemical Drinking Water Analysis in N'Djamena. - Technical Report No 9, prepared by LCBC & BGR: 37 p.; Hannover.			
15	SEEGER, K., WILCZOK, C., DAIRA, D. & BALA, A. (2016): Ground-water - Surface Water Interaction in the Lower Logone Floodplain. - Technical Report No 10, prepared by LCBC & BGR: 55 p.; Hannover.			
16	VASSOLO, S. & DAIRA, D. (2012): Lake Chad Sustainable Water Management, Project Activities. - Technical Report No 4, prepared by LCBC & BGR: 24 p.; Hannover.			

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17	VASSOLO, S, SEEGER, K. & WILCZOK, C. (2014): Groundwater Quality Investigations in the Kanem and Bahr el Ghazal Regions, Chad. - Technical Report No 8, prepared by LCBC & BGR; 41 p.; Hannover			
18	République du Tchad, UNFCCC, PNUD et FEM. Programme d'Action National pour l'Adaptation aux changements climatiques, juillet 2010 ;			
19	République du Tchad, UNFPA et UNICEF. Enquête par grappes à indicateurs multiples, Rapport final, Mai 2011 ;			
20	République du Tchad, PNUD, CCNUCC et GEF. Seconde communication nationale sur les changements climatiques, Juin 2012			
21	Republic of Chad. Intended Nationally Determined Contribution (INDC) for the Republic of Chad, September 2015;			
22	République du Niger. Le Niger en Chiffres 2014, Novembre 2014			
23	République du Niger, FEM et PNUD. Seconde communication nationale sur les changements climatiques, 2009			
24	République du Niger, PNUD et FEM. Programme d'Action National pour l'Adaptation aux changements climatiques, juillet 2006			
25	République du Cameroun. Seconde communication nationale sur les changements climatiques, septembre 2014			
26	République du Cameroun. Contribution prévue déterminée au plan national (CPDN), Septembre 2015			
27	République Centrafricaine, UNFCCC, UNEP et GEF. Programme d'Action National pour l'Adaptation aux changements climatiques, juillet 2008			

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28	République Centrafricaine, Contribution Prévue Déterminée au niveau National de la République Centrafricaine –CPDN, septembre 2015			
29	Federal Ministry of Environment and Canadian International Development Agency. National Adaptation Strategy and Plan of Action on Climate Change for Nigeria (NASPA-CCN), BNRCC, NEST, CUSO-VSO, ICF Marbeck, November 2011			
30	République du Cameroun, UNICEF, UNFPA et BM. Enquête Démographique et de Santé et à Indicateurs Multiples (EDS-MICS) 2011. ICF International Calverton, Maryland, Septembre 2012			
31	RÉPUBLIQUE DU NIGER, UNFPA, BM, UNICEF et OMS. Enquête Démographique et de Santé et à Indicateurs Multiples (EDSN-MICS IV) 2012. ICF International, Calverton, Maryland, Septembre 2013			
32	Federal Republic of Nigeria, Multiple Indicator Cluster Survey, 2011, SUMMARY REPORT			
33	Federal Republic of Nigeria. Nigeria Millennium Development Goals. 2013 report. www.mdgs.gov.ng			
34	Federal Republic of Nigeria, Nigeria's Second National Communication under the United Nations Framework Convention On Climate Change, FEBRUARY 2014			
35	Developing and using a water database for the Hadejia-Jama'are-Komadugu-Yobe Basin, Northern Nigeria (2010)	Details information on the status of water resources monitoring in the HJKYB	4. ■ Status for river flow monitoring and recommendations monitoring network, ■ water uses monitoring in the catchment, ■ status of water quality monitoring and potential pollution sources.	Aminu Magaji Bala

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36	Designing a regional strategy of protected areas of the lake chad basin	It provides a regional analysis of the state and management of the protected areas of the Lake Chad basin	Chapter 2. Situation of protected areas and biodiversity conservation sites in the basin	Aminu Magaji Bala
37	Seconde communication nationale sur les changements Climatiques Ces documents contiennent la présentation des pays, les émissions et les capacitatives d'atténuation des gaz à effet de serre, la vulnérabilité aux changements climatiques et adaptation. Fichier : Communication_Cameroun	3.1.2 Impacts du changement climatique p103 3.2.1 Risques climatiques majeurs p109 3.2.2 Options d'adaptation p113 NB : s'intéresser aux colonnes ou titre sur la zone Soudano-sahélienne et l'Adamaoua (savane humide)		Chetima Boubar
38	Seconde communication nationale sur les changements Climatiques Ces documents contiennent la présentation des pays, les émissions et les capacitatives d'atténuation des gaz à effet de serre, la vulnérabilité aux changements climatiques et adaptation. Fichier : Communication_Niger	IV. Vulnérabilité au changement climatique, p71 V. Adaptation au changement climatique, p 92		Chetima Boukar
39	Seconde communication nationale sur les changements Climatiques Ces documents contiennent la présentation des pays, les émissions et les capacitatives d'atténuation des gaz à effet de serre, la vulnérabilité aux changements climatiques et adaptation. Fichier : Communication Tchad	Vulnérabilité et adaptation aux changements climatiques, P134		Chetima Boukar
40	Seconde communication nationale sur les changements Climatiques Ces documents contiennent la présentation des pays, les émissions et les capacitatives d'atténuation des gaz à effet de serre, la vulnérabilité aux changements climatiques et adaptation. Fichier : Communication RCA	Chapitre 5 : vulnérabilité et mesures d'adaptation, p66		Chetima Boukar
41	Seconde communication nationale sur les changements Climatiques Ces documents contiennent la présentation des pays, les émissions et les capacitatives d'atténuation des gaz à effet de serre, la vulnérabilité aux changements climatiques et adaptation. Fichier : Communication Nigeria	Chapter five: evaluating vulnerability to and impact of climate change Chapter six: vulnerability to and impact of climate change Chapter seven: actions to adapt to impacts of climate change.		Chetima Boukar

