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List of abbreviations and acronyms

Acronyms	Definition
ABE	Benin Environmental Agency
ABN	Niger Basin Authority
AGRHYMET	Centre Agro-Hydro- Météorologique
AISA	Association Ivoirienne des Sciences Agronomiques
ANADER	National Support Agency for Rural Development
ANARIZ-CI	National Association of Rice Farmers of Cote d'Ivoire
APAF	Association for of Agro-forestry Promotion
APORCI	Association of Pig Farmers of Cote d'Ivoire
ASECNA	Agency for Air Navigation Safety
AVHRR	Advanced Very High Resolution Radiometer
AVOCH	Association des Volontaires pour les Œuvres, Chrétiennes et
BNETD	Bureau of Technical Studies and Development
BNETD / CCT	BNETD – Mapping and Remote Sensing Centre
BUMIGEB	Mines and Geology Department of Burkina Faso
BUNASOLS	National Department of Soils
CBRST	Benin Centre for Scientific and Technical Research
CCFCC	Cocoa and Coffee Sector Coordinating Committee
CED	Centre for Ecology and Development
CENAGREF	National Wildlife Reserves Management Centre
CENAP	National Centre of Agro-Pedology
CENATEL	National Centre for Remote Sensing and Monitoring of the Vegetative Cover
CeRPA	Regional Centre for Agriculture Development
CERSGIS	Centre for Remote Sensing and Information Services
CIRES	Centre for Economic and Social Research of Cote d'Ivoire
CNRA	National Centre for Agronomic Research
CNTIG	National Committee on Remote Sensing and Geographical Information
COPAGRUM	Cooperative of Citrus Fruits and Perfume Plants Producers
CPS/MA	Planning and Statistics Unit of the Ministry of Agriculture
CRE	Centre for Ecological Research
CRE – LAMTO	CRE – Lamto Research Station
CRO	Oceanological Research Centre
CSIR	Council for Scientific and Industrial Research
CSRS	Swiss Centre for Scientific Research
CWSA	Community Water and Sanitation Agency
DAER	Direction de l'Aménagement et de l'Equipement Rural
DAGRI	Directorate of Agriculture
DANA	Directorate of Food and Applied Nutrition
DB	Data Base
DDSP	Regional Directorate of Public Health
DE	Directorate for Environment

Acronyms	Definition
DFRN	Directorate of Forestry and National Resources
DG Eau	General Directorate for Water
DGEAP	General Directorate for Pastoral Areas
DGFRN	General Directorate for Forests and Natural Resources
DGGR	General Directorate of Rural Engineering
DGHED	General Directorate for Water and Energy
DGPSA	Regional Directorate for Agricultural Projections and Statistics
DGR	Rural Engineering Directorate
DGRA	General Directorate for Animal Resources
DGRE	General Directorate of Water Resources
DGRH	General Directorate for Fisheries Resources
DGSCN	General Directorate for Statistics and National Accounts
DHAB	Directorate for Basic Public Health and Sanitation
DIE	Directorate for Information on Water
DISA	Direction de l'Informatique des Statistiques et des Archives
DM	Meteorological Directorate
DMN	National Meteorological Directorate
DNA	National Directorate for Agriculture
DNCN	National Directorate for Wildlife Conservation
DNH	National Directorate for Water
DNI	Directorate Responsible for the Interior
DNM	National Meteorological Directorate
DNP	National Directorate of Fisheries
DNPIA	National Directorate for Animal Productions and Industries
DNSI	National Statistical Directorate
DNSV	National Directorate of Veterinary Services
DOS	Disc Operating System
DPIF	Directorate of Production and Forestry Industry
DPP	Direction de la Programmation et de la Prospective
DPP	Directorate of Planning and Programming
DRAHRH	Regional Directorate for Agriculture, Water and Fisheries Resources
DRGM	Directorate of Mineral and Geological Resources
DSID	Directorate of Statistics, Computerisation and Documentation
DSRP	Poverty Reduction Strategy Paper
DUA	Directorate of Town Planning and Sanitation
ECOPAS	Protected Ecosystems in Sudano Sahelian Africa
EDF	European Development Fund
EDST	Population and Health Surveys in Togo
EIE	Environmental Impact Study
EMMSDAG	Mapping and Monitoring Development Projects in Ghana
EPA	Environmental Protection Agency
FC	Forestry Commission
FEWS/NET	Famine Early Warning System Network
GEF	Global Environmental Facility

