



## FLOOD & DROUGHT MANAGEMENT TOOLS

Volta Basin



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## 1. The Volta Basin

### 1.1 Physical characteristics and climate

The Volta Basin covers an area of about 400,000 km<sup>2</sup> of the sub-humid to semi-arid West-African savannah zone. It is the ninth largest basin in Sub-Saharan Africa, falling within six countries: Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali and Togo. The Volta River flows primarily through Burkina Faso and Ghana. The River has an average mouth discharge of 1,210 m<sup>3</sup>/s into the Gulf of Guinea.

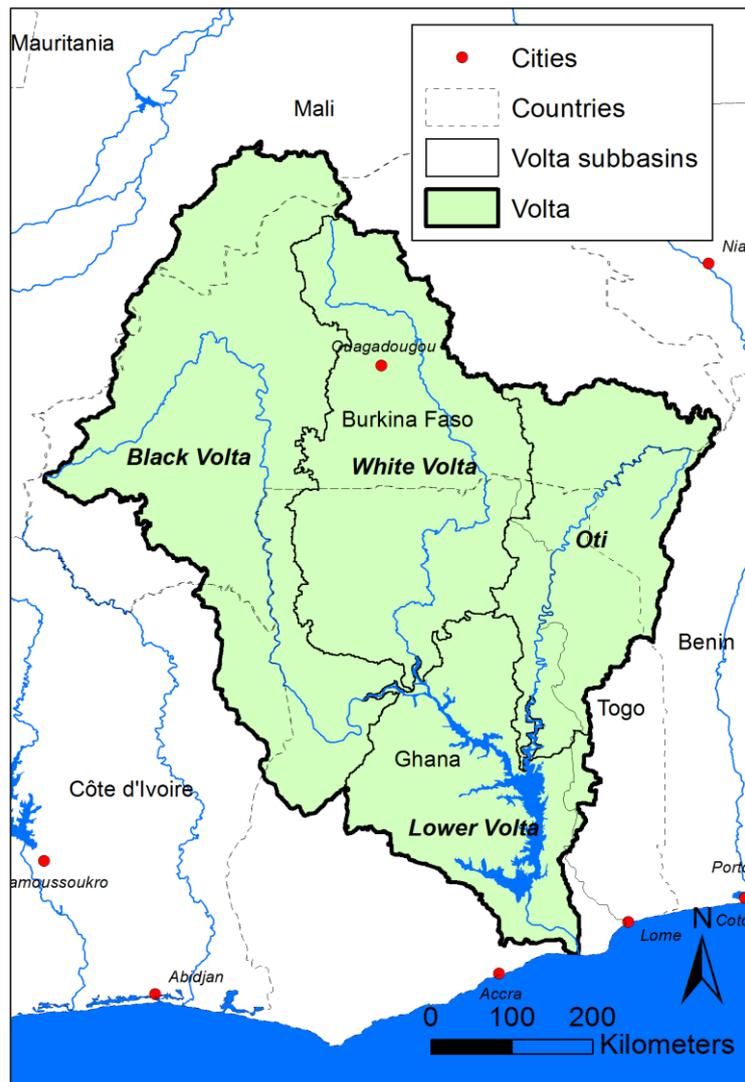


Figure 1. Map of the Volta Basin

With greater distance from the coast, aridity increases, the growing season becomes shorter and rainfall is more erratic. Annual precipitation rates vary from 1,100 mm/year to 500 mm/year respectively in the southern and northern part of the basin. With temperatures reaching as high as 44°C, the potential evaporation rates are high, ranging from 1,500 mm/year in the south to more than 2,500 mm/year in the north. Less than 10% of the precipitation contributes to the river flow.

## 1.2 Socio-economics

The countries of the Volta Basin are among the poorest in the world, having underdeveloped economies, with majority of the people living below the poverty line. The Volta Basin is home to a little over 23 million people, of which more than 70% reside in rural areas and depend on the basin's natural resources for their livelihood. With population expected to grow at a rate of between 2.5% to 3% – reaching a projected 34 million people by 2025 – greater pressure is being put on the Volta River and its resources as a result of human activities.

