The Lake Chad Basin

Background

For about four decades recurring droughts, a general decline in rainfalls, and the degradation of the vegetation cover have led to drastic changes in the environmental conditions of the Lake Chad Basin. The drying up of Lake Chad, the encroachment of the desert, and the decline of agriculture, livestock and fisheries, threatens the social and economic well-being of over 30 million people living in the Lake Chad Basin. The countries' economies suffer from low productivity, insufficient infrastructure, governance problems, a sluggish private sector and political instability. Consequently, the Lake Chad region is therefore impaired by its high poverty rate.

The Lake Chad Basin, which is the largest inland drainage basin in Africa, covers an area of about 2,500,000 km^2. This catchment region bordering the Sahara, covers about 8% of the surface area of the African continent, and is shared between the countries of Algeria, Cameroon, Central African Republic, Chad, Libya, Niger, Nigeria, and Sudan.

The need for a framework for economic cooperation and integration built around the shared resources of Lake Chad has been well understood. The Lake Chad Basin Commission (LCBC) is an inter-governmental organization for the development of the Lake Chad Basin created by a Convention and Statutes signed at Fort Lamy (N'djamena) on May 22, 1964. Member States are required to abstain from measures likely to affect other Member States, such as:

- alter the water budget,
- affect water quality,
- Influence integrated water resources management
- limit downstream access to water

Water Availability

Lake Chad and the rivers that feed it, together with their associated wetlands, have been traditional sources of freshwater for domestic consumption and agricultural production throughout the centuries. Since 1963, Lake Chad has shrunk to about 5% of its former size, apparently due to both climatic changes and high demands for agricultural water. From 1952 to 1994, the average rainfall in the Chari-Logone basin which contributes between 80 – 95% inflows to the Lake Chad was 973 mm/year. The average annual streamflow was 29.6 km^3/year. Groundwater is composed of the Quaternary aquifer estimated to hold greater than 150 km^3 and the deeper artesian Pliocene aquifer. In 2011, negotiations for the Water Charter for the Lake Chad Basin were completed with the identification of 6 major tangible commitments for IWRM. The Water Charter constitutes a binding framework whose purpose is the sustainable development of the Lake Chad Basin by means of an integrated, equitable, coordinated management of the Basin's shared water resources and environment. The 6 fundamental commitments of the Water charter are as follows;

1. During low waters periods, reserve a minimum low water flow for the tributaries flowing into Lake Chad
2. During high waters periods, reserve a minimum amount of flood waters to ensure that the basin's wetland areas are inundated

3. Restrict the proportion of abstractions from the inflow to the Lake Chad
4. Adapt groundwater abstraction to aquifer capacity
5. When necessary, create fishing reserves in part of Lake Chad and/or its tributaries.
6. Share data and ensure smoothly-run exchanges of information

The Current Use of Data in Decision Making in the Basin

The successful implementation of the Water Charter will require an annual assessment of the Lake Chad Basin water budget, forecast of water availability and allocation of equitable abstraction between the Member States.

The Study for the Creation and Extension of the Water Charter of the Lake Chad Basin recognized that the LCBC already has a hydrometric and rainfall database, but it is not up to date and the reliability of the data has not been assessed. In the study, a simulation model for the water levels in the compartments of Lake Chad developed by IRD was used. The LCBC has also completed the development of a WEAP water allocation model in 2011.

There are gaps in the data of some of the selected reference stations and not enough data to simulate the management of some sub- basins such as the Komadugu-Yobe Basin. At the moment, the LCBC does not have any data or service for floods and droughts in the Lake Chad Basin.

Basin Plans relevant to Sustainable Development and a Green Economy

The Transboundary Diagnostic Analysis (TDA) of the Lake Chad Basin identifies that the future social risks to populations of the Lake Chad Basin are the products of the combined impacts of accelerating global climate change, unsustainable resources use by a growing population, and driven overall by institutional failures. These threats are addressed through the 25 year SAP at the regional level and a 5 year National Action Plans at the national level.

In order to improve food and energy security in the Lake Chad Basin, the LCBC is conducting a feasibility study of the possible inter-basin transfer of the surplus flow of the River Oubangui in the tropical South to the Sahel Lake Chad through River Chari. A component of the study includes constructing a dam on the River Oubangui for water storage for the purpose of the transfer and the generation of hydroelectricity. The LCBC is also conducting another study for the construction of a hydroelectric dam on the upper catchment of the River Logone.

The LCBC is playing a central role in ensuring a sustainable future in the Lake Chad Basin by coordinating the development and implementation of basin-wide measures such as the common vision (Vision 2025), a regional SAP, regional observatory, Water Charter and use of other management instruments. In this process, the LCBC, and its stakeholders stand to benefit from sharing data and ensuring smooth exchanges of information and data generated through Earth Observation. Formalising the generation and exchange of information between the 6 countries using GEO principles will create transparency in transboundary water management and ensure sustainable development of the resources of the Lake Chad Basin.

THE MEDJERDA RIVER CATCHMENT
TUNISIA

(Physical, natural, and socio-economic facts, and water-related issues)

Tunisia is a country of North Africa and is situated in a climatic transition zone between Southern Europe and the Northern Sahara. The rainy season occurs in winter, lasting from 2 to 6 months in succession. Rainfall is sufficient to balance evapo-transpiration and with excess feeding runoff. The climate and hydrology of Tunisia are strongly influenced by the presence of two mountain chains, representing eastern extensions of the Atlas Mountains.

Seasonal rainfall amounts vary as a function of the geography of Tunisia, and can be categorized by regions as follows:

Northern Tunisia (including the Medjerda river catchment): 400 to 1500 mm/yr
Central Tunisia: 200 to 400 mm/yr
Southern interior Tunisia: less than 200 mm/yr
The Medjerda river valley is located in Northern Tunisia which is characterized by small mountain ranges running in a southwest-to-northeast orientation. These ranges are separated by deep and narrow valleys, with steep slopes. At the southern end of this complex, the upper and middle Medjerda valley extends from west to east.

The surface area of the Medjerda river catchment is on the order of 16,100 km^2. The Medjerda and its tributaries play a key role in the hydrography of Tunisia. At 600 km long, the river is moderate in size. The 400 km within Tunisia provide an average annual discharge rate of 30 m^3/s (ranging from 91 m^3/s in February to 3 m^3/s during summer months; up to 3500 m^3/s during flooding periods).

Several civilizations have flourished along the length of the Medjerda valley, making it an important axis of development. Many towns have prospered, with economic development leading to the establishment of 9 provinces, representing 40% of the nation's population, and irrigated agriculture covering a surface area of 80,000 ha.

WATER-RELATED ISSUES OF THE CATCHMENT:

Three-fourths of Tunisia's water resources are renewable, with almost 58% of these resources in the form of surface water. The Medjerda catchment delivers on the order of 1,000 M m^3/yr.

Several dams, retention ponds and lakes have been built on the Medjerda and its tributaries. Thousands of bore holes and water wells have been dug to take advantage of deep aquifers underlying the valley.

On an annual basis, main concerns with respect to water are two-fold: a rather large excess in winter with a deficit in summer; and the gradual shortening of the rainy season from the northwest towards the south, the humid north contrasting with the climate of sheltered valleys of the south.