Acronyms	Definition
GIDA	Irrigation Development of Ghana
GIS	Geological Information Services
GIS	Geographic Information System
GMA	Ghana Meteorological Agency
GPS	Global Positioning System
GSS	Ghana Statistical Service
GWCL	Ghana Water Company Limited
HSD	Hydrological Services Department
ICAT	Institut de Conseils et d'Appui Technique
IDB	Integrated Data Base
IDESSA	Institut Des Savanes
IER	Institute for Rural Economy
IGB	Geographical Institute of Burkina
IGM	Geographical Institute of Mali
IGN	National Geographic Institute
IGT	Institute of Tropical Geography
IMF	International Monetary Fund
IMWR	Integrated Management of Water Resources
INERA	National Institute for Environment and Agricultural Research
INOH	Inventory of National Water Works
INPHB – ENSA	Institut National Polytechnique Houphouët Boigny – Ecole Nationale Supérieure d'Agronomie
INRAB	National Agricultural Research Institute of Benin
INS	National Institute of Soils
INSAE	National Institute of Statistics and Economic Analysis
INSD	National Statistics and Population Institute
IRD	Institute of Development Research
ITRA	Institute of Agronomy Research of Togo
LANADA	National Laboratory for Animal Nutrition
LSSEE	Laboratory for Soils, Environment and Water Sciences
MAEP	Ministry of Agriculture, **Livestock** and Fisheries
MAHRH	Ministry of Agriculture, Water and Fisheries Resources
MDA	Ministries, Departments and Agencies
MDEF	Ministry of Finance and Economic Development
MDPRCTATTP	Ministry Responsible for Air and Land Transport and Public Works
MECCAG-PDPE	Ministry in charge of coordination of Government Action, Planning, Development and Promotion of Employment
MECV	Ministry of Environment and Living Conditions
MEE	Ministry of Energy and Water
MEPN	Ministry of Environment and Nature Protection
MEPS	Ministry of Primary and Secondary Education
MERF	Ministry of Environment and Forestry Resources
MERH	Ministry of Water and Water Resources
MOFA	Ministry of Food and Agriculture

Acronyms	Definition
MS	Ministry of Health
NADMO	National Disaster Management Organisation
NDPC	National Development Planning Commission
NGOs	Non-Governmental Organisations
ODEF	Forestry Commission
ONAB	Commission on Lumber
ONEA	National Department for Water and Sanitation
ONG	Organisation Non Gouvernementale
OPV	Commission for Plant Protection
ORSEC	Disaster Relief Organisation
ORSTOM	Centre for Scientific and Technical Research for Overseas Countries
PACIPE	Technical Assistance Programme on Communication and Information for Environmental Protection
PADEB	Support Project for Animal Farming in Borgou
PADES	Assistance Programme for Social and Economic Development
PAGEV	Volta Water Governance Improvement Project
PAMGE	Support Project for Water Management and Control
PAPPI	Project for the Development of Small Scale Irrigation
PARS	Regional Programme of Action for the fight Against Drought
PCU	Project Coordination Unit
PDF-B	Project Development Fund B
PDRIS	Integrated Rural Development Project in the Savannah Region
PET	Potential Evapotranspiration
PGFMR	Project for Fire Management in Rural Areas
PGIFS	Project for the Integrated Management of Soil Fertility
PNR	National Rice Project
PPDEA	Programme for the Promotion and Diversification of Non Traditional Agricultural Exports
PPMR	Multi Annual Mrico Achievement Programme
PROMEXA	Non Traditional Agricultural Exports Promotion Company
PWS	Potable Water Supply
QUIBB	Questionnaire on Basic Welfare Indicators
REI	Impact Study Network - ANADER/Headquarters
RGPH	General Population and Housing Census
RIPE	Computerized List of Environmental Projects/Programmes
RNET	National Water Company of Togo
SATMACI	Technical Assistance Company for the Modernization of Agriculture in Cote d'Ivoire
SBEE	Société Béninoise de l'Energie Electrique
SCDIOPEau	Information Collection and Dissemination Section, Water Management Agencies and Police
SDBME	Sector Data Base on Mines and Environment
SIGMA	Computerized System for Water Resource Management in Mali
SIG-OMD	GIS Tool for Planning Millennium Development Goals