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42	Intended Nationally Determined Contribution (INDC)	Ces documents présentent les projets/programmes d'adaptation aux changements climatiques et d'atténuation.	Fichier: INDC_Tchad Section 3. Adaptation Fichier: INDC_Cameroun. Pages 4-6 Fichier: INDC_Niger Adaptation component p 11-16 Fichier: INDC_Nigéria. Climate Change Adaptation, p5-7 Fichier : INDC_RCA Adaptation aux effets néfastes des Changements climatiques, p7 ;	
43	Rapport des enquêtes EDS-MIECS.	Ces rapports décrivent la situation démographiques et nutritionnel des pays, les phénomènes démographiques, la santé de l'enfant, la participation des femmes au développement et les violences.	Fichier :EDS-MICS_cam-eroun Statut de la femme et participation au développement, P309 Fichier : EDS-MICS_Niger Statut de la femme, p265; Fichier : EDS-MICS Tchad Statut De La Femme Et Participation A La Prise De Décisions, p309 Fichier: HDS_Nigeria Women's empowerment and demographic and health outcomes 279	Chetima Boukar

No	Name and Date of the Document / Nom et date du document	Why is this document relevant for the update of the TDA / Pourquoi est-ce que ce document est pertinent pour la mise à jour de l'ADT?	Which Chapters and pages of the documents are relevant for the update of the ADT / Quels chapitres et pages des documents sont pertinents pour la mise à jour de l'ADT	Name of Expert suggesting reference/ Nom de l'expert suggérant une référence
44	PANA/PAN	Les PNA ou PANA décrivent la variabilité/changements climatiques actuels et futurs, les vulnérabilités, les besoins en adaptation et les mesures d'adaptations.	Fichier : PNA_Cameroun 2.3. Les impacts des changements climatiques et la vulnérabilité par ZAE p44 2.4. Les impacts des changements climatiques et la vulnérabilité par secteur p50 2.5. La réponse du Cameroun aux changements climatiques p57 Fichier : PANA_Niger Effets néfastes réels et potentiels de la variabilité et des changements climatiques, P22 Recensement des besoins essentiels en matière d'adaptation à la variabilité et aux changements climatiques, P24 Pratiques passées et actuelles, P24 Solutions pertinentes en matière d'adaptation, P26 Fichier : PANA_RCA IV-Evaluation sectorielle des Vulnérabilités liées au Changements Climatiques, p23 Fichier : PANA_Tchad Effets néfastes réels et potentiels des changements climatiques, p23 Recensement des besoins essentiels en matière d'adaptation, p33 Pratiques passées et actuelles en matière d'adaptation aux changements climatiques, p33 Solutions pertinentes en matière d'adaptation, P33 Présentation des critères de sélection des options prioritaires d'adaptation, P36	Chetima Boukar