Water resources play a major role in the promotion of economic growth and reduction of poverty in the basin. Rain-fed, and to a lesser extent irrigated agriculture, are the main livelihood activities that most people are engaged in, generating about 40% of the basin's economic output.

## 1.3 Hydrology

The river network is formed by four main sub-basins, namely: the Black Volta, the White Volta, the Oti-Pendjari River and the Lower Volta system. Water from the Black Volta, the White Volta and the Oti-Pendjari tributaries flows into the Volta Lake, which has been created by the construction of the Akosombo Dam in 1964. This is the largest man-made reservoir by surface area in the world and it feeds the Lower Volta and discharges into the Gulf of Guinea. The total length of the main river (the Volta River) is 1,850 km.

## 1.4 Impact of flood and drought

In the past, flooding resulting from extreme rainfall events was exacerbated by uncontrolled dam releases from the upper part of the basin; e.g. from Burkina Faso to Ghana on the White Volta and from Burkina Faso to Mali on the Sourou River, as a backwater effect of the Léry Dam. The construction of the Akosombo Dam in Ghana in the 1960s led to the inundation of over 7,800 km<sup>2</sup> resulting in the creation of the Lake Volta. Drought is a common occurrence in the upper and mid part of the basin, where climatic conditions are harsher than in the south.

Among the riparian countries, Ghana has the highest risk of weather related hazards, including landslides, coastal erosion, urban floods, farmland flooding and dry spells. Flood and drought events are of concern, particularly for the northern part of the country. Ghana experienced a serious flood in 2007, which affected about 332,600 people and caused the death of 56 people in the Upper East, Upper West and Northern regions and parts of Western region. Other major floods between 1991 and 2008 caused the destruction of thousands of hectares of farmlands. Drought can significantly decrease the hydropower production at Askombo dam, the main source of electricity that Ghana relies on, with terrible consequences for the country's economy. This was the case, for example, in 2006 and 2007, when Ghana experienced power shortages that had major consequences for several sectors of the economy, including industry, mining and domestic. The dependence of Ghana on an unsteady source of energy might also jeopardize possible foreign investments in various sectors. Drought also affects the food production, since the irrigation demands of the agricultural sector, both rain-fed and from reservoirs are not met in periods of water scarcity.

Both flood and drought in Burkina Faso caused various large scale disasters. In 1983 and in 1990 two major droughts affected more than a million people in the northern part of the country.

Both flood and drought in the Volta Basin can be aggravated by future climatic changes in terms of frequency, predictability and severity.

## 1.5 Hydraulic infrastructure

Throughout the Volta basin, dams and reservoirs have been constructed to mobilise water for agricultural and industrial use and for energy production. The number of large and small dams continues to increase as population pressure grows. Increasing use of water and decreasing precipitation due to climate change in the region, threatens the management of the water and the multiple benefits that are drawn from the resource.

The Akosombo Dam in Ghana is the most significant hydraulic infrastructure in the Volta basin. It stores water flowing from the Black Volta, the White Volta and the Oti River. The dam is mainly used for hydro-power generation and it is a major contributor to the power production in Ghana. Irrigation and other consumptive water uses in the mid and upper reaches of the basin compete with the production of hydro-power.

Other major hydraulic infrastructure, crucial to sustain irrigation and hydro-power production in the Volta basin, are the Kpong and Bui dams in Ghana, and the Léry, Ziga, Kompienga and Bagré dams in Burkina Faso. In the other riparian countries, a few small reservoirs are in operation.