Since Tunisia's independence, rapid development has led to strong demand for water across many sectors such as domestic, industrial, tourism and especially irrigation usage. Several decades ago, Tunisian authorities responded by establishing a long-term water resource management policy, based on:

- the design and construction of large water-collection projects, aiming to reduce the effects of contrasting climates and droughts by regulating the intra-/inter-annual availability of water from natural sources;

- the completion of large aqueduct projects (pipes, canals) to transfer water both within and between regions;

- the establishment of research programs with respect to groundwater designed to benefit multiple sectors, especially agriculture, through a system of subsidies and credits for the expansion of surface wells for agricultural development.

- the development of different scenarios for the reuse of treated wastewater.

Under normal conditions (i.e. aside from drought), this policy currently enables sufficient delivery of:

- drinking water for the populations;
- irrigation water for approximately 80,000 hectares; and
- protection from flooding in areas located downstream of these projects.

This considerable effort to mobilize water resources has played a key role in the management and reduction of economic and social impacts of major droughts the country has faced, especially in the past 15 years. However, this plan is starting to reach both physical and economic limits. The water resources remaining for harvesting are decreasing in accessibility while becoming increasingly expensive to exploit. Over the coming decades, efforts should focus instead on a more efficient management of this dwindling resource, which would include a reevaluation of the demand rather than increasing supply. Considering the agricultural sector consumes 80% of water resources, it is no easy task to determine policies that will account for future needs while sustaining an economic industry that can respond to strategic needs and compete in an international market that is constantly evolving.

Although its share is considerably smaller, the provision of drinking water to the population still requires the highest quality, even during periods of severe drought. One of the major challenges for the government in the coming decade is the provision of high-quality potable water to rural areas.

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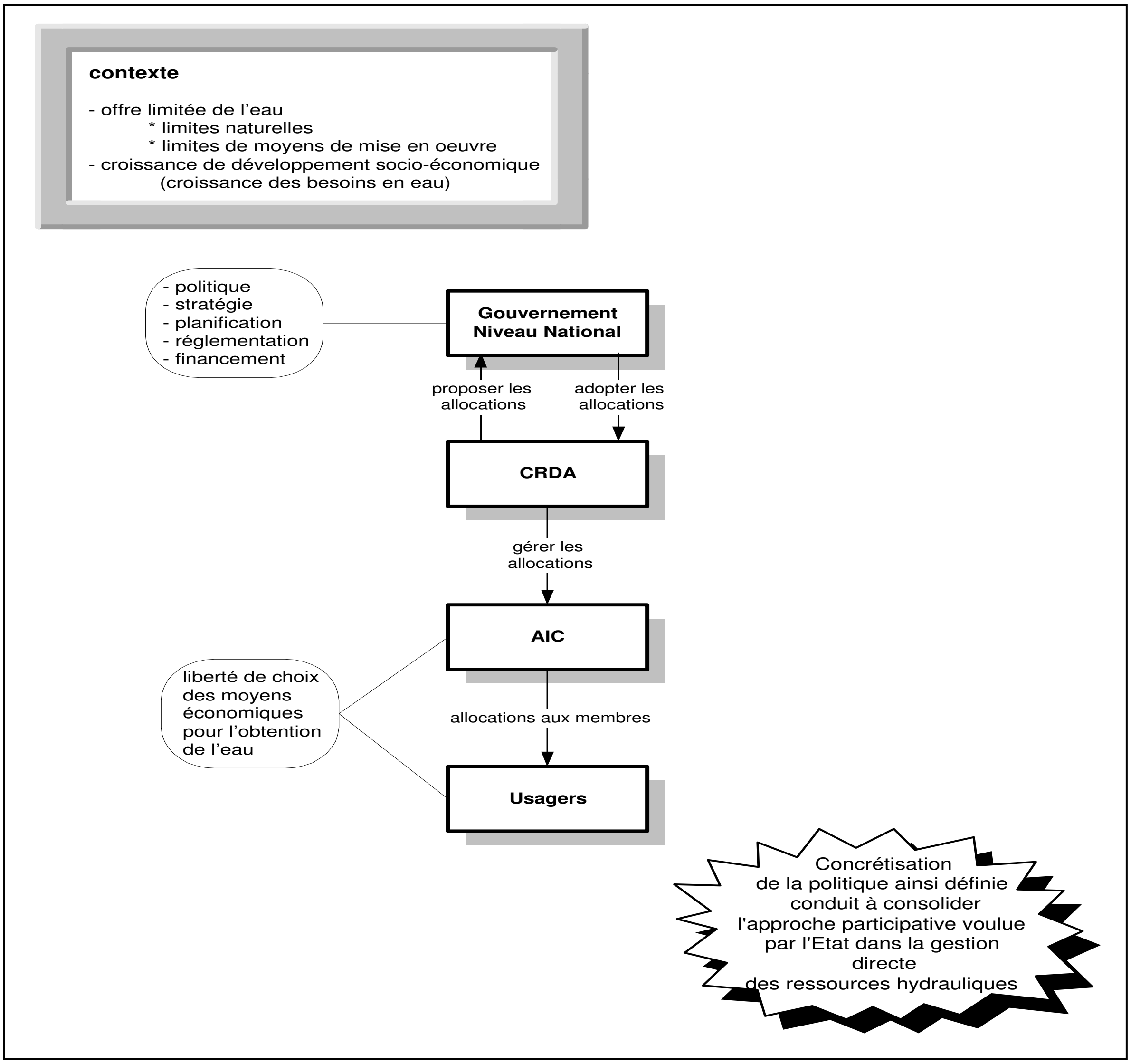
Putting policy thus defined into practice will lead to an inclusive, participative approach in the quest for proper management of water resources, which is the objective of the government.

Abbreviations:
CRDA: Regional Commission for Agricultural Development
AIC: Common Interest Association

Context:
- limited availability of water (both natural and economically feasible)
- growth of socio-economic development (increasing demands on water supplies)

National Government level: policy, strategy, planning, regulation, finance
CRDA->government: suggest allocations/subsidies
Government->CRDA: adopt allocations/subsidies
CRDA->AID: manage allocations/subsidies
AIC->end-users: distribution of allocations/subsides to members; promotion of free choice in economic means to obtain water

Integrated water resource management, dealing with both surface and groundwater, must take into account the individual characteristics of these sources.



LE BASSIN VERSANT DE LA MEDJERDA
TUNISIE

(Données physiques, naturelles, socio-économiques et enjeux de l'eau)

La Tunisie pays de l'Afrique du nord se situe dans une zone de transition climatique entre le le sud de l'Europe et le nord du Sahara. La saison humide centrée sur l'hiver dure de 2 à 6 mois successifs. La pluie couvre l'ETP et on enregistre un excédent d'eau disponible pour l'écoulement, le climat de la Tunisie ainsi que son hydrographie sont fortement conditionnés par la présence de deux chaines montagneuses qui constituent le prolongement vers l'est des chaines de l'atlas tellien.

Le régime pluviométrique conditionné par la position géographique de la Tunisie et le compartimentage imposé donne ce qui suit :

La Tunisie du nord(le bassin versant de la Medjerda) 400 à 1500 mm/an

La Tunisie du centre 200 à 400mm/an

La Tunisie de la sud inferieure à 200 mm/an

La vallée de la Medjerda appartient à la Tunisie du nord qui est marqué par de petites montagnes orientées sud-ouest nord-est, ces chaines sont séparées par d'étroites et profondes vallées avec des versants à pentes fortes. Au sud de cet ensemble s'étend de l'ouest vers l'est la haute et et moyenne vallée de la Medjerda.

