

The Atlas on Regional Integration is an ECOWAS — SWAC/OECD initiative, financed by the development co-operation agencies of France, Switzerland and Luxembourg. Divided into four series (population, land, economy, environment), the Atlas chapters are being produced during 2006-2007 and will be available on-line on the site www.atlas-westafrica.org

1. A river basin or a hydrologic basin is part of inland territory where all surface water flows towards the same outlet (watercourse or lake). The line separating two river basins is known as "the water divide".

TRANSBOUNDARY RIVER BASINS

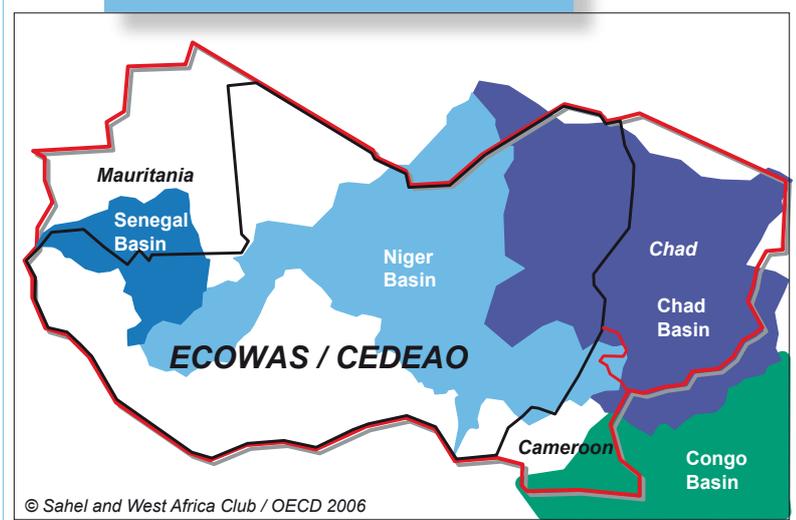
Introduction

The topic of transboundary waters clearly illustrates the necessity to address West Africa beyond the limits of regional integration organisations. The three largest river basins¹ of the Economic Community of West African States (ECOWAS), the Niger, the Lake Chad and the Senegal, map out a geographical situation in which Mauritania, Chad and Cameroon stand together with institutional West Africa. However, this de facto regional solidarity is not exclusive as southeast Cameroon depends on the immense Congo Basin that irrigates Central Africa (see Map 1).

Hence, the term "West Africa" here refers to the region covering the Economic Community of West African States, Cameroon, Chad and Mauritania. These 18 countries cover an area of 7,800,000 km² and had a total population of 290 million inhabitants in 2005.

For various reasons and at various levels, West African countries are dependent on one another. Over the past few decades, this interdependence has not only generated tension, but has also led to a dialogue and cooperation process.

Map 1. West African River Basins



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An analysis of these regional cooperation processes is the main issue addressed in this chapter of the Atlas. It is by developing these processes that the region will be better prepared for the future in which many people believe water will be one of the major stakes.

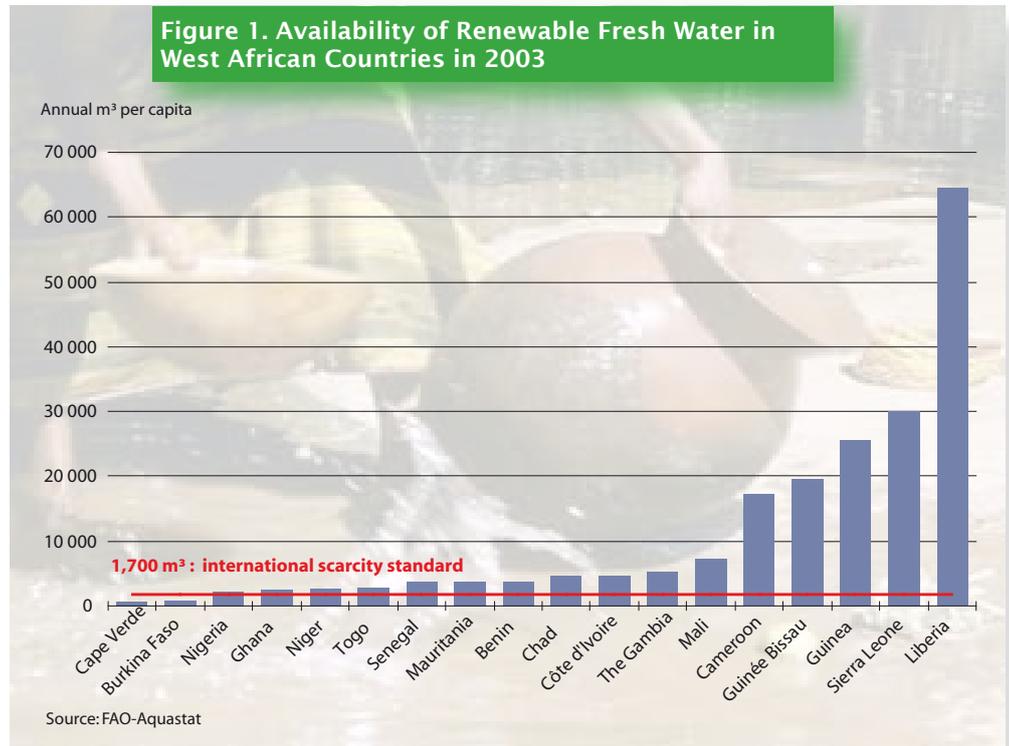
World consumption of fresh water today is about 5,500 km³ per year (the equivalent of a cube 18 km long on each side); it was 4 times less a half century ago. Consumption increases more rapidly than population for three main reasons. On the one hand, agriculture alone accounts for nearly 60% of consumption and it is increasing steadily everywhere, including in most developing countries. On the global average, to produce one kilogram of wheat requires about 1,000 litres of water; one kilogram of meat requires 5 to 10 times more. On the other hand, industrial consumption also continues to increase rapidly. Lastly, human consumption (drinking water and sanitation) is increasing very rapidly as a result of the constant improvement of living conditions in the world.

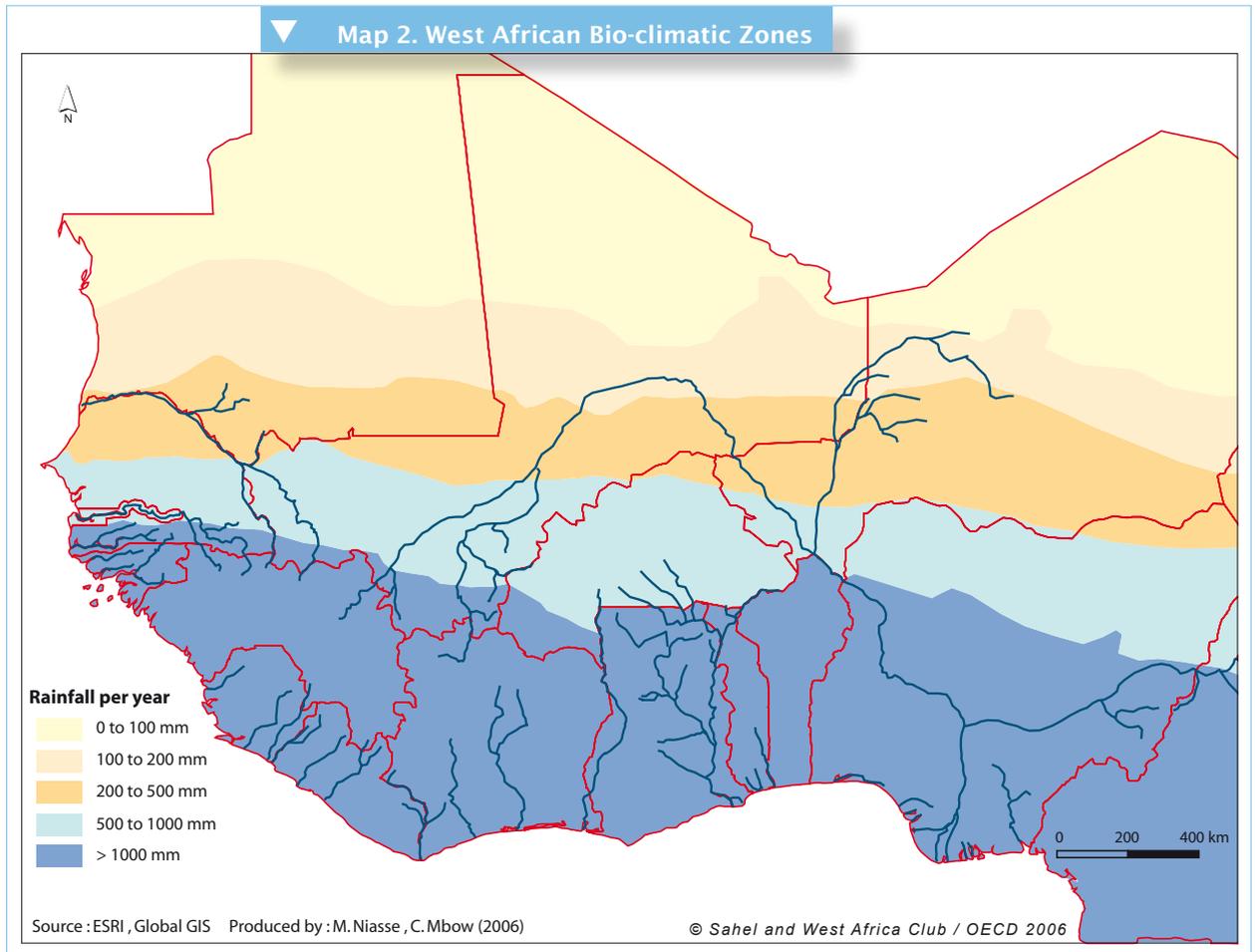
All experts agree that pressure on resources will be incomparably higher in 20 years than it is today. This will also be true in Africa, and West Africa in particular. The necessary and probable improvement of living conditions of the West African population, the progress towards the Millennium Development Goals, as well as agricultural growth and industrial development all imply a significant increase in water consumption.