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...	Stratégies du secteur rural.	Les stratégies du secteur rural sont des documents de planification que définissent les axes d'intervention nationale dans les domaines suivant : Agriculture, élevage, pêche, foresterie et irrigation.	Fichier : Agri-Stratégie_Niger Résumé : page ii-v Fichier : Agri-Stratégie_Tchad Résumé : page 6 à 8 Tableau, page 69 Fichier : Agri-Stratégie_Nigeria Chapter 7. dealing with environmental issues Fichier : Agri-Stratégie_Cameroun Tableau: Vue synoptique du secteur rural par région page 148, (considérer les régions du Nord, Adamaoua et Extrême_Nord), Description de l'offre par composante p. 57	Chetima Boukar
	République du Niger Région de Zinder (2014). Analyse Diagnostique Régionale. Volet 1 : Milieu physique.	Détail sur la Géologie, le Relief, le Climat, le Zonage Agro-Ecologique, le Potentiel Hydrique, la Problématique Environnementale de la région et tendance évolutive	1.1. La Géologie Page 6 1.2. Le Relief Page 7 1.3. Le Climat Page 8 1.6. Zonage Agro-Ecologique Page 48 1.8. le Potentiel Hydrique Page 54 2. Problématique Environnementale de la Région et Tendance Evolutive Page 72	NA-ANDI MAMANE TAHIR, EXPERT PECHE & AQUACULTURE.
	République du Niger Région de Diffa(2016). Schéma Régional d'Aménagement du Territoire de Diffa	Détail sur la Géologie, le Relief, le Climat, le Zonage Agro-Ecologique, le Potentiel Hydrique, la Problématique Environnementale de la région et tendance évolutive	Chapitre II : analyse Diagnostique : milieu physique, Relief, Géologie, Sols, Climat, Végétation, Faune, Hydrogéologie et Hydrographie, Potentialités et Contraintes du milieu physique, Problématique Générale du milieu physique, Zonage de la Région. Page 13 - 35	NA-ANDI MAMANE TAHIR, EXPERT PECHE & AQUACULTURE.

No	Name and Date of the Document / Nom et date du document	Why is this document relevant for the update of the TDA / Pourquoi est-ce que ce document est pertinent pour la mise à jour de l'ADT?	Which Chapters and pages of the documents are relevant for the update of the ADT / Quels chapitres et pages des documents sont pertinents pour la mise à jour de l'ADT	Name of Expert suggesting reference/ Nom de l'expert suggérant une référence
	République du Niger Conseil Régional de Diffa.(2016). Etude sur l'analyse participative communautaire des vecteurs et cycle des conflits à Diffa.	Historique des conflits majeurs dans la région, cycle des conflits dans la région de Diffa, Conséquences des conflits de Boko Haram sur la paix et la cohésion sociale, Effets de Boko Haram sur la Sécurité alimentaire, Conséquence de Boko Haram sur l'environnement, l'éducation, la santé,	Baromètre de la cohésion sociale aujourd'hui. Page 23 ; Historique des conflits majeurs dans la région. Page 34 ; 2.4.1. Conflit de Boko Haram. Page 38 ; 5.1.1. effet de Boko Haram sur la sécurité alimentaire. Page 61 ; 5.1.4. Conséquence de Boko Haram sur l'éducation. Page 62 ; 5.1.5. Conséquence de Boko Haram sur la santé. Page 63 ; 5.1.8. Conséquence de Boko Haram sur l'environnement. Page 63.	NA-ANDI MAMANE TAHIR, EXPERT PECHE & AQUACULTURE.
	Crise et Développement: la région du lac Tchad à l'épreuve de Boko Haram AFD, Avril 2018	A partir de 2014-2015, la crise de la secte Boko Haram avec comme point de départ le Nigeria, s'est étendue dans les portions de pays voisins du lac: Tchad, Cameroun et Niger. Cette crise a forcé plus 2,4 millions de personnes à des déplacements forcés vers les villes ou d'autres zones Rurales dans les pays voisins et l'intérieur du Nigeria. Les villages abandonnés par les déplacés et qui sont des zones productifs ont entraînés des conséquences sur les systèmes agricoles(baisse de production de la région du lac). La gouvernance des ressources naturelles (terres, pâturages, zones de pêche) dans les espaces qui étaient vidés ensuite partiellement ré-occupés, pose des nouveaux défis en matière de développement.	Chapitre 4: la recomposition du système régional: production et commercialisation des produits	FATIME ANIYERE EXPERT GENRE PRESIBALT/CBLT

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	Document de politique nationale genre du Cameroun 2011-200 publiée en 2011	Cette politique définit 6 axes stratégiques relatives à: ■ La promotion de l'accès équitable des filles et des garçons, des femmes et des hommes à l'éducation, à la formation et l'information ■ Amélioration de l'accès des femmes aux services de santé de reproduction ■ Promotion de l'égalité de chance et d'opportunités entre les femmes et les hommes dans les domaines économiques et de l'emploi ■ Promotion d'un environnement socio-culturel favorable au respect des droits des femmes ■ Renforcement de la participation et de la représentativité des femmes dans la vie publique et la prise de décision ■ Renforcement du cadre institutionnel de promotion du genre	Elements de la politique nationale Genre point 3.7	FATIME ANIYERE EXPERT GENRE PRESIBALT/CBLT