Le bassin de la Medjerda couvre une superficie de l'ordre de 16100 Km^2

La Medjerda et ses affluents constitue la pièce maitresse du réseau hydrographique tunisien ce cours d'eau de taille modeste 600 Km dont 400 Km en Tunisie présente un débit annuel moyen de 30 m3 /s (hiver 91 m^3/s février à $3m^3$ /s en crue 3500 m3/s)

Beaucoup de civilisations se sont développées tout au long de la vallée de la Medjerda faisant d'elle un axe de développement important, beaucoup de villes ont prospérées et un développement économique s'est instauré (9provinces) environ 40% de la population, plusieurs périmètres irrigués (80000 ha)

LES ENJEUX DE L'EAU DANS LE BASSIN :

Les ¾ des ressources en eau de la Tunisie sont renouvelables prés de 58% de ces ressources sont des eaux de surface.

Le bassin versant de la Medjerda accueille un apport de 1000 Mm^3par an.

Plusieurs barrages, barrages collinaires et lacs ont étés construits sur la Medjerda et ses affluents.

Des milliers de forages et de puits d'eau ont été creuses pour exploiter les nappes profondes de la vallée.

Le problème de l'eau se pose chaque année sous ses deux aspects : un excès important en hiver et un déficit en été, la longueur de la saison humide diminue du nord-ouest vers le sud le climat humide du nord contraste avec le climat des bassins abrités.

Le développement rapide depuis l'indépendance de la demande en eau, pour les usages domestiques, industriels, touristiques et surtout d'irrigation, a conduit les autorités tunisiennes à mettre en place une politique soutenue d'aménagement des ressources hydrauliques depuis plusieurs décennies appuyée sur:

- la réalisation de grands ouvrages d'accumulation permettant d'atténuer les écarts climatiques et les sécheresses grâce à une régularisation inter- annuelle des apports naturels des cours d'eau ;
- la réalisation d'importants ouvrages d'adduction d'eau (conduites, canaux...) qui ont rendu possible le transfert, intra et inter région ;
- la réalisation de programmes de recherche d'eau souterraine au profit des différents usagers de l'eau à travers le pays en particulier au bénéfice du développement agricole la réalisation d'un programme des encouragements et des crédits pour la création des puits de surface au bénéfice du développement agricole.
- la réalisation des schémas de réutilisation des eaux usées traitées.

En dehors des périodes sèches ces ressources en eau permettent actuellement d'assurer dans des bonnes conditions :

- l'alimentation en eau potable des populations;
- l'irrigation d'environ 80.000 hectares; et

La protection contre les inondations des zones situées à l'aval des ouvrages Cet effort considérable de mobilisation des ressources en eau a joué un rôle déterminant dans la maîtrise et l'atténuation des impacts économiques et sociaux des sécheresses qu'a connues le pays particulièrement durant les quinze dernières années.

Cet effort atteint ses limites tant au plan physique qu'économique. Les ressources qui restent à mobiliser sont les moins accessibles et les moins rentables. Les efforts à mener au cours des prochaines décennies doivent se focaliser sur une gestion plus efficace d'une ressource qui devient de plus en plus rare. Elle devra donc privilégier la demande plutôt que l'offre. Or l'agriculture consomme 80% des ressources en eau, c'est dire l'effort à faire dans ce secteur pour espérer répondre à ses besoins futurs sans avoir à solliciter outre mesure les ressources mais en pérennisant une activité économique qui doit répondre à des besoins stratégiques et qui doit faire face à des marchés internationaux en constante mutation.

L'alimentation en eau potable de la population quoique moins consommatrice d'eau, est assez exigeante du point de vue de qualité et devra rester incompressible même durant les sécheresses les plus sévères. En milieu rural, la politique de généralisation de la desserte d'une eau de qualité reste l'un des défis majeurs du Gouvernement pour la prochaine décennie. La gestion, qui intègre simultanément les eaux de surface et celle des nappes souterraines doit tenir compte impérativement des caractéristiques intrinsèques de ces deux ressources :

Abréviations: CRDA : commissariat régional de développement agricole(province)
AIC : Association d'intérêt commun

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THE RIVER NIGER BASIN

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1. River Niger is the third longest river in Africa that takes its source from the Fouta Djallon highland in Guinea at an approximate altitude of 800m, before traversing over a distance of about 4,200 km to empty into the Atlantic Ocean in Nigeria. The initial catchments area of the Niger basin was about 2,000,000 km^2 covering 10 Countries including Algeria but as a result of desert encroachment it was reduced to an active catchments area of about 1,500,000 km^2 with exclusion of Algeria. The 9 Countries covered by the basin active catchment's areas formed the Niger Basin Authority (NBA) initially as River Niger Commission (RNC) in 1963 with the view of fostering cooperation among its members states in use and management of the basin's resources among others. The RNC was changed to the NBA in 1980 with additional mandates for the enhancement of effective integrated water resources management and development of the basin in all fields notably; energy, water resources, agriculture, animal rearing, fish breeding, sylviculture, transportation, communications, and industry.

2. River Niger is the source of potable water for over 100 million people in the West and part of Central Africa. In the recent years it has been adversely affected by the climatic variability, particularly the drought. During the 1984/85 hydrological year, specifically on 16th June 1985, the river was completely dry in Niamey for the first time in human life memory. Also flow recorded during the 2002/2003 hydrological year was among the lowest in 50 years**.** Since the last 4 decades the Niger basin has therefore been experiencing the impact of climate changes that has resulted in the persistent drought, causing continued low flow that reduces reservoir storage with consequences of acute water shortage and increasing water demand; pollution, weed encroachment, increasing water borne diseases, mortality rate, famine, urban migration and poverty.

3. In 1984 the NBA established 65 hydrological Data Collection Platforms (DCP) along the river Niger system under the framework of the HYDRONIGER project. To consolidate hydrological data collection in the Niger basin, the Niger-HYCOS was implemented as an extension of HYDRONIGER and as an integral part of WMO initiated WHYCOS project. The Niger-HYCOS is currently in its second phase while the project first phase was carried out from 2006 to 2010 through the Financial support from French Agency For Development (FAD) and The African Water Facility (AWF) of the African Development Bank.

4. As a result of its peculiar physiographic and hydrographic characteristics the Niger basin is sub-divided into 4 sub-catchments as follows; the Upper Niger Basin; the Inland Delta; the Middle Niger Basin; and the Lower Niger Basin.

a) The Upper Niger Basin: This covers Guinea, Mali and Cote D'Ivoire with a total surface area of about 740,000 sq km. The annual cumulative rainfall ranges from 800mm in the hinterland to about 2000 mm in the coastal areas. Its main tributaries are rivers Tinkisso, Niandan, Milo, and Sankarani. The hydrological gauge station at Koulikoro in Mali which is usually used to represent the hydrology of this part of the basin was established in 1907. The maximum discharge ever recorded was 9670 m3/s in 1925 with a minimum of 13 m3/s that was recorded in 1973 while the mean annual flow was 1350 m3/s.

b) The Inland Delta: The Inland Delta of the Niger Basin is a zone characterized by wide floodplain with a gentle slope, wide channels and the absence of tributary for over 300 km stretch with a total catchments area of about 80,000 km2. The rainfall ranges from 200 to 800mm and the evapotranspiration rate is about 2200 mm/yr. The gauge station at Dire in Mali, which is used to represent the hydrology of the area, was established in 1924. A maximum discharge of 2710 m3/s was recorded in 1967 at this station and a minimum of 4.0 m3/s in 1979.