I. Regional Water Resources & Interdependence

Contrary to popular belief, West African countries, including those of the Sahel, do not lack water. Only two countries (Cape Verde and Burkina Faso) are below the international standard for water scarcity (1,700 m³ of renewable fresh water per year per person); Cape Verde is below the scarcity level which is 1,000 m³ per year (see Figure 1). On the other hand, there are major problems in terms of availability at the desired time and place.

This problem of availability is mainly regional considering most of the water resources come from the transboundary river basins and aquifers.

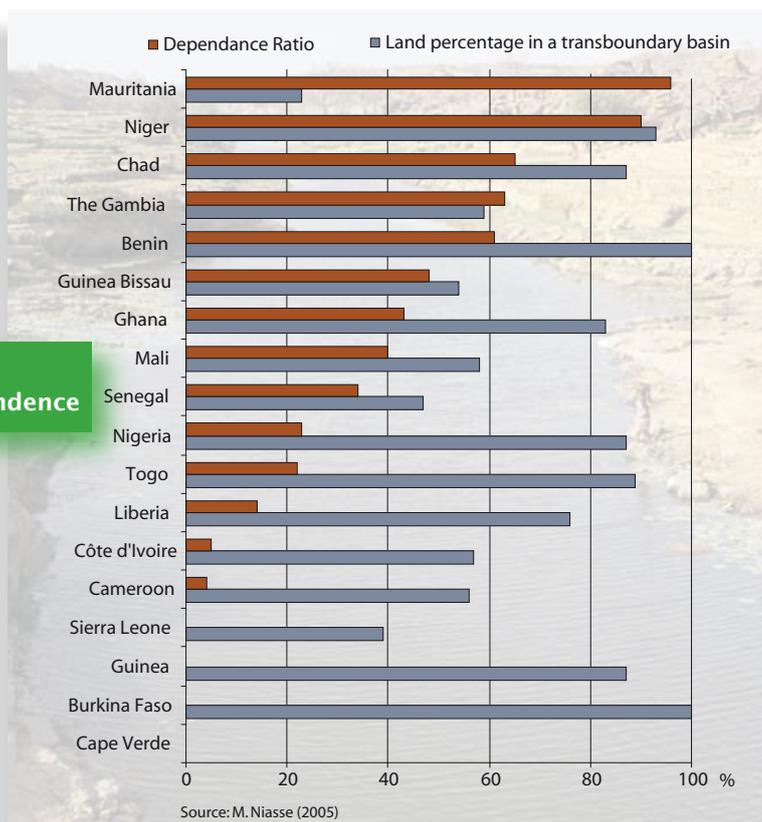




The main watercourses (The Niger, The Senegal, The Gambia, and the Lake Chad network) take their source in well-watered regions before

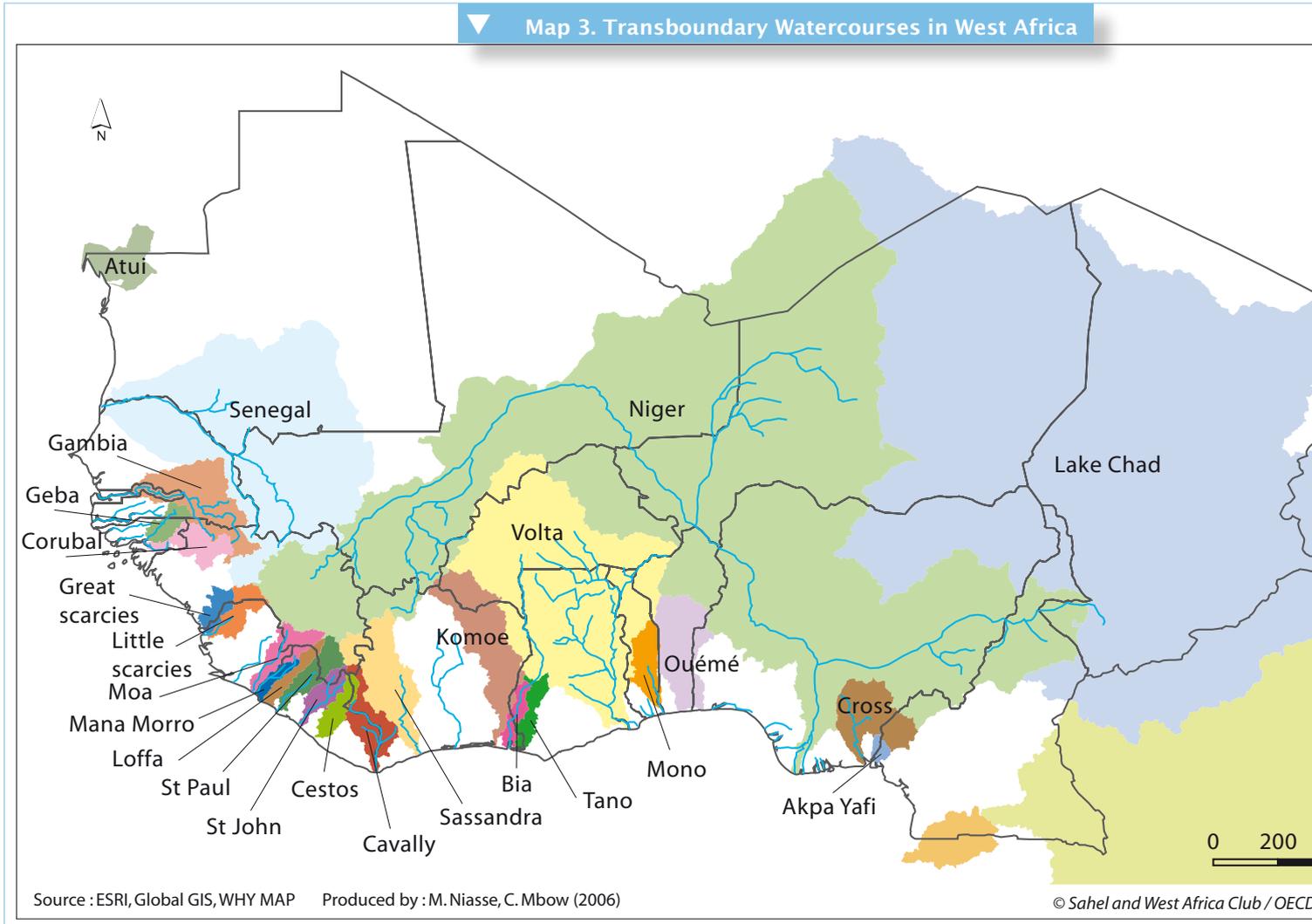
crossing the Sahel zones where there has been a chronic shortage of rainfall since the early 1970s. Reducing the marked contrasts between the wetlands and arid areas (see Map 2), these transfers still show the interdependence of West African countries for the use and management of fresh water resources.

Figure 2. River Basins: Interdependence and Dependence



West Africa has 28 transboundary river basins (see Map 3). The most important are the Niger River Basin (shared between 11 countries taking into account the non-active part of the basin), the Senegal River Basin (4 countries), the Volta River Basin (6 countries), the Lake Chad Basin (8 countries), and the Comoé River Basin (4 countries).

With the exception of Cape Verde, each West African country shares at least one watercourse with one of its neighbours. Fourteen transboundary basins are identified in Guinea where a large number of watercourses rise. There are eight in Côte d'Ivoire, seven in Cameroon and Liberia, and five in Nigeria and Sierra Leone. In all, the transboundary basins cover 71% of the total surface area of the region.



Therefore, many countries have very high dependency ratios; the dependency ratio being determined by the proportion of renewable water resources produced outside the borders of a given country (see Figure 2). However, there is no correlation between the dependency and the proportion of national territory covered by transboundary basins. With a dependency ratio close to 100%, only 20% of Mauritania's territory is covered by a transboundary basin. Contrarily, Burkina Faso "produces" all of its fresh water whereas 100 per cent of its territory is covered by transboundary basins.

The configuration of groundwater also portrays an important regional dimension. These resources are in the form of various types of water tables. On one hand, they are superficial water tables which are refilled, generally during the rainy season, and on the other hand, they are water

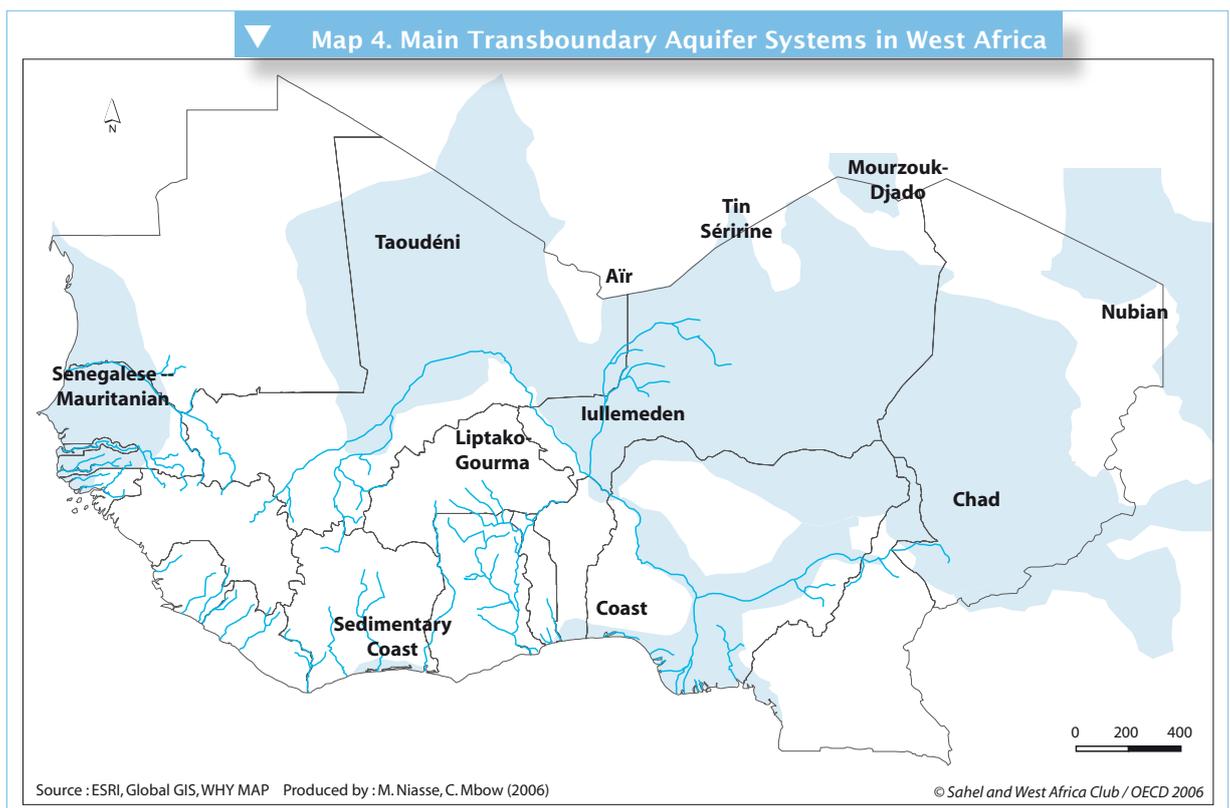
tables from an ancient base, and lastly they are deep water tables of sedimentary basins. There are considerable reserves of fresh water stored in these deep water tables: on a scale of approximately several thousand billions of m^3 . In theory, they alone could meet the current and future needs of West Africa. However, they are of variable depths, sometimes reaching one thousand to two thousand metres and are often non-renewable resources (fossil water). According to ongoing studies within the framework of the UNESCO-ISARM Initiative², there are eleven (11) sedimentary transboundary basins in West Africa (see Map 4).