Acronyms	Definition
SIRAIB	Institutional Structure for Action Research and Support for Grassroots Initiatives
SISE	Information and Environmental Monitoring System
SISEI	Information and Environmental Monitoring System on Internet
SNIE	National Information System on Environment
SNIEau	National Information System on Water
SNIST	National Information System on Earth Sciences
SODEFEL	Fruits and Vegetable Development Company
SODEFOR	Forest Management and Development
SODEPRA	Animal Production Development Company
SODEXAM	Société d'Exploitation aéroportuaire et Aéronautique en Météorologie
SONEB	Société nationale des eaux du Bénin
STP/CIGQE	Permanent Technical Secretariat of the Institutional Framework for the Management of Environmental Issues
TDA	Transboundary Diagnostic Analysis
TdE	Togolaise des Eaux
UAA	Université d'Abobo-Adjamé
UAC	Université d'Abomey Calavi
UNOPS	United Nations Office for Project Support Services
UONTO	Union of NGOs in Togo
VBA	Volta Basin Authority
VBRP	Volta Basin Research Project
VLTC	Volta Lake Transport Company
VRA	Volta River Authority
WRC	Water Resources Commission
WRI	Water Research Institute
WRIS	Water Resources Information Institute

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Foreword

This report is the synthesis of sectoral studies conducted in six (6) countries in the Volta Basin as part of the establishment of a regional system for exchange of information and data on the Volta Basin. It is made up of two documents:

The first provide a status report on existing information and data in countries of the Volta Basin. It presents an inventory of national institutions which deals with environmental data and information on the basin and could contribute to the establishment of a regional system of exchange of information and data. Their constraints as well as needs have been recorded.

The second document outlines the framework of a strategy for the establishment of regional system for exchange of information and data on the Basin, including its institutional component, operational plan and budget.

The operationalisation of the information and data exchange system will depend on the approval of proposals made in this report.

1 General Background

1.1 Context and Justification

1. Today, the growing control of human beings over the environment is raising issues of its vulnerability and threats to its integrity and more generally, its transformations as a result of various anthropic pressures. This in turn poses new dangers to humans that are worth assessed. The areas concerned are climate change, trends in the continental biosphere, plant and animal biodiversity, areas where anthropic pressure is raising fears that may become a reality in some few years to come.

2. Meanwhile, protection of the environment, or at least its sustainable management, has been at centre of major efforts both at the level of scientific and technical research as well as the implementation of appropriate programmes and projects on the ground. The results in terms of products or data constitute an important and unique scientific as well as technical asset for development in general and environmental management in particular.

3. In the case of the Volta Basin, there are currently no mechanisms for the exchange of essential data and information for the management of the basin. Meanwhile, access and use of data and information on transboundary basins for various purposes by riparian countries are necessary for the development of management tools and implementation of scientific activities.

4. This study therefore has helped in establishing the state of various works, mapping data, studies and researches conducted in the basin and developing a system for data and information circulation. This information system will enhance the formulation of projects. The gains and experiences will not only improve the institutional capacity of countries but also inform future actions to be implemented and serve as a basis for shedding more light on policies of countries in the Volta basin in terms of protecting and safeguarding natural resources.

5.

1.2 Objectives of the study

6. The main objectives of the study are to:

- Compile and inventory and conduct an analysis of national and regional data available on the basin
- Develop a plan to train national institutions in data management
- Establish a system for the circulation of regional and national data and information.