c) The Middle Niger: This covers Mali, Burkina Faso, Niger and Benin with a surface area of about 530,000 sq km. The annual cumulative rainfall ranges from 200 mm in North to 700 mm in the South. Niamey in the Republic of Niger is the representative station with a gauge station established in 1928. The maximum discharge of 2360 m3/s recorded in 1968 and a minimum of 0 in 1985 with the flow pattern shown.

d) The Lower Niger: The Lower Niger covers Nigeria, Chad and Cameroun with a total surface area of about 650,000 sq km and rainfall ranging between 700 mm in the North to 3000 mm in the South. The river Niger flows into the lower Niger in Nigeria through Jidere Bode into the Kainji and Jebba dams in Nigeria. Other dams in the Lower Niger are the Shiroro dam along the river Kaduna in Nigeria and Lagdo along the river Benue in Cameroun. Lokoja in Nigeria is the representative hydrological station that was established in 1915. The maximum flows ever recorded was 26,000 m3/s and was in 1956 and the minimum flow was 599 m3/s recorded in 1981. The river Benue which is the biggest tributary joined the river Niger at Lokoja in Nigeria. It supplies the highest flow of short duration.

5. The major dams along the river are the Sélingue dam in the Upper Niger in Mali, the Kainji, Jebba and Shiroro dams in the Lower Niger basin in Nigeria and the Lagdo dam also in the Lower Niger basin in Cameroun.

6. Other challenges facing the river Niger basin are:

i) Rainfall Decreasing Southwards: There is a distinct shift of rainfall from the North to the South. The Isohyetal map of the area indicates the line of 200 mm in 1950-1967 shifted southward at a distance of about 100 km range between 1968-1995 .

ii) Increase in Evapotranspiration Rate: The Evapotranspiration rate in the Niger basin is between 1800 mm and 2200 mm/year and the temperature is sometimes above 50℃ in the north.

iii) Continued Reduction in Catchments Area of the River Niger: The continued high temperature and evapotranspiration rate as well as reduced rainfall and impact of climate change are turning the perennial river into seasonal and reducing the basin catchment's area.

iv) Excessive River Siltation: Strong wind occurrence coupled with poor agricultural practices resulted into soil erosion thereby causing excessive siltation of river bed and increasing river meandering and flooding.

v) Ground water Depletion: The low flow of the river is also affecting the groundwater recharge.

vi) Socio-economy: Socio economic development is grossly affected as a result of displacement of people from one place to the other due to inadequate water and problems of increasing aquatic weed causing reduction fisheries production etc.

vii) Inadequate Flow Forecasting Models: The lack of adequate hydrological model for flow forecasting is also affecting the water management of the river Niger basin.

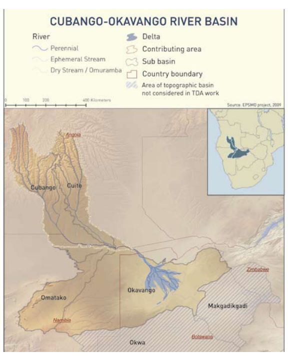
7. Conclusion: Unless adequate capacity building, hydrological data collection and flow forecasting models are sustained and reinforced, the Africa Water Vision 2025 will continue to face serious challenges posed by the impact of climate change.

Background and overview of the Cubango - Okavango River basin

1. Geographical setting

The Cubango-Okavango River rises in the headwaters of the Cuito and Cubango Rivers in the highland plateau of Angola. The topographic extent of the Cubango-Okavango Basin comprises approximately 700,000 km^2, but derives its principal flow from 120,000 km^2 of sub-humid and semi-arid rangeland in the Cuando Cubango Province of Angola. The basin is drained by the Cubango (referred to as the Kavango River in Namibia and Okavango River in Botswana), Cutato, Cuchi, Cuelei, Cuebe, Cueio, Cuatir, Luassinga, Longa, Cuiriri and Cuito Rivers and the Okavango Delta (Figure 1).

The contributing area of the basin responsible for perennial surface water flow is much smaller than the topographic extent of the basin. In Namibia and Botswana only a part of the basin's population is directly dependent on surface water resources, while other parts rely on groundwater resources. The Cubango-Okavango River basin is internationally important for its biodiversity and biological productivity (Figure 2).

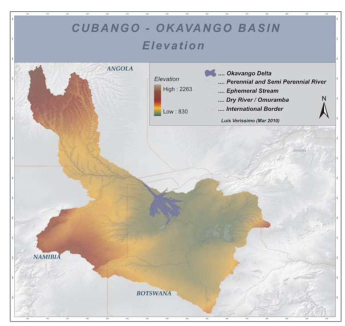


2. Topography

The headwaters of the Cubango-Okavango River are located on the central highlands of Angola between Huambo and Cuito, at an altitude of 1,700–1,800 metres above sea level, dropping to just over 900 metres above sea level in the delta. The elevation map of the basin (Figure 3.1), illustrates the key topographical features.

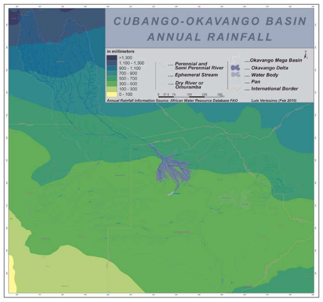
Catchment zones and river morphology
The Cubango-Okavango River system[3] can be divided into several morphologically distinct zones. These are:

- **The Angolan headwaters** – the Cubango and Cuito catchments
- **The middle reaches** – the lower Cuito and Cubango Rivers, as well as the Kavango upstream of the panhandle
- **The panhandle** – formed by two parallel faults, where the river gradually transforms into swamp
- **The delta** – the Okavango Delta, comprising both permanent and seasonal swamp areas.



3. Climate

The Cubango-Okavango Basin lies within the 12–21° southern latitude, which is characterized by rainfall in one distinct season, October to May. The northern parts of the basin receive the highest rainfall during the December to January period, while the southern parts, such as Maun, have peak rainfall during January and February. Mean annual rainfall varies from about 1,300 mm/annum in the Huambo and Cuito areas in the headwaters of the basin, to 560 mm/annum at Rundu, 550 mm/annum at Mohembo, and 450 mm/annum at Maun (Figure 3). The rainfall is highly variable: there is a tendency for high rainfall years to group for a period; this is then followed by below average rainfall years. Years with extremely low rainfall occur frequently, particularly in the southern parts of the basin.



4. Population

The human population in the basin consists predominantly of rural communities, most of which are located either adjacent to the river or along access routes. In each country, the basin populations are remote from the capital cities and main centres of economic activity. Table 1 shows the demographic characteristics of the three countries and Table 2 indicates more specific details for the Cubango-Okavango River basin.