2. Internationally Shared Aquifer Resources Management Project.
3. Global Water Partnership-West Africa. 2000. Water for the 21st century - From vision to Action for West Africa. GWP- West Africa. pp.17-19.
4. Source: <http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm>

II. Generally Under-Exploited Resources

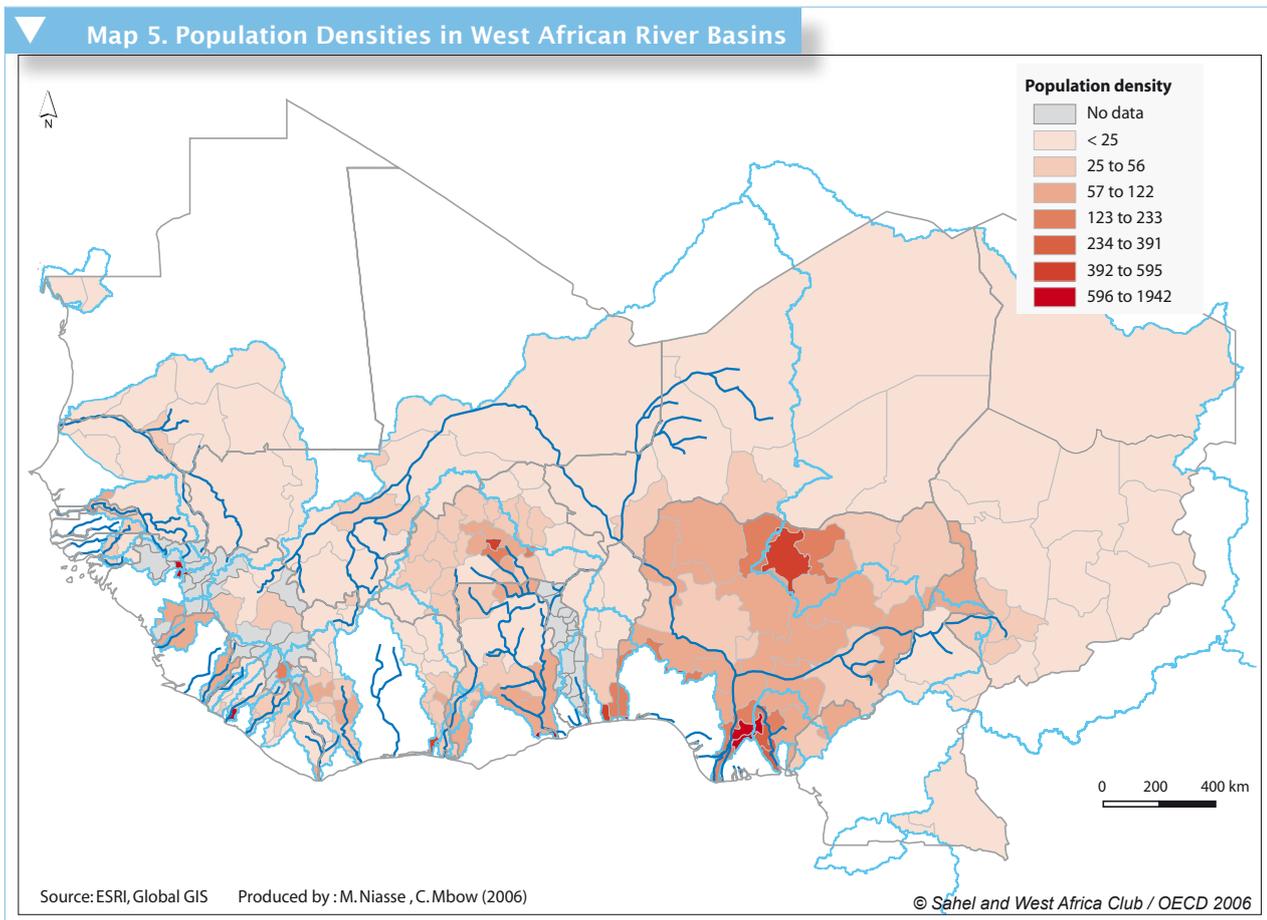
According to the Global Water Partnership³, the withdrawal level of renewable water resources in West Africa (excluding Cameroon and Chad) is currently at 11 billion m^3 per year for an available 1,300 billion m^3 , which is less than 1%. Agriculture uses 75% of these withdrawals, domestic consumption 17%, and industry 7%.

Although it is by far the highest in proportion, agricultural use of water resources is low. Out of the 75.5 million hectares of arable land in West Africa, only 1.2% (917,000 ha) is developed for irrigation, and 0.8% (635,000 ha) is used effectively⁴. The small number of dams also helps explain the lack of capitalisation of these resources. However, by storing fresh water during seasons and years of excess for when needed, dams are effective tools in combating uncertainties and shortages. They also help produce electric power, and reduce energy dependence on petroleum. However, building many of these infrastructures poses a number of problems.



The withdrawal level of fresh water resources is increasing very rapidly. It could increase six-fold between 2000 and 2025 if West Africa maintains its current level of access to drinking water and food security⁵; it would then increase from 11 billion to more than 65 billion m³ per year. Concurrently, the West African population would probably double. Water consumption could therefore increase three times more rapidly than the population. This differential is mainly due to probable changes in the distribution map of the West African population: continued urbanisation as well as increase in human population density in rural areas with good farming potential and proximity to large consumption centres. The population distribution in 2000 (see Map 5) already shows high concentration zones in some river basin areas: mouth of the Niger river in Nigeria, southwest of Lake Chad in Niger, mouth of the Ouémé river in Benin, mouth of the Volta river, and upstream of the Volta basin in Burkina Faso.

5. Source: Global Water Partnership - West Africa, 2000, op. cit.

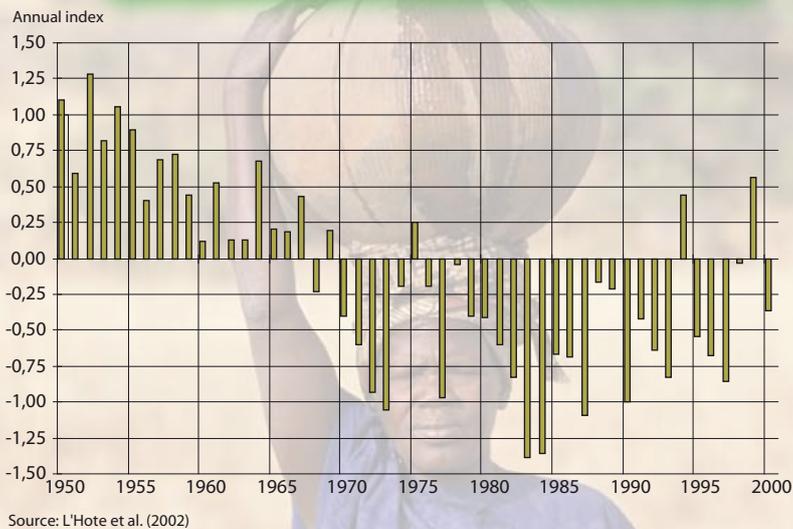


III. Diminishing Surface Water Resources

West Africa has, over the past few decades, experienced a sharp decline in rainfall and average annual flow of watercourses. A break in the rainfall pattern was observed around 1968-1972⁶. 1970 is considered as the turning point after which the decline in average rainfall worsened from minus 15% to minus 30% depending on the zone (see Figure 3). This situation led to the drifting of isohyets by about 200 km to the south. An accompanying variation in annual average flows was observed for most

6. See the chapter "The Ecologically Vulnerable Zone of Sahelian Countries" in the Atlas on Regional Integration in West Africa.

Figure 3. Trend of Rainfall in the Sahel (1950-2000)



of the rivers. In a number of cases, the decline in flows was even greater than that of rainfall; going down to minus 30% for the Senegal River⁷ and minus 60% for the Niger River⁸. During the extremely difficult years, there were exceptionally low water levels, to points where flows actually stopped, as was the case in 1983, 1984 and 1987 on the Bani tributary in Douna (Mali) or as in 1985 in Niamey on the Niger (see Figure 4).

Facing this hydroclimatic degradation, the construction of dams seems like a logical solution.