1.3 Methodology

7. To implement this activity, the United Nations Office for Project Support Service commissioned six national consultants (one for each country) to establish a status report on available national data and information, realities, constraints, and institutions holding such data and information and a regional consultant to provide this regional synthesis and develop a system for the circulation and exchange of information among all stakeholders.

8. The approach adopted by the regional consultant for the preparation of this reports is as follows :

- Identification and preparation of matrices for relevant groups of data to be collected
- Preparation of a format for drafting national reports
- Review and synthesis of national reports

2 General Context of the Basin

2.1 Geographical and socio-economic context

2.1.1 Geographical situation and administrative demarcation

9. The catchment area of the Volta stretches from North to South over a distance of 1850km^2 with a basin covering an area of 400 000 km^2. It is the ninth most important lake river basin in Sub Saharan Africa. It covers six countries, namely, Benin, Burkina Faso, Cote d'Ivoire, Ghana, Mali and Togo.

10. The area of the basin is unevenly distributed among the countries (see Table 1). It is very wide in Burkina Faso (42.9%) and in Ghana (41.6%), quite significant in Togo (6.41%), Benin 3.41%), Mali (3.2%) and narrow in Cote d'Ivoire (2.48%).

11. It stands out therefore that Ghana and Burkina Faso (Figure 1) have a greater responsibility in the sustainable and viable management of the basin. However, the relative proportion of the area of the basin in a country does not necessarily correspond to the relative importance of the section of the Basin in relation to the entire national territory.

Table 1: Distribution of the Basin on country basis

Country	Total area of the country (km^2)	Area of the basin within the country (km^2)	% in relation to the total area of the basin (%)	% in relation to the total area of the country (%)
Benin	112 620	13 590	3.41	12.1
Burkina Faso	274 000	171105	42.9	62.4
Cote d'Ivoire	322 462	9890	2.48	3.1
Ghana	238 540	165830	41.6	70.1
Mali	1 240 190	12430	3.12	1.0
Togo	56 785	25545	6.41	45.0
Total		**398390**	**100**	

Sources: Volta Basin Authority

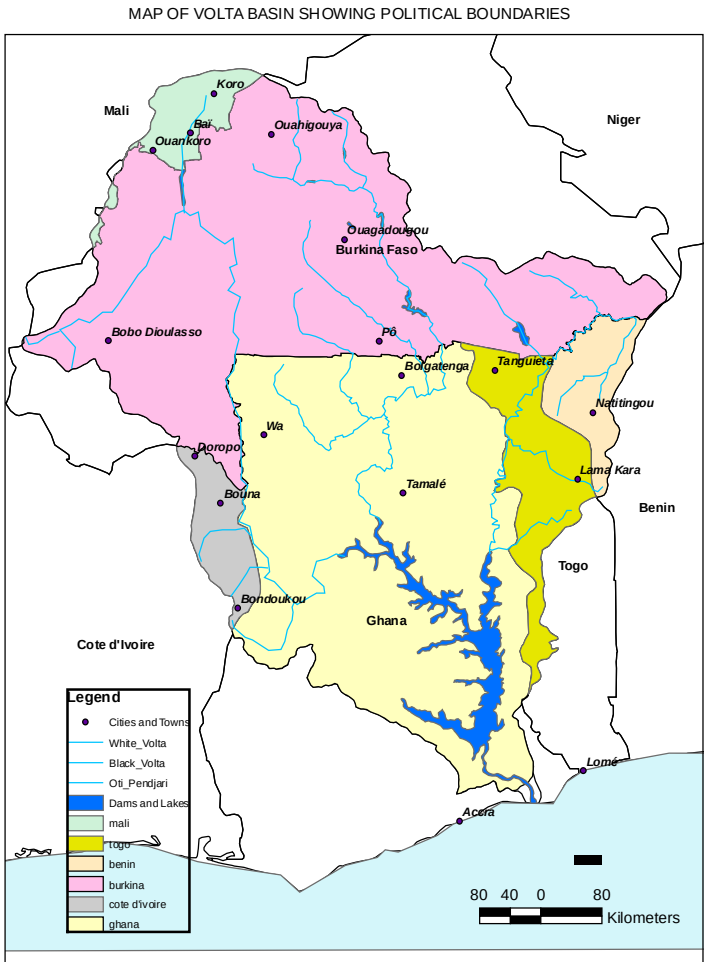

Figure 1: Configuration of member countries of the VBA and their respective portions in the basin