## 1.6 Institutional environment

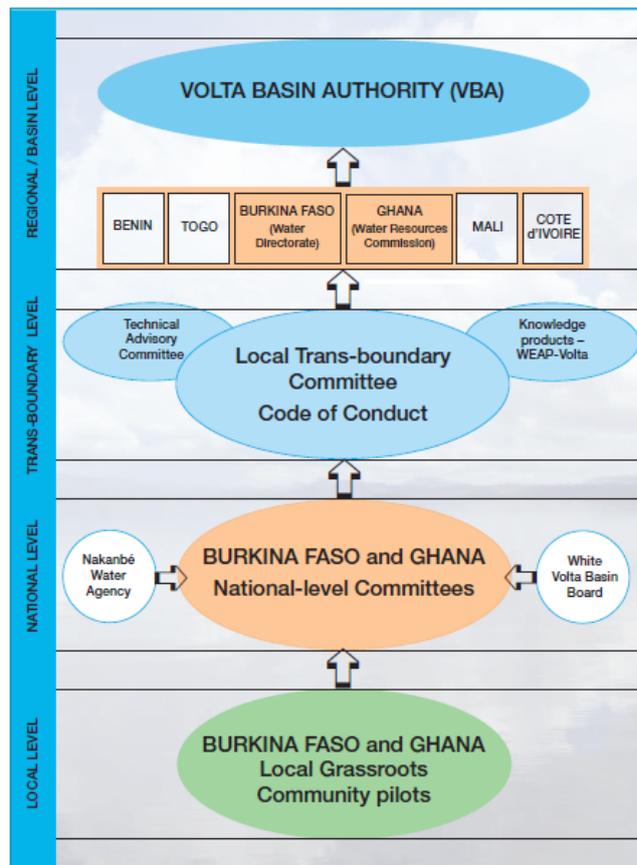


Figure 2. The Volta Basin's participatory multi-scale governance framework (IUCN, 2012)

The Volta basin faces many development challenges to meet the needs of an increasing population, challenges that require a basin-wide response. Although the Volta Basin Authority (VBA) is putting an effort to harmonise national policies addressing the management of the water resources of the Volta Basin, the institutional environment is characterised by uncoordinated policies and development initiatives which threaten the sustainable management of the basin resources.

Regulation is very complex within member States and is applied in a sectoral way. There are many government agencies involved, often leading to confusion. Many laws do not provide specific provisions for the promotion or enforcement of Integrated Water Resources Management (IWRM).

Comparing the Ghanaian national water management and the national water management of the other riparian countries, many differences in their set-up can be observed. Ghana is in a favorable position, as donors are heavily involved in its water sector reform. The involvement of international partners led to the establishment of the Water Resources Commission (WRC) in 1996. WRC serves as an umbrella institution for national water policy and aims at coordinating the various

government agencies and their different interests and management approaches. In Burkina Faso a new Water Framework Law was adopted in 2001 and, under this legislation, the Directorate of Water Resources (DGRE) is responsible for managing the country's water resources. In Mali, a colonial decree from 1928 concerning water resources is still in force. Such big differences in management and institution-building are a huge obstacle to cooperation at the basin level.

Currently all the basin states are engaged in the process of adopting IWRM.

## 1.7 Key issues

Although overall the economic situation has improved in recent years, countries that share the Volta Basin remain among the poorest in the world, with poverty being greater in rural areas. Poverty and increasing population pressure have led to the massive exploitation of natural resources, contributing

to water scarcity, land degradation and the siltation of river channels. The high variability of rainfall in space and time, together with soil degradation, are the main cause of the low crop yield which mainly concerns Ghana and Burkina Faso and threaten the population during the within-season dry spells.

Even though most of these challenges should be addressed at a basin-wide level, the Volta River remained one of the main transboundary watercourses in Africa without an international treaty and without a basin-wide coordination mechanism. Only starting from 2000 Ghana and Burkina Faso started showing significant development of their water policies, alleviating the tensions caused by uncontrolled dam releases. Limited consultation and coordination between Burkina Faso and Ghana combined with uncoordinated policies and development initiatives were serious threats to the sustainable management of Volta Basin.