Today, there are fewer than 150 large dams in West Africa (see Map 6) out of a total of 1,300 on the continent⁹, and 45,000 in the world¹⁰. The

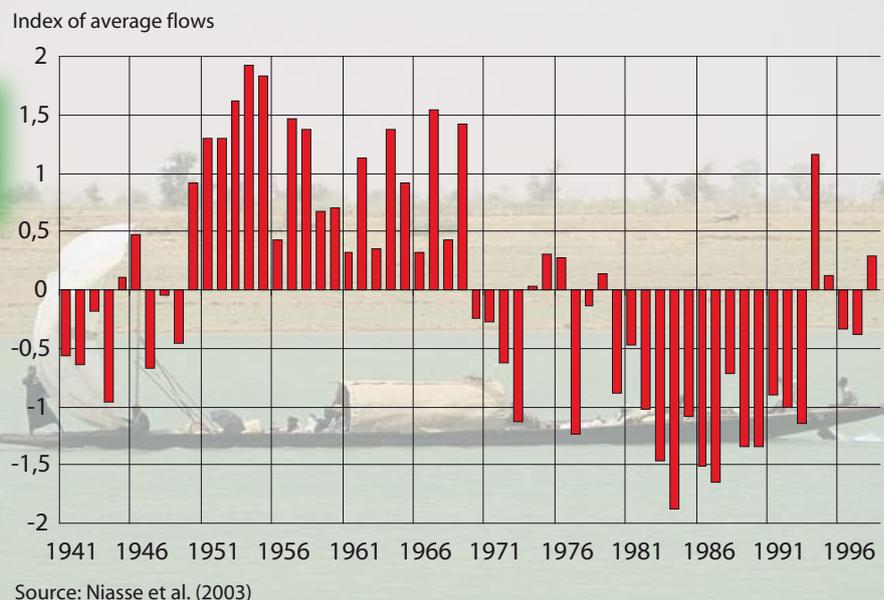
region has less than two (2) large dams per 100,000 km², as compared to 4.3 dams per 100,000 km² in Africa as a whole. For the same surface area, China has an average of 240 large dams, India 130, Japan 670, and the United States has 75¹¹.

Many projects are being initiated. On the Niger River alone, about twenty sites have been identified for large dams, and are at more or less advanced stages of planning. They include, in particular, Fomi and Kamarato in Guinea; Kénié, Tossaye and Labezanga in Mali; Dyodyonga and Gambou between Benin and Niger; Kandadji in Niger; and Lokoja, Makurdi and Onitsha in Nigeria.

In most cases, the projects are conceived only at the national level, whereas the “purpose” of the dam (the river) is essentially regional, and the construction of a structure has, by definition, consequences beyond the borders. It may, in particular, result in:

7. Servat et al., 1997.
8. Paturol et al., 1997.
9. In southern Africa (particularly in South Africa and Zimbabwe) we find 2/3 of the large dams constructed in Africa.
10. As defined by the International Commission on Large Dams (ICOLD) large dams are 15 metres or more in height or if the height is between 10 and 15 metres, having a reservoir capacity of more than 3 million cubic metres. Dams between 10 to 15 metres high with a crest length of more than 500 metres, or with a reservoir volume of more than 1 hm³ of water, or with a spillway of a capacity of more than 2,000 m³/s are also considered as large dams. (www.icold-cigb.org/chartefr.html).
11. According to statistics provided by the World Commission on Dams (WCD, 2000) and the Large Dams Register of the International World Commission on Large Dams.

Figure 4. Annual Flows of the Niger River in Niamey: Average Variation from 1950-2000



- an alteration of the water quality due to increased river fragmentation.
- a change in the hydrologic regime as a result of intra and inter-basin transfers.
- a disruption of fish migration along the river and between the river and the sea; the resulting alteration of fishery resources.
- the destruction of natural habitats and of reproduction areas for species such as water birds.
- the slowing down of flows; the change in sedimentary load of the water and of its temperature; the modification of the ecology of coastal and delta areas¹².

12. Ravenga et al, 2000; WCD, 2000.

IV. Water, Source of Tension

The increase in the number of large dam projects or other river developments, the high degree of interdependence of West African countries with respect to water, as well as the significant reduction of surface water availability creates fertile ground for misunderstandings and tensions between countries of the region. In most cases, problems are solved through dialogue. Here are a few recent examples.

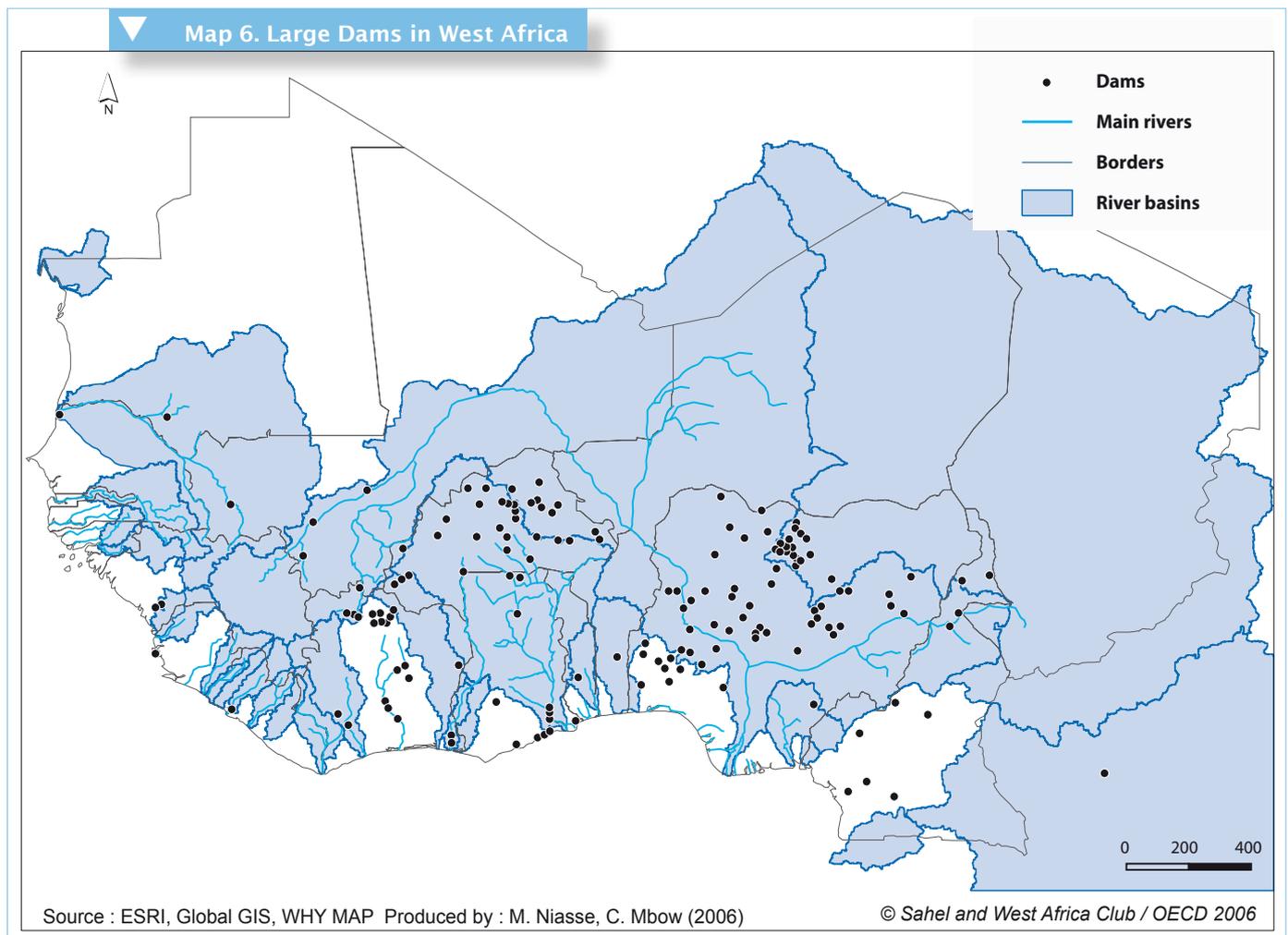
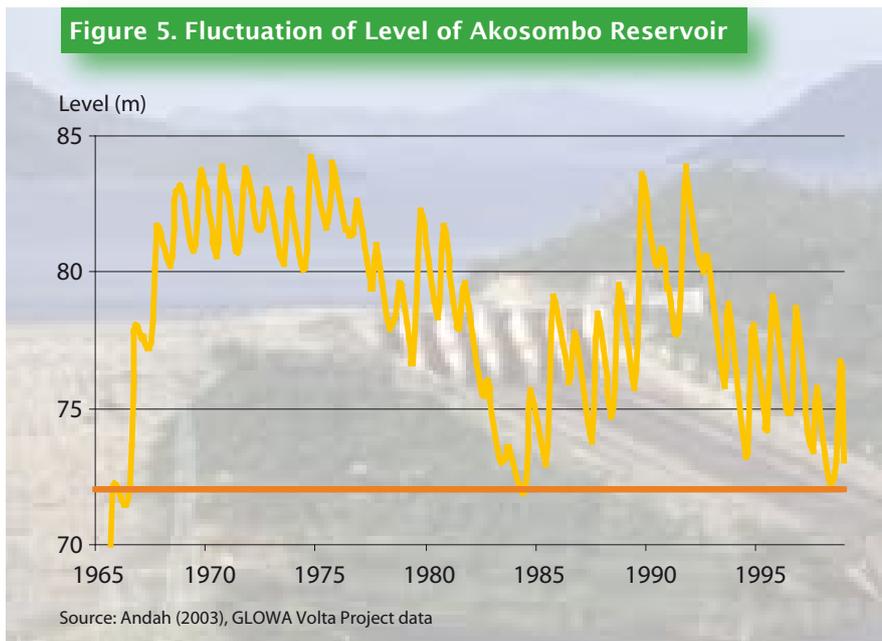


Figure 5. Fluctuation of Level of Akosombo Reservoir



Senegal – Mauritania. The Development of Fossil Valleys

In June 2000, the Government of Senegal developed a project for the revitalization of dry valleys in the north of Senegal. This project consisted in deviating part of the water from the Senegal River to a 3,000 km network of ancient watercourses in the Ferlo, Saloum, Sine, Baobolon, Car Car and Sandougou (centre-north of Senegal) valleys. The Government of Mauritania expressed fears with respect to the impact of water reductions. Following these reservations, the Government of Senegal announced a freeze on the project.

Burkina Faso – Ghana. More Dams less Electricity?

In 1998, the level of Lake Volta fell sharply and disrupted the operation of the Akosombo hydroelectric power station in Ghana. Some observers linked it to the increase in water withdrawals by Burkina Faso on upstream sections of the White Volta and the Black Volta; these two tributaries account for 56% of the water supply to Lake Volta in an average year. This assumption is supported by the fact that between the end of the 1960s and the mid 1990s, Burkina Faso developed 1,500 small dams, constructed 3 large dams, and increased irrigated areas from 2,000 ha to 25,000 ha in the Upper Volta Basin¹³. However, scientific analyses show that the total water storage capacity of all the small and large dams in Burkina Faso (including three large dams under construction) is only 1.5 billion m³, which represents less than 5% of the normal water volume of Lake Volta¹⁴. The most plausible explanation is therefore that the decline in the level of the lake was due more to climate change and variability (see Figure 4).