Table 1: Comparative demographic characteristics of Angola, Botswana and Namibia

National values	Angola	Botswana	Namibia
Population	16,752,000	1,842,000	2,089,000
Population density (people/square km)	13	3	3
Birth rate (number of births per 1,000 people)	47	24	25
Death rate (number of deaths per 1,000 people)	21	14	15
Rate of natural increase (% per annum)	2.7%	0.9%	1.0%
Infant mortality rate (deaths per 1,000 live births)	132	44	47
Total fertility rate (number of children per woman)	6.8	2.9	3.6
Proportion of population aged less than 15	46%	38	41%
Urbanization rate (% of population)	57%	57%	35%
Rate of change of urban population (2005-2010)	4.4%	2.5%	2.9%
Gross National Income (per capita, US$)	$4,400	$12,420	$5,120

Note: *2008 unless otherwise stated*
Sources: The national level data was extracted from several websites, including UNHDR Human Development Reports (http://hdr.undp.org), World Bank Key Development Data & Statistics (http://web.worldbank.org), and Population Reference Bureau (PRB) (http://www.prb.org). For Angola the national level data was extracted from documents produced by the Ministry of Planning, the National Statistics Institute (INE), the National Directorate for Studies and Planning (DNEP) under the Ministry of Planning, and the United Nations Department of Economic and Social Affairs/Population Division.

Table 2: Okavango River Basin, specific values

	Angola	Botswana	Namibia
Basin population (estimated)	505,000	157,690	219,090
Basin population as proportion of national total	3.0%	8.6%	10.5%
Basin households (number)	126,250	33,550	35,120
Basin household size (people)	4.0	4.7	6.2
Urbanization rate in basin (% of population)	48%	30%	20%
Basin rural population (people)	262 600	110,630	175,270

Sources: The national level data was extracted from several websites, including the United National Human Development Report (UNHDR) (http://hdr.undp.org), World Bank Key Development Data & Statistics (http://web.worldbank.org), and the Population Reference Bureau (PRB) (http://www.prb.org)

5. Economy – macro-economic overview and trends

Angola has the largest economy of the three basin countries, eight times as large as that of Botswana or Namibia. The Angolan economy is also growing at a much faster rate (almost 20 percent in 2007) than the other two economies, which are growing at about 5 percent per annum. To a great extent this reflects the rapid economic gains Angola is making after two decades of internal strife. The increase in the price of oil has also been fortuitous, as Angola is now the leading oil exporting country in Africa. Meanwhile Botswana and Namibia, while growing more slowly, have had decades of steady but significant growth. Botswana's GDP per capita at US$5,739 is by far the largest, with Angola's at US$3,068 and Namibia's US$3,573.

6. Countries in the basin – national perspectives

Angola

The dominant feature of Angola's economy is the extractive sector, particularly oil and gas, which accounts for over half of GDP. The combined resources sector – agriculture, hunting, forestry and fisheries – are the third most prominent, making up 7.8 percent of GDP or US$3.8 billion in 2006. Despite their relatively small participation in GDP, the combined resources sector employs a large share of the workers in the country; by some estimates up to 85 percent. In addition, a large percentage of this activity is of a subsistence nature. Just 10 percent of agricultural land is being used on a commercial basis. Despite this high level of activity in the agricultural sector, the country recently became a net importer of foodstuffs. Angola with its five main perennial drainage areas of radial configuration topographically operates as a main water distributor gravitating from the Huambo central plateau. From the three countries sharing the Okavango, Angola is the least impacted on surface water scarcity.

Botswana

Botswana, like Angola, is heavily reliant on extractive industries for its economic well-being. Diamond mining brings in 40 percent of GDP. Manufacturing is limited to just 3.7 percent of GDP. Given the climate, agriculture is limited, making only a 1.6 percent contribution to GDP, the lowest of the three countries. As a consequence, services – government, banking, trade, transport, tourism, utilities and social services – make up a large portion of the remainder of the economy. Tourism plays a modest role in the country's economy providing almost US$200 million (2.16 percent), a large share of which comes from the Cubango-Okavango. Water and electricity are also responsible for US$200 million (2.16 percent) in value added. The higher level of development in the country compared to its neighbours is revealed by the higher level of spending on these basic services, at US$100/annum per capita. Water resources issues are dominated by limited perennial river systems and high dependence on ground water.

Namibia

Namibia has the most diversified economy of the three countries. Trade, transport, manufacturing and mining all contribute around 10 percent of the GDP. Agriculture and forestry contribute 6.6 percent or US$491 million. Farming itself is fairly limited owing to climate and soils, but large areas in communal conservancies or private lands are devoted to livestock and game ranching/wildlife. Tourism is also a significant factor in the economy, earning 2 percent or US$139 million. A portion of this tourism comes from the Cubango-Okavango region, although the bulk of it is associated with Etosha National Park, the coast and the dunes. Water and electricity contribute an additional US$99 million, or on average US$50/annum per capita. Similar to Botswana, Namibia also experiences limited availability of perennial systems making the country highly dependent on ground water.

VOLTA BASIN AUTHORITY (VBA)

(www.abv-volta.org)

The Volta River Basin is spread over parts of six West African countries (**Benin, Burkina Faso, Cote d'Ivoire, Ghana, Mali and Togo**). The basin covers an estimated area of 400,000 km^2 and the river flows for a total distance of 1,850 km.

The basin area in the six countries varies. It ranges from 2.48% in Cote d'Ivoire to 42.9% in Burkina Faso. On the other hand, while the Volta basin covers 70.1% of the land area of Ghana and 62.4% of Burkina Faso, it dwindles to 1.0 % in Mali.

Table 1 Proportions of Volta Basin

Country	Area of Basin (km^2)	% of Basin Area	% of Country Area	% Population
Bénin	13,590	3.41	12.1	2.56
Burkina Faso	171,105	42.9	62.4	47.6
Côte d'Ivoire	9,890	2.48	3.1	2.13
Ghana	165,830	41.6	70.1	35.8
Mali	12,430	3.12	1.0	3.35
Togo	25,545	6.41	45.0	8.55
Total	398,390	100		100

Source: Volta HYCOS, 2003

The major sub-basins are the Black Volta, White Volta, Oti River and the Lower Volta. Although the Oti or Pendjari sub-basin accounts for only about 18% of the total basin area (Table 1), it contributes about 26% of the annual flow into the Volta Lake. This is because its catchment is the most hilly and mountainous (>900 m) in the whole Volta basin.

Characteristics of Major Sub-Basins

Sub-basin	Area (km^2)	Mean Flow(m^3/s)	% Contribution
White Volta	104,749	220	20
Black Volta	149,015	200	18
Oti	72,778	280	26
Other tributaries			36

(Source:Volta River Authority, 2010

Groundwater potential varies over the basin. Overall, data on the occurrence of groundwater in the Volta basin is inadequate since there is no systematic monitoring of groundwater. The need to undertake location specific studies to support resource exploitation cannot be overemphasised.

The climate of the Volta Basin is characterized by great variability in rainfall distribution as a result of spatial variability, with a south-north gradient of increasing aridity and medium-term variability, with alternating dry and wet periods. There is also strong spatial and short-term variability within a given rainy season. Annual rainfall in the basin varies from about 500 mm in the upper parts of the basin in Mali and northern Burkina Faso to more than 1,100 mm in southern Ghana.

The major consumptive water uses in the Volta basin are domestic, crop irrigation and livestock production. Hydropower generation is the major non-consumptive use followed by fisheries while recreation and tourism are growing in importance. The water demand for domestic and industrial activities is projected to increase due to rapid population increases and industrial expansion with even higher increases expected for irrigation as more food needs to be produced for the expanding population and rain-fed agriculture becomes less reliable due to climate change. Thus increases in total water demand of more than 1000% are projected between 2000 and 2025.