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	Document de politique nationale genre du Niger publiée en Juin 2017	Cette politique s'articule autour de quatre axes stratégiques suivants : 1. Amélioration de l'environnement socioculturel en lien avec la démographie, la paix et la sécurité pour plus d'équité entre les hommes et les femmes ; 2. Renforcement du cadre institutionnel et juridique favorable à l'application effective des droits des femmes et des petites filles, à la lutte contre les violences basées sur le genre et à la participation équitable des hommes et des femmes à la gestion du pouvoir ; 3. Autonomisation économique et croissance inclusive en lien avec la gestion durable de l'environnement, la gestion des risques de catastrophes, les migrations et les urgences humanitaires ; 4. Renforcement des mécanismes institutionnels et cadres organisationnels de Coordination, de suivi-évaluation et de partenariat.	Chapitre 3: Cadre d'orientation Stratégique pour l'équité de genre	FATIME ANIYERE EXPERT GENRE PRESIBALT/CBLT
	Plan national d'Organisation des Secours en cas de catastrophe au Tchad (Novembre 2014) PNUD	Détails sur les risques de catastrophes naturelles	Page 54 INVENTAIRE ET ANALYSE DES RISQUES	Rohallati
	Revue des cadres juridiques et institutionnels en matière de prévention et de gestion des risques des catastrophes au Tchad (Octobre 2016) PNUD	Détails sur la gouvernance au Tchad	.Page 109: RECOMMANDATIONS POUR UNE AMELIORATION DU CADRE INSTITUTIONNEL ET JURIDIQUE AU TCHAD	Rohallati
	Hamit Abderamane • Moumtaz Razack • Sara Vassolo Hydrogeochemical and isotopic characterization of the groundwater in the Chari-Baguirmi depression, Republic of Chad Environ Earth Sci DOI 10.1007/s12665-012-2063-7	■ Details on geology and hydrogeology ■ Details on Hydrochemistry and isotopic ■ Details on Quality of water	Page 6 to page 16 of this paper	Dr ABDERAMANE HAMIT

Annex 3. Assessment of 2005 TDA

Assessment of the 2005 Lake Chad Basin Transboundary Diagnostic Analysis

Peter Whalley and Paul Gremillion

**Submitted to the Lake Chad Basin Commission
7 May 2018**

The Lake Chad Basin Commission (LCBC) is in the process of updating both the Transboundary Diagnostic Analysis (TDA) and Strategic Action Programme (SAP) for the conservation, protection, and restoration of water and ecological resources in the Lake Chad Basin. This document provides a critical assessment of the 2005 TDA and proposes some initial activities in updating the original TDA.

Rationale for This Assessment

Tasks associated with both this assessment and the updating of the TDA requires an understanding of how the previous TDA was used and where perceived strengths/weaknesses were. We approach these tasks as follows:

- Provide a critical assessment of the detail and geographical coverage of data/information in the 2005 TDA
- Evaluate gaps
- Assess how the 2005 TDA guided the development of the SAP
- Determine how information from the 2005 TDA has been used at national and regional level.
- Summarize the new national / regional data collected since the 2005 TDA
- Determine the sources of new information (reports/studies etc.)
- Collect any information available from international sources (e.g. satellite, UN programmes, etc)

Response from M. Bila: OK

Critical Evaluation of 2005 TDA from GEF IW-Learn TDA/SAP Manual (2013)

In its 2013 update of the GEF Transboundary Diagnostic Analysis / Strategic Action Programme

Manual⁴, GEF / IW-Learn provided critical analyses of six TDA/SAP projects completed worldwide and included the Lake Chad Basin TDA. This brief assessment is reproduced below in its entirety:

The objective of the Full-Sized Lake Chad project was to build capacity within the Lake Chad Basin Commission (LCBC) and its national committees, so that it could better achieve its mandate of managing land and water resources in the greater Conventional Basin of Lake Chad. The Project initially ran into difficulties due to poor project management, successive project managers and a general lack of strategic direction, particularly with reference to the TDA.

After a difficult and poorly planned start, the TDA Technical Task Team participated in TDA/SAP training using the 2005 GEF IW TDA/SAP “best practice” approach and redesigned the TDA accordingly. During the process of TDA development, country specific reports (termed national TDAs) were drafted and information from these was used to develop the regional Lake Chad TDA.

There were significant issues around availability and quality of data and information (particularly from CAR, Chad and Niger). In addition, a single consultant from Nigeria, aided by an international consultant, drafted the TDA and there was little collaboration with the countries, beyond an initial TDA meeting. However, the final TDA was presented in a very clear, logical and manner, within 18 months.

Based on the findings of the TDA, the SAP was completed as a regional policy framework for the Lake Chad Basin in 2007. The SAP was a well defined, aspirational but reasonably achievable document and as a consequence was endorsed by the Council of Ministers in June 2008. However, the Investment Plan for SAP implementation was not developed within the duration of the project.