Benin – Niger. Border Uncertainties

Lété Island, on the Niger River, has always been a meeting place for nomad herdsmen from Niger, who settle there seasonally, and sedentary farmers from Benin. To which country does the island belong? As is often the case, several documents dating from the colonial period give contradictory indications. After many years of fruitless discussions, the two Governments referred the border dispute to the International Court of Justice. This desire for peaceful settlement is certainly linked to the prospects of joint development of the river. The two countries recently signed an agreement of cooperation for the construction of Dyodyonga dam on the Mékrou River (tributary of the Niger River). Another dam on the Niger River will be constructed in Gambou.

13. Source: www.glowa-volta.de/cd_v3.1/index.htm.

14. Andreini et al., 2000; van de Giesen, 2001.

Niger – Nigeria.

Upstream and Downstream

Nigeria has made enormous hydroagricultural and energy investments downstream of the Niger River (large dams in Kainji and Jebba: 1.6 million hectares of irrigated areas, developments for river transport, and water supply to towns). The country fears that the construction of dams upstream could reduce flows in the Nigerian part of the watercourse. The concern stems from the Kandadji dam in Niger and, to a lesser degree, the Tossaye dam in Mali. These two developments could, according to some estimates, reduce the annual volume of water received in Nigeria by more than 10%.

Furthermore, a high variability in average flows of the river has been observed in Nigeria in recent years (reductions of 20% to 50% in average flows). Fears based on climate change over the long term and on exploitation of the resource over the medium term seem to be intermingled.

Cameroon-Nigeria. The Migration of Lake Chad

The maximum flooded area of Lake Chad decreased from 37,000 km² in the early 1950s to 15,000 km² in the early 1990s. The flooded area for four (4) consecutive months decreased from 23,000 km² to 2,000 km² (see Figure 6). The populations have tended to follow the “migration of the lake” (see Map 7). In the mid 1990s, about thirty villages were created by Nigerian immigrants in the Cameroonian part of the lake¹⁵.

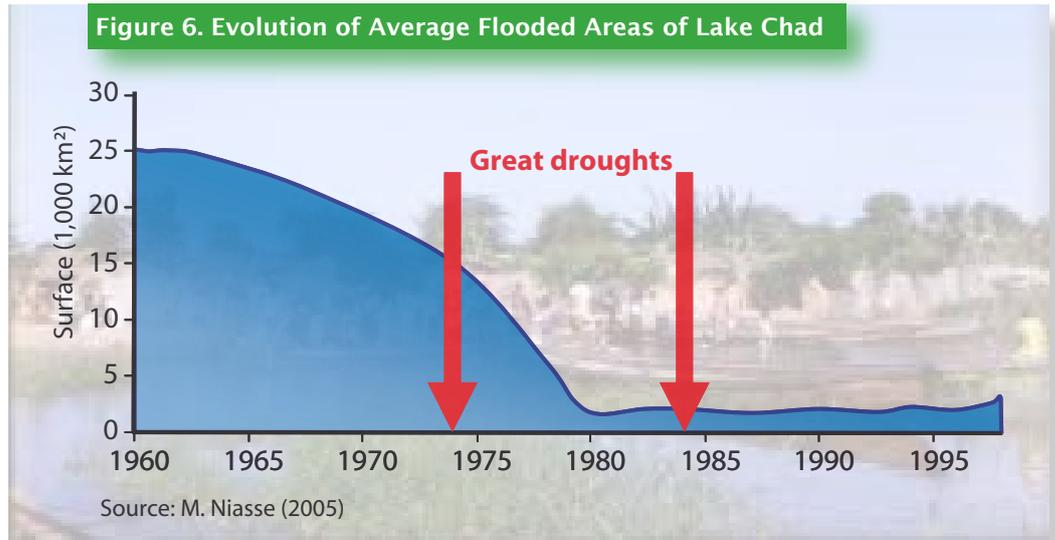
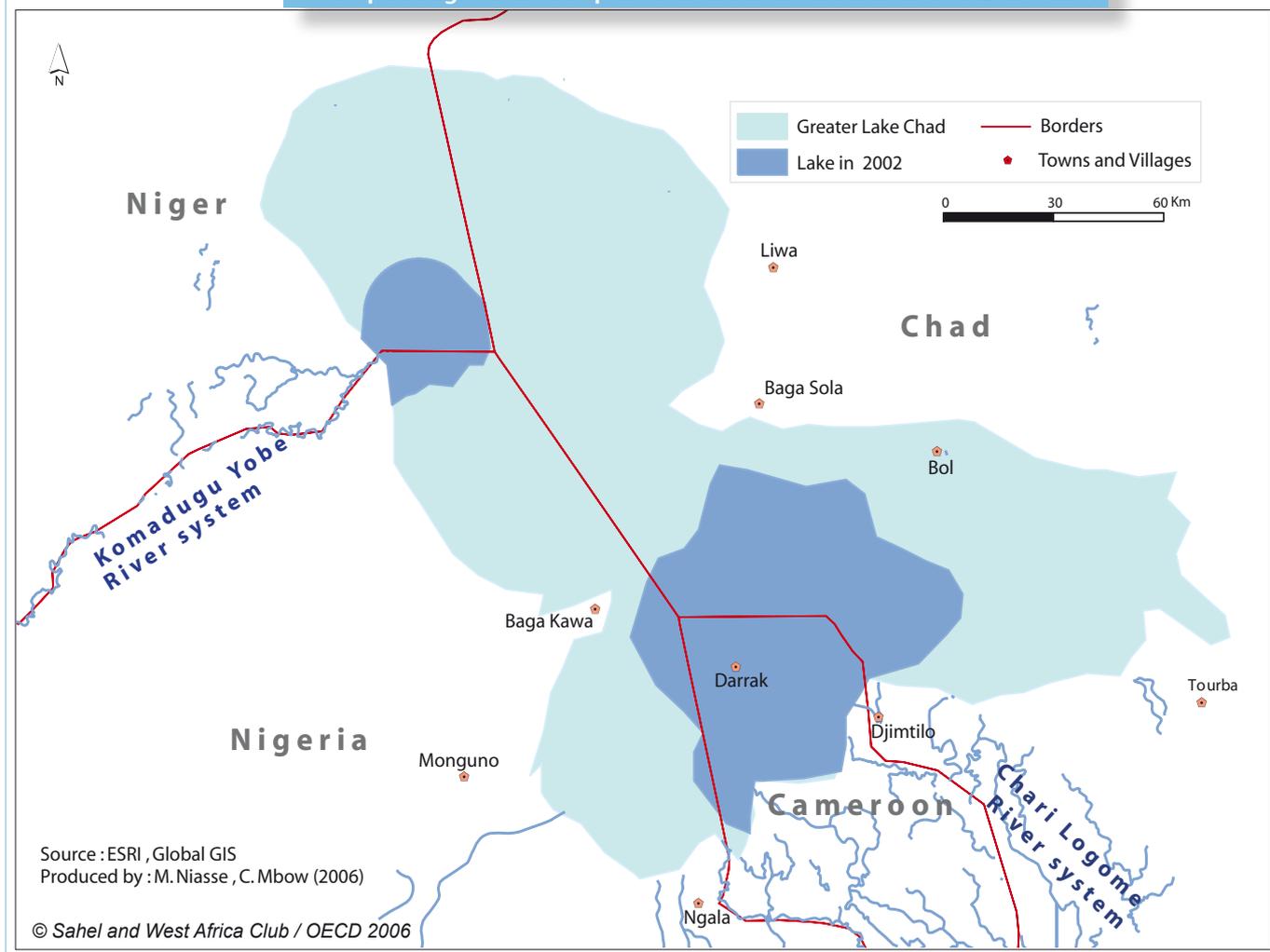


Table 1. Transboundary Watercourse Basin Organisations Concerning West African Countries

River Basin	Basin Agency	Member States	Establishment Date
Niger	NBA (Niger Basin Authority)	9 States: Benin, Burkina Faso, Cameroon, Guinea, Côte d'Ivoire, Mali, Niger, Nigeria, Chad	1963
Lake Chad	LCBC (Lake Chad Basin Commission)	5 States: Cameroon, Niger, Nigeria, CAR, Chad	1964
The Gambia	OMVG (Gambia River Basin Development Organization)	4 States: The Gambia, Guinea, Guinea Bissau, Senegal	1967
Senegal	OMVS (Senegal River Development Organization)	4 States: Guinea, Mali, Mauritania, Senegal	1972
Volta	VBA (Volta Basin Authority)	6 States: Burkina Faso, Benin, Côte d'Ivoire, Ghana, Mali, Togo	2006

15. IRIN News.

Map 7. Migration of Populations with the Withdrawal of Lake Chad



These villages had schools and health centres which were managed by the Nigerian government.

After a period of tension, the two countries unsuccessfully sought to find a solution to their dispute within the framework of the Lake Chad Basin Commission (LCBC). In 1994, they brought their dispute before the International Court of Justice. In October 2002, the International Court of Justice delivered its verdict in favour of Cameroon. In December 2003, Nigeria started to withdraw from the disputed territory.

✓ V. Experiences in Joint Management

Since the establishment of the Volta Basin Authority (VBA) in 2006, all the major transboundary watercourses in West Africa now have joint organisations (see Table 1).

5.1 Advantages of Cooperation on a Boundary River: Example of the OMVS

The establishment of the OMVS in 1972 was accompanied by a Convention declaring the Senegal River and its tributaries “international watercourses” on the territories of member States. One of the

consequences of this status is that any intervention that can significantly alter the regime of the river and the conditions of its navigability requires the prior approval of OMVS member States. Furthermore, a Convention in 1978 declared water and electric power infrastructure (dams, electricity lines, port infrastructure, etc.) constructed under OMVS “joint and indivisible properties of member States”.