In the last fifty years, several large dams have been constructed in the Volta basin with the primary purpose of generating electricity but also to meet the increasing needs of the growing population and of agriculture and industries. In addition to the major dams at Akosombo, Kpong, Kompienga and Bagre, there are two new dams currently under construction in Burkina Faso and Ghana mainly for hydropower generation at Samandeni and Bui respectively. The two dams are both located in the Black Volta basin. Other dams in the basin include Ziga and Lery for water supply and irrigation respectively in Burkina Faso and several small dams in Togo, Benin and Côte d'Ivoire. In Ghana, the Tono, Bontanga and Vea dams located in the Volta basin are used mainly for irrigation purposes.

There are many small reservoirs in the basin located especially in Burkina Faso but also in the northern part of Ghana. These serve multiple purpose uses, including dry season farming, livestock watering, fishery and domestic water requirements.

In all the riparian countries, there are plans to construct more dams in the Volta basin. Further expansion of small reservoirs in the northern part of the basin is also expected in the future.

In spite of its socio-economic importance, development of rivers for hydropower and other uses in Africa, just as in other areas of the world, has also come at a high cost in terms of riverine communities and ecosystems. Water storage behind dams disrupts the natural variability in the flows that sustain floodplain agriculture, fishery production, groundwater replenishment and stabilization of beaches. This is quite evident in the Volta basin where traditional food production systems are quite dependent upon the annual replenishment of waters and nutrients to the floodplains, wetlands, estuaries and deltas. Small reservoirs also contribute to the spread of some water related diseases in the basin including malaria and guinea worm infections.

Climate change is a major challenge to sustainable development in Africa. Although the continent contributes less than 4% of total greenhouse gas emissions, its countries are among the most vulnerable to climate change, which derives from multiple stresses coupled with low adaptive capacity. West Africa is among one of the most vulnerable regions to climate change because some of its physical and socio-economic characteristics predispose it in such a way as to be disproportionately affected. Such characteristics include the highly visible contrast between wetlands and arid zones and continuing poverty. Within the Volta basin, several studies such as those of GLOWA (www.glowa.volta.de) and the Challenge Program for Water and Food (www.waterandfood.org) have predicted negative impacts including increasing temperatures, reduced rainfall and decreased availability of water resources, water quality deterioration, loss of biodiversity and spread of some water-related diseases. With water resources already stressed by non-climatic factors such as rapid population growth and development, pollution and deforestation, the impacts of climate change will further aggravate the situation. These impacts will also lead to negative socio-economic consequences, which if unmitigated, will tighten the poverty and disease cycle and bring further hardship to the population of the basin.

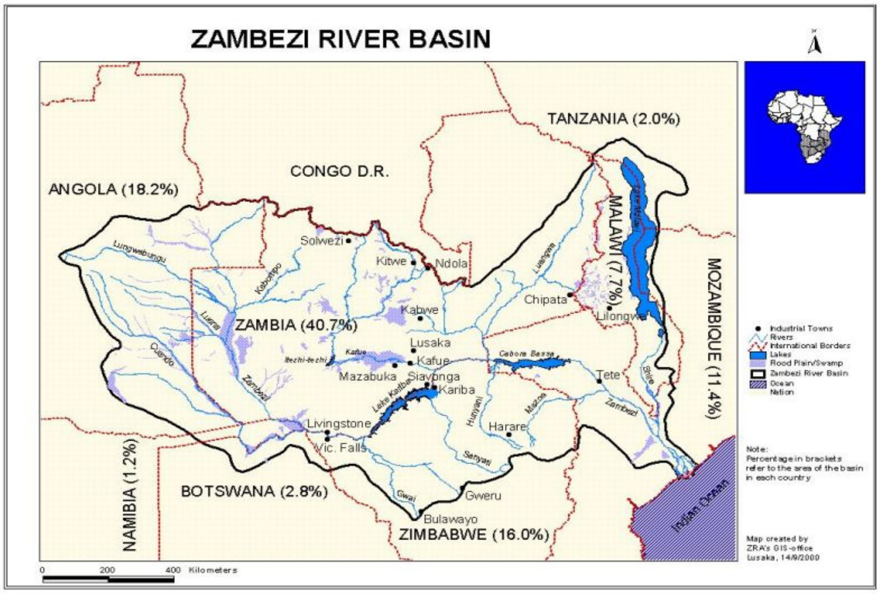
THE ZAMBEZI BASIN

BACKGROUND AND OVERVIEW OF THE BASIN

Location, Topography and Geology

The Zambezi River Basin is located between 9-20^0 south and 18-36^0 East in Southern Africa. The Zambezi Basin is the fourth largest river basin of Africa, after the Congo, Nile and Niger Basins. Its total area represents about 4.5% of the area of the continent and spreads over eight countries i.e Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia and Zimbabwe. (See Figure 1).

Figure 1. Map of the Zambezi Basin



The area of the basin is 1 390 000 km^2, slightly less than half of that of the Nile. The 3 540 kilometre long river has its source in North-western, Zambia. Most of the basin is high plateau land of the ancient Gondwana Continent, with elevations varying between 800 and 1 450m above sea level, the most extensive areas being between 1000 and 1300m above sea level. Only very small portions of the basin are below 100m or above 1500m. These elevation differences contribute significantly to the high hydropower potential of the basin.

Water Resources

The basin receives a mean annual rainfall of about 950mm, most of which is concentrated in the austral summer period (October – April). The north of the Zambezi Basin has a mean annual rainfall of 1100 to 14000 mm which declines towards the south, reaching about half that figure in the south-west. The rain falls in the rainy season when the Inter – Tropical Convergence Zone moves over the basin from the north between October and March. The north and east of the basin experience significantly more precipitation than the south and west. The rainfall pattern is such that there are distinct wet and hot summer months and a dry and cooler period in the remainder of the year. Less than 10% of the mean annual rainfall in the basin flows through the Zambezi river in to the Indian Ocean. Evaporation rates are high (1600mm -2300 mm) and much water is lost this way in swamps and flood plains, especially in the south west of the basin.

The Zambezi carries an average run-off of about 103 km^3/ year. There are significant variations and uneven distribution in the available water resources from one sub-basin to another and over time. The major contributors to the runoff are the sub-basins in the upper part of the Zambezi, as well as the Kafue, Luangwa and Shire sub-basins; the large Cuando/Chobe Basin in contrast contribute only very little.

There are three major lakes in the basin: Lake Malawi/Nyasa/Niassa, Lake Kariba and Lake Cahora Bassa. The latter two are reservoirs created by the construction of dams on the Zambezi River.

Demographic Features
The population of the basin is estimated at 30 million people of which approximately 7.5 million live in the urban centres. The population is expected to increase to 47 million by 2025 with urbanization steadily increasing. The proportion of rural population varies from around 50% in Zambia to around 85% in Malawi. This split has a bearing on water demand since domestic water consumption in rural areas is relatively smaller than in the urban areas.

Water Use in the Basin
Around 20% of the basin runoff is used. However the high degree of seasonal and spatial variability in available water resources, some areas in the basin have much higher water demand relative to the available water resources. Table 1 below shows the current consumptive water use and run-off.

Table 1. Current consumptive water use and run-off in the Zambezi basin.

	Mm^3	**%**
Available run off	102 224	100
Rural domestic consumption	24	0.02
Urban domestic consumption	175	0.17
Industrial consumption	25	0.02
Mining	120	0.12
Environmental/flood releases	1 202	1.16
Irrigated agriculture	1 478	1.43
Livestock	113	0.11
Hydropower (evaporation)	16 989	16.46
Total consumptive water use	**20 126**	**19.49**

Given the uneven distribution and temporal and spatial variability, and the possible effect of climate change, a number of areas (or countries) would experience water stress and/or scarcities. Other areas of concern in the basin are point pollution around large urban, manufacturing and mining centres, the spread of aquatic weeds and wetland degradation.