⁴ <https://iwlearn.net/manuals/tda-sap-methodology>

Conclusion:

- *The final Lake Chad TDA was an acceptable document that conformed to the 2005 best practice approach.*
- *The TDA was adopted by the steering committee and the countries.*
- *It provided a good foundation for SAP development.*
- *Despite many challenges, a fully endorsed SAP was produced within the timeframe of the project.*
- *However, the TDA and SAP process were driven by external consultants rather than the Project Coordination Unit (PCU) and the countries, which resulted in a lack of collaboration and consultation.*

Regarding the last conclusion, we note that external consultants have worked as advisors, rather than as managers, at least in recent years. This work has been accomplished through close cooperation with LCBC staff to ensure that both first-hand knowledge of technical and political matters is used in the development of regional management plans and assessments, and that this capacity remains embedded within LCBC.

Response from M. Bila: OK

CHAPTER BY CHAPTER ASSESSMENT OF 2005 TDA

Chapter 1 – Introduction

Strengths: Provides a concise overview of the geographic, historical, and political contexts underlying water resource management in the basin. The introduction also describes the TDA within the context of Integrated Water Resource Management (IWRM) and the Millennium Development Goals (MDGs), which were used at the time to evaluate resources and prioritize investments.

Weaknesses: Although the water resources and history of policy agreements were addressed in this section, two other areas were not addressed: the economic significance of the Lake Chad basin and the overall Lake Chad Basin ecosystem. The

Lake Chad Basin is an interconnected system of water resources supporting an ecosystem which provides economic support for the region. These economic resources can only be sustained through cooperative transboundary management of both the water and ecosystem resources.

A unique aspect of the Lake Chad Basin is that it evolved from pre-human times to adapt to wide climatic variations over relatively short time periods. This adaptation has enabled the ecosystem to survive both natural climate variability and human-caused perturbations. This resilience provides hope that careful stewardship can result in successful sustainable management of the ecosystem. This is particularly striking, considering that Lake Chad is a terminal basin with no outlet. Such ecosystems are often both at risk of collapse and vulnerable to high salinity. We recognize that the perspective of ecosystem services is relatively new, and do not criticize the report for its absence. Rather we take the opportunity to introduce this as a governing concept for future management strategies.

Gaps & Information Needs: Update necessary to describe changes since 2005. This should include the role of national SDGs in guiding water and ecosystem priorities, a description of the Water Charter, the inclusion of security issues in the mission of the LCBC, the development and completion of the Report on the State of the Lake Chad Basin Ecosystem, the award of the UNDP SAP project, and other relevant developments.

Response from M. Bila: The Environmental Audit report analyses policies, institutions, and deficiencies.

Chapter 2 –TDA Approach

Strengths: This section outlines the IW-Learn TDA methodology as applied to the Lake Chad Basin project. It provides an excellent resource for understanding the step-by-step process of developing the TDA.

Weaknesses: This section includes both general methodologies for conducting TDAs, as well as specific activities undertaken in support of the TDA. Some details were provided; for example, “The individual national TTTs were brought together ... in September 2006 in Maroua, Cameroon.”⁵ However, a more complete timeline of activities, meetings, and participants would have

⁵ TDA (2005), Page 25, Paragraph 2.

been useful. A description of the methodology for conducting the stakeholder analysis was not included and should have appeared on Page 25 of the TDA, after Paragraph 2. We discuss this below in our assessment of Chapter 5, but Chapter 2 would have been an appropriate place to describe difficulties in conducting the TDA.

Gaps & Information Needs: No significant gaps.

Chapter 3 – Baseline Information on the Lake Chad Basin

Strengths: This is, in our assessment, an extremely well organized chapter, which provides analyses at the sub-basin level with separate sections for water resources, ecological resources, and human resources (Section 3.2). Other data are presented in sections on climatic features and climate change (Section 3.3), natural resources (Section 3.4), unique ecological communities and protected areas (Section 3.5), water resources (Section 3.6) and institutional and legal aspects (Section 3.7).

It could be argued that institutional and legal aspects should be covered in a separate chapter, but this organization seems to work, considering that the information provided in this chapter provides context useful for the following chapter on priority transboundary problems.

Weaknesses: The ecosystems of the Lake Chad Basin were well characterized in this section. However, we return to comments in our assessment of Chapter 1 – Introduction. We note that considering the evolutionary history of the basin would be useful to underscore the following: The nations of the Lake Chad Basin are fortunate to have an ecosystem that is naturally resilient, and therefore a promising location for conservation and restoration investments.

Gaps & Information Needs: This section appears to provide a comprehensive picture of the basin in 2005, however many changes have taken place in the basin and new information has become available. Security has emerged as a significant concern and needs to be addressed in the updated TDA. We are aware of many additional resources, which include notably the Report on the State of the Lake Chad Basin Ecosystem, The Lake Chad

Development and Climate Resilience Action Plan, and technical reports published by IAEA and BGR. We will solicit the assistance of the LCBC and GIZ to identify relevant information from these and other sources.