The mission of the OMVS is to promote cooperation between member States, coordinate technical studies and activities for the development of the river, as well as regulate the flow of the river to meet the needs of irrigation, electricity production, and navigation. The two major OMVS projects to date are the Diama and Manantali dams. The Diama Dam (1986), located near the mouth of the river, is intended to limit saline seeps; it creates a theoretical irrigation capacity of 120,000 hectares and improves the filling of Lake Guier in Senegal and Lake Rkiz in Mauritania. The Manantali Dam in Mali (1987) is mainly intended for electricity production (200 megawatts). It has a storage capacity of 11.5 billion m³ of water¹⁶ and creates an irrigation capacity of 225,000 hectares. More recently, member States adopted a Charter defining the principles and modalities of sharing the waters of the river between the different sectors of utilization, including the environment.

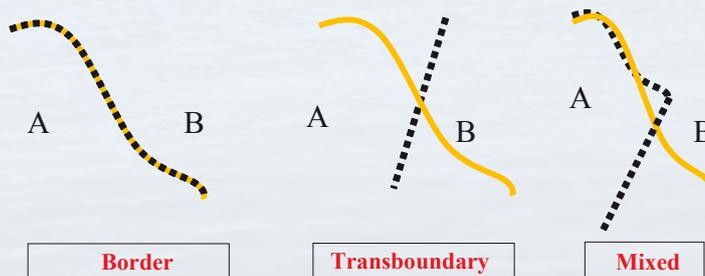
The dynamism of OMVS is perhaps due to the common interests of member States and the cooperation required for managing their common

16. Which is equivalent to the annual fresh water consumption in all of West Africa.

Box 1. Typology of Basin Organisations

In order to analyse basin organisations, it is useful to distinguish:

1. Those which are organised around a border river: The main course of the river is the border between two States. The Senegal River, for example, is the border between Mali and Senegal over part of its course, and the border between Mauritania and Senegal over another part of its course. These three countries are OMVS member States. The recent admission of Guinea modifies this configuration, and moves OMVS to the third category described below.
2. Those which are organised around a transboundary river: This category is the most frequent in West Africa. For example, the Niger River successively runs across Guinea, Mali, Niger and Nigeria. Its main tributary, the Bénoué, runs successively across Chad, Cameroon and Nigeria. These different countries, as well as Burkina Faso, Benin, and Côte d'Ivoire from where a few tributaries of the river rise, form member States of the Niger Basin Authority (NBA). The situation of the Gambia is similar (OMVG), as well as that of the Volta Basin (VBA).
3. Lastly, those managing a watercourse that is a border in some of its sections and a transboundary in others. Taking into account Guinea (upstream country and a new member of the OMVS), the Senegal river may be placed in this category of watercourses.



border, which is the river (see Box 1). The integration of Guinea into the organization could in part change the situation since, for this country, the river does not constitute a border. Furthermore, the large irrigation and navigation development projects, which are at the core of current OMVS activities, are not of direct interest to Guinea. It is certainly in the area of hydroelectric power production that cooperation between Guinea and the three States upstream could develop in the future.

5.2 The Difficult Problem of Managing a Transboundary River: Example of the NBA

Established in 1963, the Niger River Commission (NRC) became the Niger Basin Authority (NBA) in 1980. While the NRC had an essentially consultative function aimed at ensuring that a national project does not have a negative influence on the territory of another member country, the NBA had higher ambitions. Its objective was mainly to coordinate national resource development policies, plan the development of the basin, and undertake joint structures and projects.

However, it is difficult to ensure joint management of a river that is more than 4,000 km long, with a basin covering 1.5 million km² which is shared between nine States. The transboundary nature of the river does not easily lend itself to joint management arrangements in which each member State (from Guinea to Cameroon) can clearly identify benefits more significant than those it can obtain by acting unilaterally or formulating collaboration arrangements at a smaller scale.

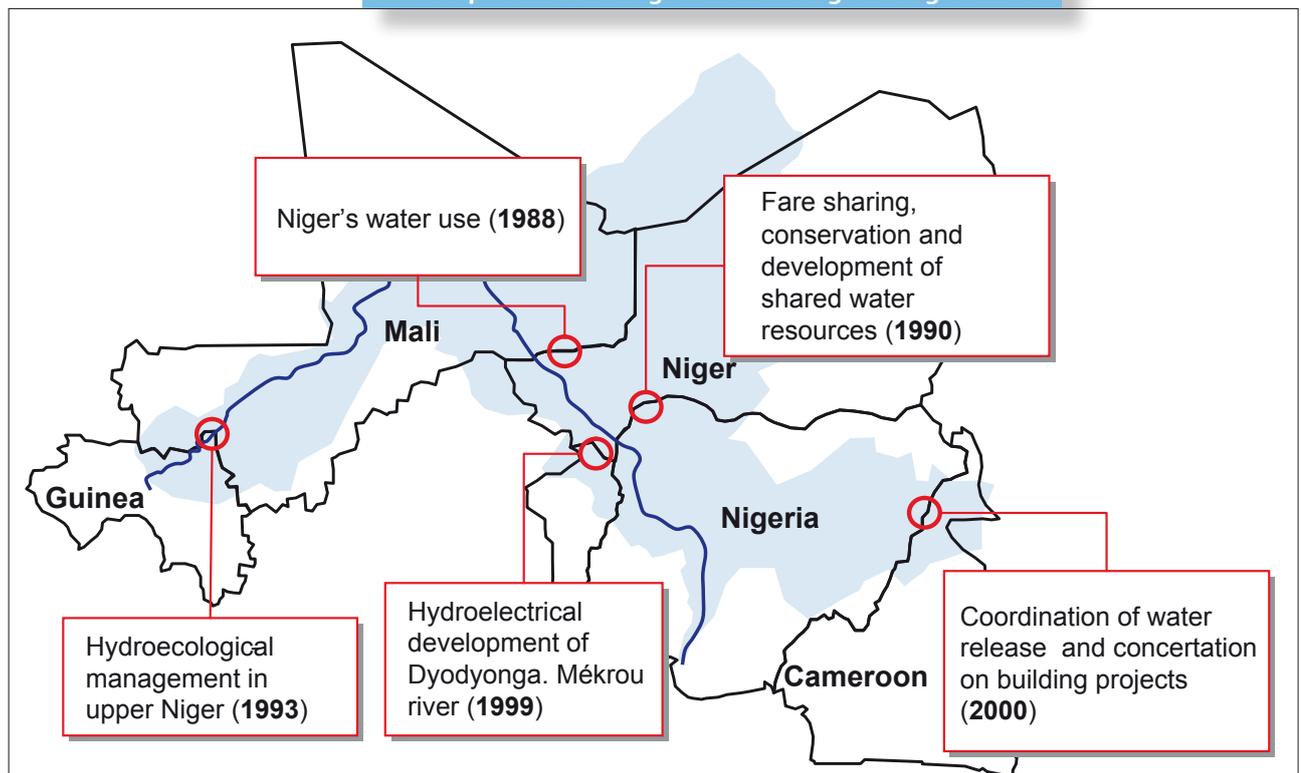
This certainly explains why the achievements of the NBA to date are mainly concentrated in the area of environmental protection (control of silting and water hyacinth, etc), an important area which also has the advantage of easily obtaining consensus. In the other areas, the results are still mixed. In 2005, the Heads of State of NBA member countries adopted a Declaration, known as the Paris Declaration, which defines the general principles of good governance for the Niger Basin. Through this declaration, NBA member countries initiated a consultation process aimed at adopting a shared vision of the river and its development. This exercise should ultimately produce an ambitious long-term development programme. Achieving these goals would refute the above-mentioned geographical determinism, which does not predispose the Niger River to economic cooperation within the river basin.

5.3 Bilateral Cooperation

Difficulties of cooperation between many States on a large basin certainly account for the development of bilateral dialogue. There are five examples of bilateral dialogue along the Niger River (see Map 8):

- The Agreement between Niger and Benin relating to the development of a hydroelectric power station in Dyodyonga on the Mékrou River (January 1999).

Map 8. Bilateral Agreement along the Niger River



Source: M. Niasse (2005)

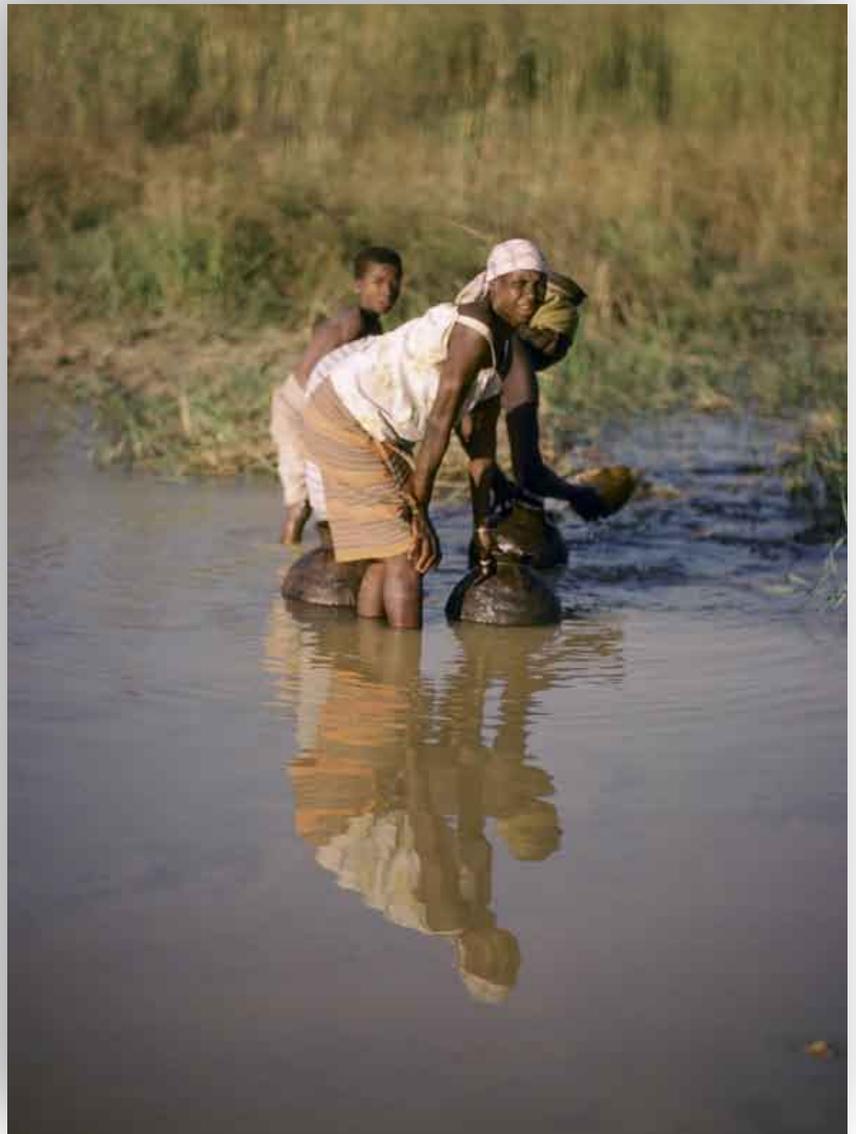
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The Agreement between Nigeria and Niger on the equitable sharing, conservation and development of their resources in common waters (1990). This agreement concerns the sub-basins of Maggia, Lamido, Gada-Goulbi, Tagwai-El Fadama, Komadugu Yobe (this last watercourse forms part of the Lake Chad Basin Network¹⁷).