## 1.8 Future changes

Rain water is important for the basin's water resources. For this reason, the Volta Basin is particularly threatened by changes in precipitation patterns due to climate change. Climatic conditions are likely to push people towards irrigated agriculture to meet certain targets; e.g. food production, further contributing to an increased demand for water. Rain-fed agriculture is highly vulnerable because of its dependence on the spatial and temporal variability of rainfall and climate change.

There is also an increasing demand for water from industries to promote economic growth and from municipalities for development. In Ghana, for example, water is largely used to produce hydro-power, which supports major industries such as mining and aluminium production. The growing industrial and municipal water demand is further stretching supplies. This with other concerns that are likely to increase, e.g. environmental pollution and degradation, will continue to mount pressure on water resources in the basin.

The predicted negative impacts of climate change include:

- Increasing temperature
- Reduced rainfall / reduced availability of water
- Water quality deterioration
- Reduced hydro-power production
- Spread of water-related diseases
- Increased poverty

## 1.9 Projects and programs

Different projects and programs aimed at promoting transboundary management of the Volta Basin are currently active.

The Volta Basin Observatory project, entitled "Observatory for Water Resources and Related Ecosystems", is funded by the Agence Française de Développement (AFD) with the objective of promoting the sustainable use of water resources and related ecosystems in the basin. It supports decision making and promotes permanent consultation tools among the relevant parties, including all national and regional stakeholders.

The Volta-HYCOS Project (a part of the larger World Hydrological Cycle Observing System), funded by the Fonds Français pour l'Environnement Mondial (FFEM) and the AFD between 2006 and 2009, offers a reliable water resources information to support water resource management through the improvement of hydrological data collection infrastructure and data management in the Volta basin member countries. The exchange of information on water resources will facilitate national and regional development. The African Water Facility (AWF) of the African Development Bank (AfDB) financed the Second Phase of the Project that ran from 2011 to 2015.

The Volta River Basin Strategic Action Program Implementation Project, funded by the Global Environment Facility (GEF), improves the capacity of the VBA for transboundary water resources management. The project accomplishes this through development activities that address institutional

weaknesses and implementation of priority actions of the Strategic Action Program (SAP). This will result in direct environmental and livelihood benefits.

The West African Science Service Center on Climate Change and Adapted Land Use (WASCAL), funded by the German Federal Ministry of Education and Research (BMBF), is a large-scale, research-focused Climate Service Centre designed to help tackle climate change related challenges and enhance the resilience of human and environmental systems to the increased climate variability.

The regional programme of the Integrated Drought Management Programme in West Africa (IDMP WAF) based at the Global Water Partnership (GWP) West Africa is an ongoing programme with the overall aim of enhancing strong partnership in order to develop resilience to drought and climate change in the region, following an IWRM approach. Its particular contribution will be to influence policy and practice towards more integrated management of drought in the West Africa region in a changing climate.

## 2. Urban environments and utilities

### 2.1 Overview of urban areas in the basin

About 30% of roughly 23 million people living in the Volta Basin are concentrated in urban areas. The most populated areas in the basin include Ouagadougou and Bobo-Dioulasso in Burkina Faso, Tamale, Wa and Bolgatanga in Ghana and the Kara region in Togo (see Table 1).

Table 1. Major city population distribution within the basin

Country	City	Population
Burkina Faso	Ouagadougou	1,708,079
	Bobo-Dioulasso	555,121
	Ouahigouya	89,148
	Tenkodogo	49,710
	Leo	33,714
	Pô	30,057
	Ouagadougou	1,708,079
Ghana	Tamale	562,919
	Wa	105,821
	Bolgatanga	68,183
Togo	Kara	103,075

### 2.2 Major utilities in the basin

The most significant water consuming towns of the basin are Ouagadougou and Bobo-Dioulasso in Burkina Faso, Bolgatanga and Tamalé in Ghana, Natitingou and Tanguiéta in Benin and Kara and Dapaong in Togo. Their water supply is generally secured from a combination of surface and ground water resources.

In 1997, the Public Utilities Regulatory Commission (PURC) was launched to regulate and oversee the provision of utilities in Ghana.