Chapter 4 – Priority Transboundary Problems

Strengths: This section presents the priority transboundary threats in separate sections that consider the immediate, underlying, and root causes (the causal chain) for each of seven priority threats. Causal chain analysis and priority threats are sometimes organized into separate sections in TDAs. Combining them makes sense in this TDA, achieving efficiency and creating a logical sequence of concepts that facilitates clear comprehension of the central ideas of the chapter. This section also introduces additional data not included in the previous chapter on baseline conditions. These additional data are useful and add to a more clear understanding of priority threats in the basin.

Weaknesses: Although the flowcharts showing the causal chains was effective, alternative ways of presenting the CCA may improve the ability for LCBC to ensure that the management benefits of the CCA are utilized. These can include tables, versus flow diagrams. One minor comment is that flowcharts require additional editing.

Gaps & Information Needs: Each priority threat has a sub-section titled, “Knowledge Gaps”. It would be useful to update these sub-sections with any relevant data acquired since 2007. More broadly, a new causal chain analysis will be an early step in the project to update the TDA. As we work through the causal chain, information from the 2007 TDA can be adopted for the updated TDA and checked against the most recent available data.

Response from M. Bila: OK

Chapter 5 – Stakeholder Analysis

Strengths: The stakeholders for Nigeria were well defined using standard methodology for stakeholder analyses.⁶ This section gives a clear idea of the primary, secondary, and key stakeholders in Nigeria.

⁶ For example, UNDP guidelines for stakeholder engagement (https://info.undp.org/sites/bpps/SES_Toolkit/SES%20Document%20Library/Final%20UNDP%20SES%20Stakeholder%20Engagement%20GN_Oct2017.pdf), or the World Health Organization methodology for preparing stakeholder analyses (<http://www.who.int/workforcealliance/knowledge/toolkit/33.pdf>).

Weaknesses: No analysis was provided to identify the stakeholders in the region, other than for Nigeria. The Nigerian stakeholder analysis was presented as a, “sample stakeholder analysis”⁷, with the expectation that, “approaches for identifying stakeholders ... which have been applied in Nigeria ... can be applied as LCBC progresses with the development and implementation of the SAP.”⁸ Also, although this is minor, we note that acronyms (e.g., “FMWR-IUCN-KYB”⁹) are not defined. We recognize the constraints under which the original TDA was prepared, however some indication of the similarity among stakeholders across other countries in the basin would have been helpful.

Response from M. Bila: *For the other countries, a stakeholder analysis exists in French. A translation could be attempted but would require substantial resources.*

Gaps & Information Needs: Stakeholder analyses for the Lake Chad Basin Countries (i.e., Cameroon, Central African Republic, Chad, and Niger) are necessary including updating the stakeholder analysis for Nigeria. In addition to national reports, a regional stakeholder analysis is necessary. Because climate change has been included as a priority transboundary threat, it is possible that additional stakeholders can emerge and should be identified. The regional stakeholder analysis should also consider the evolving security concerns.

Response from M. Bila: *Can the LCBC take-on this as an urgent activity?*

Chapter 6 – Governance Analysis

Strengths: This brief section provides the regional context for national governance and some of the challenges of regional coordination. It also identifies relevant international conventions and the national participation in each of these conventions. This section also identifies some of the challenges the LCBC faces in implementing water resources management plans at the transboundary level.

Weaknesses: This section does not include any national governance analyses or detailed consideration of regional governance.

Gaps & Information Needs: Gaps and additional information needed for a TDA update include national and regional governance analyses, an analysis of the status of the Water Charter, and information on the activities of the LCBC concerned related to governance.

Response from M. Bila: *It is necessary, and the Water Charter implementation needs it for success.*

Chapter 7 – Conclusions and Recommendations

Strengths: This section clearly identifies a major impediment which may prevent development and implementation of a strategic action programme: “The LCBC ... lacks the power to arbitrate water conflicts in the basin; it cannot sanction member countries; it has no mechanism for fostering basin level integrated water resources management by way of getting the line agencies of the member countries to harmonize their water resources development programs.”¹⁰ This comment was not fully supported in the text previously, so additional supporting information is necessary. If this comment is no longer correct, an updated assessment of the effectiveness of the LCBC is appropriate.

Response from M. Bila: *Some of the statements are exactly what the water charter is meant to address. The environmental audit report could provide a more updated assessment of LCBC effectiveness.*

Weaknesses: It would be appropriate to include a section in this chapter on, “Bridging the TDA and SAP.” This section could both introduce the objectives of the Strategic Action Programme and start to map the findings of the TDA to future planning for policy changes necessary for conservation and protection of the basin.

Gaps & Information Needs: Impediments to effective implementation of water management policies need to be evaluated as part of the CCA in the updated TDA.

Response from M. Bila: *Important.*

⁷ TDA (2005), Page 7, Line 1.

⁸ TDA (2005), Page 121, Lines 13-15.

⁹ TDA (2005), Page 122, Line 12.

¹⁰ TDA (2005), Page 130, Paragraph 2.