17. Another Bilateral Agreement was concluded in the Lake Chad Basin. This is the Moundou Agreement between Chad and Cameroon dating from 1970 on levels of water withdrawals from the Logone for irrigation purposes.



- The agreement between Niger and Mali relating to cooperation in the use of water resources of the Niger (July 1988).
- The hydroecological management project of the Upper Niger between Guinea and Mali. This initiative to improve hydroecological knowledge is aimed at enhancing the ecology management policies of this part of the Niger Basin.
- The Nigeria-Cameroon Protocol Agreement concluded under the supervision of the NBA in January 2000 was aimed at coordinating the release of water from dams, consulting each other with respect to water structure projects, as well as the conception and eventual implementation of joint projects.



These agreements came after the establishment of the basin organisations concerned (NBA and LCBC). They highlight the relevance of the subsidiarity principle more than they challenge that of basin organisations. Furthermore, it is important to emphasise that in at least one case (Nigeria-Cameroon Agreement), it is the basin organisation (NBA) which facilitated discussions between the two countries concerned.

5.4 Macro-Regional Cooperation

Subsidiarity is at the core of the concerns of the Permanent Forum for the Coordination and Monitoring of the Integrated Management of Water Resources in West Africa (CPCS-GIRE) created in 2001 under the auspices of ECOWAS. The objective of CPCS-GIRE is to promote and facilitate the creation of consultative frameworks for riparian countries of shared or transboundary basins, while more generally fostering the joint management of shared water resources. The CPCS-GIRE Programme is coordinated by the ECOWAS Water Resource Coordination Unit (WRCU) based in Ouagadougou, Burkina Faso, and operating since 2004.

The West African Water Partnership (GWP-WAWP) is the West African component of the Global Water Partnership (GWP). The GWP/WAWP was established in 2002. Its secretariat is located in Ouagadougou. The GWP/WAWP is a regional platform for dialogue and consultations to promote the integrated management of water within States and within river basins.

The African Network of Basin Organizations (ANBO) was established in July 2002. Initially designed to group the basin organizations of West Africa (West African Basin Organizations or RAOB), it was subsequently extended to all basin organizations in Africa. West Africa continues to play a key role within ANBO: the secretariat of the network is hosted by the OMVS, and the organization is chaired by the NBA.



Conclusion

On the whole, West Africa is not threatened over the medium term by lack of renewable water. In light of the theoretical availability of thousands of billions of m³, the prospect of increasing consumption six-



fold between 2000 and 2020 (from 11 billion to more than 60 billion m³) is not frightening; even if we know that there are and will be problems at the local level¹⁸. The problem lies in the technical and financial difficulties of access to groundwater reserves of which very little is exploited today¹⁹. It also lies in climate change and variability which have led to significant decline in the volumes of rivers over the past few decades. In other words, very little groundwater is exploited, and surface water is diminishing. This broadens the spectrum of water shortage which, even though is far from certain, has encouraged States in the region to prepare for the construction of an ever increasing number of dams, irrigation canals or inter-basin transfer systems. The risks of

disagreement and tension are real, but so far dialogue and cooperation have triumphed.

History shows that “wars over water” are fortunately very rare. Professor Aaron Wolf stresses that “the only recorded incident of an outright war over water was 4,500 years ago between two Mesopotamian city-states over the Tigris and Euphrates Rivers in the region we now call southern Iraq. Since then, you find water exacerbating relations at the international scale. But you also regularly find hostile states—such as India and Pakistan or the Israelis and Palestinians—resolving water conflicts even while disputes rage over other issues. (...) Strategically, water wars don’t make sense. You cannot increase your water resources by going to war with a neighbour unless you are willing to capture the entire hydrographic basin²⁰”. However, interdependence is such that there is pressing need to improve the quality of cooperation in West Africa as regards shared water management.

The prerequisite for such an undertaking is certainly to improve information for policy-makers, water users and the general public

18. For example, in Maradi region in Niger, in Dakar area in Senegal, or in the Ouagadougou area in Burkina Faso.

19. Some countries depend largely on aquifers for agriculture. 96% of irrigation water comes from groundwater in Saudi Arabia, 69% in Bangladesh; 61% in Tunisia; 60% in Syria; 53% in India; and 34% in Pakistan (source UNEP). In West Africa, the use of groundwater for agriculture is almost zero.

20. Aaron Wolf is Associate Professor at Oregon State University (USA) and Director of the Transboundary Freshwater Dispute Database Project. This statement is taken from an Article in the Courier of UNESCO of October 2001: “Sabre-rattling among thirsty nations”; Interview by Amy Otchet.

on climate change and variability and their impacts on fresh water resources. Indeed, in certain cases, some countries have been suspected of reducing the level of rivers by diverting very large quantities, whereas only the aridification of climate was the cause. Scientifically established information on water constitutes, more than in any other area, an indispensable basis for sound dialogue between stakeholders. This implies that joint observation systems should be set up, including for transboundary aquifers of which the dynamics are rarely shared.

Box 2. International Standards on the Management of Transboundary Basins

The 1997 United Nations Convention on the non-navigational uses of International Watercourses is the result of nearly thirty years of strategic thinking and debate by experts. Although it has not entered into force which requires ratification by at least 35 States, this Convention serves as an international standard in defining the responsibilities of States in the management of transboundary river basins. It defines major principles such as those on equitable and reasonable use of shared watercourses, the obligation not to cause significant damage to third party countries, prior notification, information sharing between States, and consultation between riparian States, etc.

The 1971 Convention on wetlands of international importance (or Ramsar Convention). With the exception of Liberia and Cape Verde, all West African States have acceded to this Convention. Today, the region has 46 Ramsar sites covering a total area of 10 million hectares. This Convention is particularly important for the ecological protection of wetlands.

The Convention on Biological Diversity (1992), ratified by all the States in the region except Sierra Leone, aims for “the conservation and sustainable use of biological resources” and seeks to “mitigate or avoid adverse impacts on biological diversity” and to “prevent any threat to biological diversity”. This Convention insists particularly on the need to conduct environmental impact assessments so as to minimise damage to ecosystems, and river ecosystems in particular.

The World Commission on Dams was established in 1997 to conduct an independent assessment of world experience in the planning, construction and management of large dams, draw lessons, as well as to make recommendations for the future. Regarding dams in transboundary basins, the WCD report recommends that national water policies should explicitly include negotiation mechanisms with the other States concerned on the basis of the principles of equitable and reasonable use, prevention of significant damages, and prior information. The WCD also appealed to the international community and donors to refrain from supporting dam projects on transboundary watercourses if the riparian States raise an objection considered founded by an independent group of experts.

Strategic thinking on subsidiarity between the different levels of regional cooperation should be initiated.

Bilateral Agreements offer a good basis for promoting integrated development programmes that are difficult to envisage in most river basins because of divergent interests or priorities between certain member countries of basin organisations.

Basin Agencies do not all have the same purpose (boundary/transboundary river, dimension of the basin, number of member countries). Consequently, they cannot be perceived in the same manner or have the same goals. Their common link could be the development of a common vision for all the countries concerned, dialogue on codes of conduct or water charters, and lastly, support for the implementation of bilateral agreements.

The macro-regional level is just beginning. It is certainly the missing link to regional cooperation pertaining to water. It could help formulate a regional water protocol which would facilitate the task of many stakeholder States in several shared basins. It is also at the West African level that States could be encouraged to ratify and implement international conventions on shared waters and the environment (see Box 2). The ECOWAS Permanent Forum for the Coordination and Monitoring of the Integrated Management of Water Resources in West Africa (CPCS-GIRE) could play the pivotal role of this regional process along with other regional organisations (GWP-WAWP, ANBO, etc.) that are active in the promotion of better governance of water resources in the region.