In Benin, the National Water Society of Benin (SONEB) has been assigned to assure urban water supply and waste water treatment on behalf of local authorities. SONEB is placed under the Ministry of Energy and Water. In Burkina Faso, the national utility for water, National Office for Water & Sanitation (ONEA), manages the urban water and sanitation services. According to the World Bank (WB) and USAID, ONEA has an excellent record of performance in West Africa. In Ghana, the Ghana Water Company Limited (GWCL) was set up in 1998 to provide water supply to urban areas. The Electricity Company of Ghana (ECG) manages the supply of electricity, including the one produced from hydro-power plants. In Togo, Togolese Electric Energy Company (CEET) manages the collection, treatment and supply of water and electrical power distribution. Togo Water and the CEET hold monopolies in these sectors.

The West African Power Pool (WAPP) is a cooperation of national electricity companies in Western Africa, under the support of the Economic Community of West African States (ECOWAS). The members of WAPP are working to establish a reliable power grid for the region and a common market for electricity. WAPP was founded in 2000.

### 2.3 Water Safety Plan implementation status

Water quality degradation is an important issue in the Volta Basin. The current water quality standards are inadequate to guarantee a continued supply of safe water.

As in most countries in the region, Ghana faces the challenge of ensuring safe drinking water supplies. To mitigate this, GWCL has taken steps to send 12 staff members to Kenya to receive the training programme on Water Safety Plans (WSPs) issued by the World Health Organization (WHO) and the International Water Association (IWA). The WHO-IWA WSP training is designed for use by all professionals managing the supply of safe drinking-water. With support from several stakeholders, GWCL has embarked on a pilot WSP development and implementation for the Weija Water Treatment Plant. GWCL continues to work with IWA to ensure that more of their staff is trained and WSPs are developed and implemented for all its water treatment and supply systems. Most of the activities in the WSP development and implementation are supported under the project on capacity building in Water Quality Monitoring and Surveillance in Ghana.

## **2.4 Management of floods and droughts in urban areas**

In 2010, the Parliamentary Select Committee on Employment, Social Welfare and State Enterprises in Ghana called for the establishment of the joint Upper Volta Basin Management Agency (UVBMA) between Ghana and Burkina Faso. The UVBMA would be mandated to set up action plans through the appropriate governmental agencies within each country to control the perennial floods in the northern parts of Ghana.

In Burkina Faso, a drainage network was built to manage potential flooding in the city of Ouagadougou, but its operation is compromised by the garbage that accumulates in the channels blocking the system.

With regards to drought issues, in Ghana, large gorges have been constructed to retain water for hydro-power production and ensure the availability of water during the dry seasons.

Insufficient communication between countries on flood and drought management remains one of the major issues in the basin. The lack of data and the absence of efficient monitoring networks between the countries (horizontal communication) but also within the countries and the peripheral areas (vertical communication) constitute the main gaps for successful and short-term information sharing.

## **2.5 Interaction between Water Utilities and Basin Organisations**

Communication between stakeholders from the riparian countries is often limited and actions uncoordinated.

The Technical Committee of the Volta Basin (CTBV) was created in March 2004 to prepare for the establishment of a Volta Basin organisation for the sustainable management of natural resources within the basin through the development of joint projects and works among countries in the basin.

The Volta River Authority (VRA) in Ghana was then established managing the water resources on a regional level following the IWRM principles and a straightforward vision on co-operation among the member countries and related organisations and water utilities.

There is not much interaction between utilities and basin organisations. However, with the introduction of the WSP approach, it is expected that collaboration at the two scales increase. Utilities need to be aware and engage with all stakeholders within the basin as they start with their WSP implementation.

## **2.6 Data and information availability**

Data availability is a big issue in the Volta Basin. Historical data series are lacking, and what data is available should be viewed with reservation, as this is not often reliable or validated. Moreover, the available data collection instruments are often obsolete.