THE PATH FORWARD

The 2007 TDA formed the basis for the Strategic Action Programme adopted in 2008. The seven priority transboundary problems were translated into four Ecosystem Quality and Water Resource Objectives (EQWRO) as follows:

Priority Transboundary Problem	Ecosystem Quality and Water Resource Objective
Variability of Hydrological Regime and Fresh Water Availability Water Pollution Sedimentation in Rivers and Water Bodies	Improved quantity and quality of water in the Lake Chad Basin.
Decreased Viability of Biological Resources Invasive Species	Restoration, conservation and sustainable use of bioresources in the Lake Chad Basin.
Loss of Biodiversity	Conservation of biodiversity in the Lake Chad Basin.
Loss and Modification of Ecosystems	Restoration and preservation of ecosystems in the Lake Chad Basin.
No direct transboundary problem. Addresses root causes.	Strengthened participation and capacity of stakeholders, and institutional and legal frameworks for environmental stewardship for the Lake Chad Basin.

The 2008 SAP recognized the need for strengthened regional legal, institutional, and governance mechanisms reflected in the 2007 TDA. An assessment of the progress toward this and other EQWROs will be necessary as part of the updated TDA.

The updated TDA will also reflect a revised set of priority transboundary problems. In a January 2018 meeting, the LCBC defined the following priority transboundary problems:

Revised Priority Transboundary Problems	
1.	Variability of hydrological and hydrogeological regime.
2.	Biodiversity degradation including the loss and modification of ecosystems and decreasing viability of living resources.
3.	Sedimentation.
4.	Climate variability and change.

The updated TDA will use these priority transboundary problems as the basis for developing the new causal chain analysis.

Finally, the TDA update will require evaluation of relevant events, documents produced, and data collected since the 2007 TDA. The table below

summarizes some of the information needed to update the TDA, along with a description of how we intend to use the information. Because the timeframe for conducting update is short, we request that LCBC and GIZ assist us by highlighting or referencing specific parts of reports and documents which meet our information needs.

Information Need	Context / Purpose
SDGs by nation	Identify how SDGs affect national and regional planning for water allocation and resource protection. Response from M. Bila: As far as I know, this is not yet available to the LCBC.
Water Charter	Status of adoption of Charter by nations and how this influences TDA/SAP development and implementation. Response from M. Bila: Only Libya and CAR remain to ratify the charter but only four countries are needed to bring it into force. I am not aware if any country is implementing it.
National Action Plans	Both the most recent documents and the status of implementation of NAPs.
Strategic Action Programme	Update on status of activities at LCBC related to implementation of the original SAP and status of planning for current SAP project.
National and regional studies on the environment and socio-economic conditions.	LCBC to identify appropriate recent reports (with specific references) to guide the updating of the TDA.
Stakeholder, governance, and legal/institutional analyses.	Updates to existing analyses and any changes made to governance, legal, and institutional structures at both the national and regional levels.

CONCLUSIONS

The 2005 TDA provides a thorough technical analysis of priority threats to the ecosystems and water resources of the Lake Chad Basin. Rather than re-draft a complete, new TDA, we anticipate that the updated TDA will cite all relevant aspects

of the 2005 TDA, include an analysis of information collected since publication of the original TDA, and reflect the LCBC's reassessment of the priority transboundary problems. The updated TDA will therefore provide current assessment of conditions in the basin in preparation for SAP implementation.

Annex 4. Causal Chain Analysis Results

The causal chain analysis was conducted by two separate teams. These teams presented their results to the plenary group and a single set of analyses was developed for each primary trans-

boundary problem. The CCA was conducted in French and both the French and English versions are presented in this appendix.

Variability of hydrological and hydrogeological regime

Group 1	Group 2
Goods and Services at risk	
Ecosystems Groundwater recharge Arable lands Aquatic habitat Regulation of water quality	1. Biological diversity 2. Arable land 3. Vegetation cover 4. Surface Waters 5. Groundwater 6. Agriculture, livestock, production 7. Industries 8. Governance
Impacts (ecosystem and socio-economic)	
Flood Destruction of houses and farms Outbreak of epidemics Changing in the groundwater level Changes in aquatic habitat Water supply for the household, agriculture, cattle breeding, fishing, industry Ecosystem disasters Declining fisheries resources, agricultural production, pastoral, industrial Decreasing groundwater Desert encroachment (desertification) Seasonal migration Population migration Population / resource conflicts	1. Biological diversity Decrease in resources Loss of certain species / extinction 2. Arable land Decrease of exploitable areas Land pressure and conflict Food insecurity 3. Vegetation cover Decrease in grazing Migration Desertification 4. Surface Waters River navigation (difficulties) Decrease in production of fish Decrease in agricultural production 5. Groundwater Decrease in recharge Pressure on the resource Drying of surficial groundwater Decrease in water production 6. Agriculture, livestock, production Decrease in productivity Decrease in income Loss of investment Migration and / or change of fishers to farmers 7. Industries Difficulty in water supply Drop in production 8. Governance Difficulty applying regulations (texts) Conflicts in the exploitation of water resources