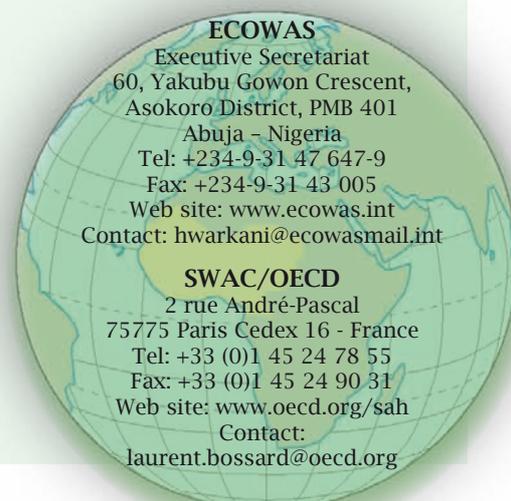
Bibliography

- ABN (2002) *Réunion d'information sur les barrages de Taoussa (Mali) et de Kandadji (Niger)*. Niamey 6-7 août. Autorité du Bassin du Niger. Niamey.
- Adams, W. (2000) *The Social Impacts of Large Dams: Equity and Distributional Issues*. Working Paper. The World Commission on Dams. Cape Town. November. Source: www.dams.org/docs/kbase/thematic/tr11main.pdf
- Andreini, M.; van de Giesen, N. et al. (2000). *Volta Basin Water Balance*. Center for Development Research. University of Bonn. ZEF Discussion Papers. No. 21. March.
- Ashton, P.J. (2002) *Avoiding Conflicts over Africa's Water Resources*. *Ambio*. Vol. 31 No. 3, pp. 236-242. May.
- Bradlow, D. (2000) *Report on International and Comparative Law Applicable to Large Dam Construction*. Contributing Paper to Thematic Review V4. World Commission on Dams. Cape Town (www.dams.org).
- Diagne, B. (2004) *Modèles d'organisation de bassin en Afrique de l'Ouest : le cas de l'Organisation pour la Mise en Valeur du fleuve Sénégal (OMVS)*. In Niasse, M.; Iza, A.; Garane, A.; Varis, O. (eds). 2004. *La gouvernance de l'eau : Aspects juridiques et institutionnels de la gestion des ressources en eau en Afrique de l'Ouest*. IUCN, Gland (Suisse) et Cambridge (Royaume-Uni).
- Fourd, J.P. (2002) *Petites retenues d'eau. Performance et coûts : Quelles leçons tirer des expériences dans la sous-région du Burkina Faso en particulier*. Communication présentée au Forum régional sur les zones humides. UICN-BRAO. Komienga (Burkina Faso). 12-14 juin, pp. 32-47.
- Gleditsch, N.P.; Taylor, O.; Furlong, K. and Lacina, B. (2004) *Conflicts over Shared Rivers: Resource Scarcity or Fuzzy Boundaries?* Paper presented to the Fifth Pan-European International Relations Conference, The Hague, 9-11 September.
- GWP-WATAC (2000) *Water for the 21st Century. Vision to Action for West Africa*. Global Water Partnership-West Africa Technical Advisory Committee (GWP-WATAC). Ouagadougou.
- Horowitz, M.M. (1989) *Victims of Development*. *Development Anthropology Network*. 7(2):1-8
- ICJ (no date) *Land and Maritime Boundary Between Cameroon and Nigeria*. International Court of Justice (ICJ): www.icj-cij.org/icjwww/idocket/icn/icnframe.htm
- IRIN News (2003a) *Cameroon-Nigeria: Border Commission discusses handover of 33 villages*. Integrated Regional Information Networks (IRIN): www.irinnews.org/report.asp?ReportID=37536&SelectRegion=West_Africa. October, 29. Abuja
- IRIN News (2003b) *Cameroon-Nigeria: Handover of Lake Chad villages begins*. Integrated Regional Information Networks (IRIN): www.irinnews.org/report.asp?ReportID=38319&SelectRegion=West_Africa December, 9. Lagos.
- L'Hôte, Y.; Mahé, G.; Somé, B. and Triboulet, J. (2002) *Analysis of a Sahelian annual rainfall index from 1896 to 2000*. *Hydrological Sciences* No. 47 (4), pp. 563-572. August.
- Ly, I. (2004) *Les aspects juridiques liés à la gestion des eaux transfrontalières : Prévention et résolution des conflits*. In Niasse, M.; Iza, A.; Garane, A.; Varis, O. (eds). 2004. *La gouvernance de l'eau : Aspects juridiques et institutionnels de la gestion des ressources en eau en Afrique de l'Ouest*. IUCN, Gland (Suisse), et Cambridge (Royaume-Uni).
- Magistro, J.V. (1993) *Ethnicity and Transboundary Conflict in the Senegal River Valley*. *Cahiers d'Etudes Africaines*. No.130-XXXIII-2, pp. 201-232.

- Mahé, G.; Olivry, J.C.** (1995) *Variations des précipitations et des écoulements en Afrique de l'Ouest et Centrale de 1951 à 1989*, Sécheresse, n°1, Vol. 6, 109-117.
- McCaffrey, S.** (2001) *The Contribution of the UN Convention on the Law of the Non-Navigational Uses of International Watercourses*. International Journal of Global Environmental Issues, Vol. 1, Nos. 3/4, 2001.
- Niasse, M.** (2004) *Prévenir les conflits et promouvoir la coopération dans la gestion des fleuves transfrontaliers en Afrique de l'Ouest*. In Vertigo (Revue électronique sur les sciences de l'Environnement). Vol. 5 (1). Mai. Source: http://www.vertigo.uqam.ca/vol5no1/art5vol5no1/vertigovol5no1_niasse.pdf.
- Niasse, M.; Iza, A.; Garane, A.; Varis, O. (ed.)** (2004) *La gouvernance de l'eau : Aspects juridiques et institutionnels de la gestion des ressources en eau en Afrique de l'Ouest*. IUCN, Gland (Suisse), et Cambridge (Royaume-Uni).
- Niasse, M.** (2002) *Equity Dimensions of Dams-Based Water Resources Development - Winners and Losers*. In Steffen, Will; Jäger, J.; Carlson, D.J.; Bradshaw, C. (ed). *Challenges of a Changing Earth*. Springer. Paris, Londres; pp.39-43.
- Niasse, M.; Afouda, A.; Amani, A. (ed.)** (2004) *Réduire la vulnérabilité de l'Afrique de l'Ouest aux impacts du climat sur les ressources en eau, les zones humides et la désertification*. Eléments de stratégie régionale de préparation et d'adaptation. IUCN, Gland (Suisse) et Cambridge (Royaume-Uni).
- Paturel, J.E.; Servat, E.; Kouame, B.; Lubes, H.; Ouedraogo, M.; Masson, J.M.** (1997). *Climatic variability in humid Africa along the Gulf of Guinea - Part two: an integrated regional approach*. Journal of Hydrology, 1997, 191: 16-36.
- Parker, R.** (1991) *The Senegal-Mauritania Conflict of 1989: a Fragile Equilibrium*. Journal of Modern African Studies, 29-1, pp. 155-171.
- Postel, S.L. and Wolf, A.T.** (2001) *Dehydrating Conflict*. Foreign Policy. September, 18, <http://www.globalpolicy.org/security/natres/water/2001/1001fpol.htm>.
- Ravenga, C.; Brunner, J.; Henninger, N.; Kassen, K.; Payne, R.** (2000) *Pilot Analysis of Global Ecosystems*. Freshwater Systems. WRI. Washington, DC. Source: http://pdf.wri.org/page_freshwater.pdf.
- Seck, S.M.** (1991) *Les cultivateurs "transfrontaliers" de décrue face à la question foncière*. In Crousse, B.; Mathieu, P.; Seck, S.M. (ed). *La Vallée du Fleuve Sénégal. Evaluations et perspectives d'une décennie d'aménagements*. Paris. Karthala.
- Servat, E.; Paturel, J.E.; Lubes, H.; Kouame, B.; Ouedraogo, M.; Masson, J.M.** (1997). *Climatic variability in humid Africa along the Gulf of Guinea - Part one: detailed analysis of the phenomenon in Côte d'Ivoire*. Journal of Hydrology, 1997, 191 : 1-15.
- Tchoué, G.** (2004) *Le modèle de l'Autorité du Bassin du Niger*. In Niasse, M.; Iza, A.; Garane, A.; Varis, O. (eds). 2004. *La gouvernance de l'eau : Aspects juridiques et institutionnels de la gestion des ressources en eau en Afrique de l'Ouest*. IUCN, Gland (Suisse) et Cambridge (Royaume-Uni).
- Turton, A.R.** (2000) *Water wars in Southern Africa: Challenging conventional wisdom*. In *Water for Peace in the Middle East and Southern Africa*. Green Cross International. Geneva; pp. 112-130.
- UNEP** (2006) *Challenges to International Water: Regional Assessments in a Global Perspective*.
- Van de Giesen, N.; Andreini, M.; van Edig, A. & Vleg, P.** (2001) *Competition for Water Resources of the Volta Basin*. Center for Development Research. University of Bonn.
- WCD** (2002) *Dams and Development. A New Framework for Decision-Making*. World Commission on Dams. Earthscan. London & Sterling.
- Wolf, A.** (2001) *Water, Conflict, and Cooperation*. In Meinzen-Dick, R.S. and Rosegrant, M.W. (ed): *Overcoming Water Scarcity and Quality Constraints*. 2020 Focus 9: October. Source: http://www.ifpri.org/2020/focus/focus09/focus09_14.htm.
- Wolf, A.T.; Yoffe, S.B. and Giordano, M.** (2003) *International Waters: Identifying Basins at Risk*. Water Policy No.5, pp. 29-60
- Wouters, P.** (2000) *The Legal Response to International Water Scarcity and Water Conflicts: The UN Watercourse Convention and Beyond*. Source: http://www.africanwater.org/pat_wouters1.htm.

Websites

- Autorité du Bassin du Niger** <http://www.abn.ne>
- Earthprint library** <http://www.earthprint.com>
- ECOWAS. Water Resources Coordination Unit (WRCU)** <http://www.wrcu.ecowas.int/>
- FAO. Aquastat** <http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm>
- Forum mondial de l'eau/World Water Council** <http://www.worldwatercouncil.org/>
- Global Water Partnership/Partenariat Mondial de l'eau** <http://www.gwpforum.org>
- IUCN. Water Ressources eAtlas** <http://www.iucn.org/themes/wani/eatlas/>
- Organisation pour la mise en valeur du Fleuve Sénégal** <http://www.omvs.org/>
- Réseau International des organisations de bassin/ International network of basin organizations** <http://www.inbo-news.org/>
- The African Transboundary Water Law** <http://www.africanwaterlaw.org/>
- The World Commission on Dams** <http://www.dams.org/>
- The World Water Week** <http://www.worldwaterweek.org/>
- UNESCO. Water Programme** <http://www.unesco.org/water/>
- World Resource Institute** <http://www.wri.org/>



Chapter produced by Madiodio Niasse under the supervision of Laurent Bossard
 Maps: Madiodio Niasse, Cheikh Mbow and the team from the Laboratoire d'Etudes
 et de Recherches Géomatiques (LERG) of the University of Dakar. Maps were
 finalised by Philipp Heinrigs and Christophe Perret of the SWAC.
 Assistant: Sylvie Letassey, Layout: Marie Moncet
 Photos: USAID: Ray Witlin; Curt Carnemark; UNESCO: Ledru and Martel