Different projects aimed to promote data collection and management within the Volta Basin are currently active. The Volta-HYCOS aims to develop a regional framework and underlying technical solution for data collection and management to promote the exchange of information on the status of water resources in the Volta Basin.

As part of the GLOWA Volta Project, the Volta Basin's Geoportal has been developed as a web-based interface to access to the different databases; data encompass not only structured (tabular) data, but also documents, graphs, maps and software-modules. The Geoportal addresses the necessity to develop a data-infrastructure offering easy access to data and organisation and exchange of data.

Within WASCAL, a large number of heterogeneous data are collected. In order to facilitate the acquisition, provision, integration, management and exchange of these data resources, an online public data-exchange platform called the Spatial Data Infrastructure (SDI) WAscal Data Infrastructure (WADI) has been developed.

At the national level, the National Disaster agencies in the basin countries, for example the National Disaster Management Organisation (NADMO) in Ghana, offer their contribution in gathering historical flood data.

## 2.7 GEF past and present involvement in the Basin

The UNEP/GEF Volta River Basin Project for "Addressing Transboundary Concerns in the Volta River Basin and its Downstream Coastal Area" is a regional initiative designed to facilitate the integrated management, sustainable development and protection of natural resources of the Volta River Basin within the six riparian countries; Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali and Togo.

The leading implementing agency is the United Nations Environment Programme (UNEP) together with local executing agencies.

## 2.8 Key contacts

Name	Organisation	Contacts
Dr. Charles A. Biney Ag. Executive Director	Volta Basin Authority (VBA)	<a href="mailto:c.biney@abv-volta.org">c.biney@abv-volta.org</a> ; <a href="mailto:cbiney@gmail.com">cbiney@gmail.com</a>
Mr. Jacob W Tumbulto Director of Volta Basin Observatory	Volta Basin Authority (VBA)	<a href="mailto:jwtumbulto@gmail.com">jwtumbulto@gmail.com</a>
Mr. Moumouni Sawadogo Director de l'Exploitation	Office National de l'Eau et de l'Assainissement (ONEA)	<a href="mailto:moumouni.sawadogo@oneabf.com">moumouni.sawadogo@oneabf.com</a>
Mr. Jonas Jabulo Chief Manager (Water Quality Assurance)	Ghana Water Company Limited (GW)	<a href="mailto:jonasjab@yahoo.com">jonasjab@yahoo.com</a>
Ibrahim Babatunde Wilson Director of WRCC ECOWAS	Economic Community of West African States (ECOWAS)	<a href="mailto:ibrwilson@yahoo.com">ibrwilson@yahoo.com</a>
Adwoa Painstil Water Quality Specialist	Water Resource Commission (WRC)	<a href="mailto:himapainstil@yahoo.com">himapainstil@yahoo.com</a>
Boubacar Barry WASCAL Coordinator in Burkina Faso	West African Science Service Center on Climate Change and Adapted Land Use (WASCAL)	<a href="mailto:barry.b@wascal.org">barry.b@wascal.org</a>
Joachim Ayiwe Abungba Assistant Basin Officer	Black Volta	<a href="mailto:joachimayiwe@yahoo.com">joachimayiwe@yahoo.com</a>
Aaron B. Aduna Basin Officer	White Volta	<a href="mailto:aaronaduna@gmail.com">aaronaduna@gmail.com</a>
Adama Ilboudo Directeur de l'Eau et de l'Environnement	Agence de l'Eau de Nakanbé	<a href="mailto:ilboudama@yahoo.fr">ilboudama@yahoo.fr</a>
Konané Benjamin Directeur Général	Agence de l'Eau de Mouhoun	<a href="mailto:benjaminkonane@yahoo.fr">benjaminkonane@yahoo.fr</a>
Boureima Ouedraogo Chef de Service du Suivi de la Qualité de l'Eau et de	Agence de l'Eau du Gourma	<a href="mailto:ouedkhalilou@yahoo.fr">ouedkhalilou@yahoo.fr</a>

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