Group 1	Group 2
Sectors	
Agriculture Fisheries Cattle breeding Forestry	Agriculture Fisheries Trade Transport Industry Natural habitats
Immediate Causes	
Rainfall variability Bad management dams Degradation of vegetation Overexploitation of water resources	Variability / climate change Pressure on the water resource Modification / degradation of soils Development of hydraulic Structures Migration
Underlying Causes	
Weakness in monitoring the application of Regulations Absence of regulations regulating groundwater / surface water management Poor application of groundwater and surface water laws	Poor governance of the water resource Decrease of the water resource
Root Causes	
Inadequate monitoring leading to poor management of water quality/quantity Insecurity Insufficient financial resources Climate change Demographic pressure	Demographic growth Poverty illiteracy

Biodiversity Degradation

Group 1		Group 2	
Goods and Services at risk			
1. Flora Vegetation coverage Food Safety Medicinal plants Wood in energy Pasture lands Lumber Soil protection / humus Habitat Tourism 2. Wildlife Food Safety Soil fertilization Medicinal plants Ecosystem services / balance Industry / Artisanal Tourism 3. Aquatic ecosystems Habitat / fauna and flora Food Safety Trade and Industry Tourism		Ecotourism Pasture lands Wetlands Soil / Fertility Plant cover / Fauna Water resources Natural habitats	
Impacts (ecosystem and socio-economic)			
Decrease in vegetation coverage Loss of medical plants Shortage of firewood Migration / Transhumance (seasonal migration) Decrease in animal and plant biodiversity Loss of arable land Loss of pasture area Degradation of soil Ecosystem imbalance Insecurity Conflicts Poverty		Socio-Economic Impacts Drop in visits to tourist sites Decrease in income Decline in local development Development of hydrology diseases Decrease in productivity Food Insecurity and Nutrition Intercommunity conflicts Ecological Impacts Loss of Habitats Decrease / loss of species Imbalance of the species Increased soil erosion Silting (sedimentation)	
Sectors			
Agriculture Fisheries Cattle breeding Trade Industry / Handicraft Tourism Construction / Housing Health		Tourism Fisheries Agriculture Cattle breeding Health Environment Infrastructure	
Immediate Causes			
Poor fishing practice Drought Bushfire deforestation Overexploitation of natural resources Poaching Industrial development Accidental spillage of polluting waste		precipitation Flood Temperature variability Overexploitation of species Human pressure on resources pollution	

Group 1	Group 2
Underlying Causes	
Weakness in the application of regulatory texts Insecurity Absence of harmonized laws and political laws Non-application of the Water Charter Insufficient sensitivity of the actors on the B.P.	Inadequacy of regulation enforcement Insufficient / lack of harmonization of regulations Development / planning (lack of) Inadequate Resources
Root Causes	
Population growth Climate change Institutional Reform Poor governance Institutional instability	Poverty Climate change Population growth Insecurity Institutional political instability

Sedimentation

Group 1	Group 2
Goods and Services at risk	
Lake and its tributaries Aquatic habitat Aquatic flora and fauna Storage capacity of flood plains Navigation Water supply	Water bodies Bowls / Oasis Biological diversity infrastructures habitats Exploitable land / agricultural Pasture areas Air
Impacts (ecosystem and socio-economic)	
Flood Acceleration of evaporation Increased electrical conductivity Degradation of habitats Decrease of aquatic fauna / flora Development of harmful species / Pollution / Deterioration of water quality Imbalance of the food chain Loss of income Food insecurity Destruction of crops and homes Tourism development Availability of sand and aggregates for construction Migration / Transhumance (seasonal migration) Scarcity of collective fishing	Drying of surface water Degradation and recovery of cuvettes Loss of investments Degradation of biodiversity Habitat modification / loss Retention storage loss Loss of income diseases Damage to hydraulic infrastructure Flood Chanel changes (from silting)
Sectors	
Agriculture Breeding Tourism Trade Industry River transport Health	Infrastructure Health Water Agriculture Fishing Environment Trade / Transport

Group 1	Group 2
Immediate Causes	
Water Erosion / Wind deforestation overgrazing High intensity of rainfall Urbanization Civil engineering work Landslides Winds and silting	Change of ground occupation Extreme climate phenomenon deforestation Bad waste management Inappropriate agricultural techniques
Underlying Causes	
Weakness in the application of regulatory texts Absence of regulatory texts and harmonized political laws Non application of the Water Charter Insufficient awareness of stakeholders on best practices	Low regulatory text application Overproduction / increased needs
Root Causes	
Population growth Bad governance Institutional instability Climate variability	Climate change Poverty Education / Illiteracy

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