Hydropower
A total capacity of 4 684 MW (about 10% of the total potential) has been developed in the basin of which 75% is on the Zambezi River itself, producing an average of almost 33 000 GWh per year. Although hydropower generation does not consume water, the associated evaporation from the hydropower generation reserves has been estimated at approximately $17km^3$ and is by far the largest water use in the basin. The evaporation is dominated by Kariba, which accounts for more than half of the total evaporation, and Cahora Bassa, which accounts for close to 35%. Development of irrigation and other forms of consumptive water use would theoretically reduce the generation of hydropower downstream. Figure 2 shows the existing and planned hydropower projects on the common Zambezi River.

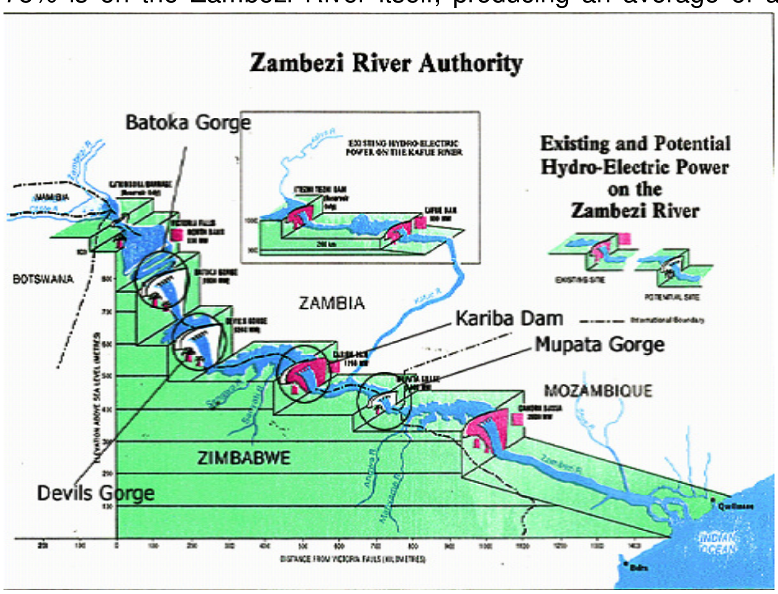


Figure 2. Existing and Planned Hydro Power Projects on the Common Zambezi River (Source: Zambezi River Authority: http://www.zaraho.org.zm)

Présentation of the transboundary basin of the Senegal River in the session of GEO-UNESCO joint workshop – Nairobi, january 12 – 16 2012.

1. **Background and Overview of the Basin and Water Resource Issues**
   a. **Location**:an ovoid shape between latitudes10 ° 20 'and 17 ° N and,longitudes7 ° and 12 ° 20' W (*see SDAGE phase 1, December 2009*).
   b. **Area**:300.000 km^2 (*see ADT, June 2007*).
   c. **Climate**:3 main climatic zones: Guinea zone in the south, Sahelian zone in thenorth and Sudanian zone in the center.
   d. **Topography**: mountainous terrain in Guinea, highlands in Mali and alluvial plains in Senegal and Mauritania dam. Altitude ranging from 1500 m (Fouta Djallon) to -0.53 m in St. Louis.Ferralitic, hydromorphic and alluvial Soils(*see ADT, June 2007*).
   e. **Economic activity:** Agriculture (76% of basin population (*see Socio Economic Report of the basin, 2009*)), livestock, fisheries, handicrafts, trade (wood, grain, meat, fish products) and transport.
   f. **Population**:10.6 million people in the basin of which 4 million live near the river (*seeSocioEconomicReportof the basin,2009*).
   g. **Countries in the basin**: Guinea, Mali, Mauritania and Senegal.
   h. **Water use in the basin**: Production of electricity (800 GWh / year (*see ADT, June 2007*)), Transportation (SITRAM), Agricultural Development and Irrigation (375 000 ha (*see ADT, June 2007*)), recession agriculture, greenhouse crops, Water Supply drinking, fishing, livestock (watering) and preservation of wetlands.
   i. **Water issues**:preservation and availability of water in quality and quantity for all uses (agriculture, water supply, etc.),on account of different demographic and environmental pressures (climate change, soil degradation, etc.) on the water resources of the basin.

2. **The Current Use of Data in Decision Making in the Basin**
   a. **What are the different water-related decisions made on an annual basis in the basin?**
   Decisions are made on a seasonal basis (off-hot season, rainy season and off-cold season) to the needs / resources (producible).They are expressed by the populations of the basin beforeeach season.Their relevance depends on the expressed needs and available water resources in the basin.
   b. **What data and models are used in making these decisions?**
      - ***Legal texts of the OMVS***: All texts andconventionsgoverningthe institution and itsvarious agenciessuch asSOGED, SOGENAVand SOGEM.
      - ***Water Data***: Hydraccess(daily monitoring),Dashboard (monitored quarterly, semi-annualand annual)and Standing Committeeof Water(decision-making instrument forwater managementaccording todifferent needs).
      - ***Environmental data***:SOE-FSEN (decisionsupportTool), TransboundaryDiagnosticAnalysis(assessment of the basin environment), Strategic Action Plan(Priority actions in the basin) and Monitoringofthe basinEnvironment(decisionsupport Tool).
      - ***Energy data***: Simulsen(strategic management of the water reservoirof Manantali dam).
      - ***Spatial data***: GIS–progressive mappingof thebasin.
      - ***Socio-Economic data***:Access database.
      - ***Health data***: health monitoring system(data collectionfromclosethe Member States).
      - ***Costsand expensesdata***: CAMmodel(Cost-Allocation-Model).
      - ***Master Plan for the Development andManagement (DMPWM) of the Senegal River BasinWaters***: planning tools.
      - ***Global/comprehensivetool***: visualizing andsynthetizing dataproduced byother tools.
      - ***Basin WaterCharter***: set the principlesforwater managementin the basin.
      - ***Model rainfall/flow***: Forecast volume of waterdrained by theriver.
   c. **Are any difficulties encountered in using these data and models (e.g. data access, data completeness, data accuracy, coverage of observations, etc.)?**
   Deficiencies in data collection,financial and technical difficulties of the partner services of member state.

d. **How does your basin cope with data needs and services for special events such as floods and droughts?**
Emergency warning Plan against floods and droughts (great disaster), data collection missions on the fields where the events have occurred; daily collection of hydrological data (SSB) and simulation of the flood wave (Corediam).

3. Basin Plans relevant to Sustainable Development and a Green Economy (Rio +20)

a. **What are the greatest threats in this basin to ensuring water is sustainable for the future generations?**
Water quality (pollution risk), climate changes (chronic rainfall and water deficits), major ecological crisis, deforestation (220,000 ha / year (*see ADT, June 2007*)), overgrazing, silting, bush fires, loss of biodiversity ofanimal and plant and the proliferation of invasive aquatic plants (Typha (*see SAP, July 2008*)), increased prevalence of water borne diseases (*see NOT, July 2008*), etc.

b. **How water availability and water quality in this basin is likely to be affected by climate change, land uses change and population growth?**
Chronic rainfall and water deficits (reduced mean annual flow of 1374 m3 / s (1903) to 597 m^3 / s (2002) (*see ADT, June 2007*)) given the increasing needs for 2025 (4.5 billion m^3 / year for irrigated agriculture, 5 billion m3/year for agrosilvopastoral and fisheries, 83.6 million m3/year for livestock (*see SDAGE phase 2, March 2010*), 71.499 762 million m^3/year for the population of the basin (*see. SDAGE phase 1, December 2009*)), major ecological crisis, the expansion of cultivated areas and livestock, soil salinization.

c. **What steps are being taken by large population's centers in the basin to conserve water and energy?**
Space of OMVS- a Network of monitoring water quality in the Senegal River Basin is being built, such as the Senegal-HYCOS. Also, a piezometric network for monitoring groundwater has been built (pH, static level, conductivity, salinity, quantity).

d. **How are the needs for food security being addressed in the Basin?**
Regional Action Plan for the Improvement of irrigated crops (PARACI), development of irrigated areas and lowland(375,000 ha and about 80% of water withdrawals) (*see ADT, June 2007*) National policies (e.g.: GOANA in Senegal, rice Initiative in Mali, etc.). Promotion of irrigated agriculture, agroforestry, improvement of traditional fisheries, processing of agricultural products, diversification of production.

e. **What role will water play in developing renewable energy in the Basin?**
Important (priority of OMVS): Manantali and DIAMA dam (800 GWh / year) have been completed.Félou is in anadvanced phase of construction and Gouina, Gourbassi, Koukoutamba, Bureya, Balassa are being prepared (*see SAP, June 2008*).

f. **What steps are being taken to promote a green economy in this Basin?**
Public awareness raising and promotion of good agricultural practices by the development agencies, production of cheap energy, hydro-agricultural activitiesand enforcementmeasures against polluters

g. **What role are (or could) River Basin Authorities and other coordinating mechanisms and networks in the basin take to address sustainability issues?**
Decision-makingrelated to goodwater management(using decision makingand support tools). Any planned projectin the basinis subject tothe approval of theCPE, which is thedecision-making bodyof OMVSin the managementofthe Basin waters.

h. **How could GEO principles be applied to improve planning in the basin for a sustainable future?**
As part of an inter-basin organizations on the one hand and, on the other hand, with various experts in charge of all forms of water issues, the principles of GEO will help us strengthen our capabilities in terms of collecting, analyzing and interpreting data on water (nature, location, quantity and quality). Doing so will help cope with climate and environmental challenges but also meet the needs of local populations and ecosystems of the basin. This could be through the implementation of joint projects between GEO and OMVS. Therefore, we will benefit from GEO's experience and expertise.

Présentation du bassin fluvial transfrontalierdu fleuve Sénégal à la session de l'Atelier conjoint de GEO-UNESCO – Nairobi, les 12 – 16 janvier 2012.

1. Contexte et aperçu du bassin et des ressources en eau

a. **Localisation** : une forme ovoïde entre 10°20' et 17° de latitude Nord et 7° et 12°20' de longitude Ouest (*cf.SDAGE phase 1, déc. 2009*).

b. **Etendue** : 300.000 km^2(*cf. ADT, juin 2007*).

c. **Climat** : climat de type sub-guinéen au sud, sahélien au nord et soudanien au centre.

d. **Topographie** : relief montagneux en Guinée, hauts plateaux au Mali et plaines alluviales au Sénégal et en Mauritanie. Altitude variant de 1500m (au Fouta Djallon)à -0,53m à Saint Louis.Sols cuirassés, ferralitiques, hydromorphes et alluviaux (*cf. ADT, juin 2007*).

e. **Activités économiques** : Agriculture (76%de la population du bassin (*cf. Rapport étude socio économique du bassin, 2009*)), élevage, pêche, artisanat, commerce (bois, céréales, viandes, produits de pêches) et transport.

f. **Populations** : 10,6 millions d'habitants dans le bassin dont 4 millions vivent au près du fleuve (*cf. Rapport étude socio économique du bassin, 2009*).

g. **Pays/Etats riverains** : Guinée, Mali, Mauritanie et Sénégal.

h. **Usages de l'eau dans le Bassin** : Production hydroélectrique (800 GWh/an (*cf. ADT, juin 2007*)), Transport (SITRAM), Aménagement agricole et irrigation(375.000 ha(*cf. ADT, juin 2007*)), Agriculture de décrue,Culture sous serre, Approvisionnement en Eau Potable, Pêche, élevage (abreuvement) et maintient des zones humides.

i. **Enjeux de l'eau** :disponibilité de l'eau en qualité et en quantité pour tous les usages (agriculture, AEP,etc.). Ceci, compte tenu des différentes pressions démographiques et environnementales(changements climatiques, dégradations des sols, etc.) sur les ressources en eau du bassin.

2. L'utilisation actuelle des données dans la prise de décisions dans le bassin

a. **Quelles sont les différentes décisions, relatives à l'eau, prises sur une base annuelle dans le bassin ?**

Ce sont des décisions sur une base saisonnière (contre saison chaude, hivernage et contre saison froide)par rapport auxbesoins/ressources (productible). Elles sont exprimées par les populations du bassin à la veille de chaque saison. Leur pertinence dépend des besoins exprimés et des ressources en eau disponibles dans le bassin.

b. **Quelles sont les données et modèles utilisés dans la prise de ces décisions ?**

- ***Textes juridiques de l'OMVS*** : Ensemble des textes et conventions régissant l'institution et ses différentes sociétés telles la SOGED, SOGENAV et SOGEM.
- ***Données hydrologiques*** : Hydraccess (suivi journalier) ; Tableau de bord (suivi trimestriel, semestriel et annuel) et Commission Permanente des Eaux (instrument de décision pour la gestion de l'eau face aux différents besoins).
- ***Données environnementales*** : SOE-FSEN (outil d'aide à la décision) ; Analyse Diagnostic Transfrontalière (bilan de l'environnement du bassin), Plan d'Action Stratégiques (Actions prioritaires dans le bassin) et Observatoire de l'Environnement du bassin (outil d'aide à la décision).
- ***Données énergies*** : Simulsen (gestion stratégique de la retenue d'eau du barrage de Manantali).
- ***Données à références spatiale*** : SIG – cartographie évolutive du basin.
- ***Données socio-économiques*** : Access.
- ***Données sanitaires*** : Système de Veille sanitaires (collecte des données aux près des Etats membres).
- ***Données des coûts et charges*** : model CAM (Coast-Allocation-Model).
- ***Schéma Directeur d'Aménagement et de Gestion des Eaux (SDAGE) du bassin du fleuve Sénégal*** : outils de planification ;
- ***Outil global*** : visualisation et synthèse des données produites par les autres outils.
- ***Charte des eaux du Bassin*** : grands principes de gestion de l'eau dans le bassin.
- ***Modèle pluies/débits*** : Prévision du volume d'eau drainé par le fleuve.

c. **Quelles sont les difficultés rencontrées dans l'utilisation de ces données et modèles (par exemple l'accès aux données, l'exhaustivité des données, la précision des données, la prise en compte des observations, etc.) ?**

Insuffisances de la collecte des données (grèves des agents) et difficultés financières et techniques des services partenaires des Etats membres.

d. **How does your basin cope with data needs and services for special events such as floods and droughts?**
Emergency warning Plan against floods and droughts (great disaster), data collection missions on the fields where the events have occurred; daily collection of hydrological data (SSB) and simulation of the flood wave (Corediam).

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