2.1.2 Population and socio-cultural context

12. The population is estimated to reach about 24 million people in 2010 with a growth rate of 2.54% per annum (Tableau 2). The distribution of the population varies, with the density ranging from 17 inhabitants /km^2 in Cote d'Ivoire for example to 97 in Togo. Nearly 80% of the basin's population depend directly on indirectly on basin's resources. The population lives mainly on farming, livestock production and fishing which are the major economic activities. It is obvious that the greater proportion of the population is in the two main countries of the Basin i.e. Burkina Faso and Ghana.

13. The basin area is also marked by high level of migration due sometimes to the social culture, (Fulani herdsmen as a result of the transhumance phenomenon are spread across the entire region, the same applies nomad population in Cote d'Ivoire and Mali) but mostly to the quest for arable land. The onchocerciasis free zones account for low population density in some portions of the Basin.

14. There is a whole range of diversity and cultural intermixing among populations of the basin, with a high tendency of people migrating from the North to the South in search of employment and arable land.

Table 2: Distribution of the Basin's Population on Country Basis

Country	1990	2000	2010	2020	2025	Growth Rate (%)	P/km² Density		
						2000	2000	Urban %	Rural %
Benin	382,328	476,775	596,000	746,000	820,000	2.27	43.4	36	64
Burkina Faso	7,014,156	8,874,148	11,227,366	14,204,605	15,997,351	2.38	41.53	22.6	77.4
Côte d'Ivoire	-	397,853	497,469	632,313	717,672	2.53	8 - 22	23	77
Ghana	5,198,000	6,674,376	8,570,068	11,004,185	11,696,054	2.5	26 - 104	16	84
Mali	380,000	625,000	880,000	1,140,000	1,260,000	2.78	45 - 75	12.2	87.8
Togo	1,189,900	1,594,446	2,153,719	2,891,457	3,385,266	2.80	66	30	70
Total	**14,474,276**	**18,642,598**	**23,924,622**	**30,618,560**	**33,876,343**				
Average						**2.54**	**48.49**	**23.30**	**76.70**

Source: TDA

2.1.3 Major economic activities

15. The major economic activities range from farming, predominantly cotton farming in Burkina Faso, to fishing, livestock breeding, lake transport, mining, trading and forestry activities. In the case of Burkina Faso, for example, the basin holds the most important industries and many gold mining sites as well as the biggest dams in the country.

16. **Farming in the Basin:** It is subsistence and rain fed farming of food crops (rice, groundnut, millet, sorghum starchy foods) in some cases and cash crops in others**.** With regard to cotton farming, it has been practised for a long time with a relative specialization and consolidation in the northern part of the basin.

17. **Livestock production in the Basin:** It is an important activity in the Basin's economy and an important source of revenue for rural dwellers especially. Some data collected in the countries highlights the pastoral calling of the Basin but in spite of its importance, the livestock sector is still marked by the extensive mode of production and traditional management of grazing lands where natural fodder is the main source of feed aside harvest waste. There is, however, some improvement in livestock production in peri-urban areas.

18. **Fishing in the Basin:** Fishing activities in the Basin are rudimentary. The fishing is done at sea along the coast or in water bodies. In the big lakes such as Kompienga, Bagre in Burkina Faso and Akossombo in Ghana, it generates substantial revenue for the people and only major centres are supplied.

2.2 General information on the biophysical environment and water resources

2.2.1 Relief and slope

19. The relief of the basin is generally low with varying degrees of slopes. While there are

plateaus in the northern part, there are very varied rocky formations in the south and south west made up of a chain of mountains with heights ranging from 200 to 900 metres. The average altitude is about 257 m. Over half of the basin falls within the later category. Table 3 below presents some features of the relief in this portion of the Volta basin.

Table 3: Some features of the relief in the basin

Altitude in m	Black Volta	White Volta	Oti	Main Volta
Minimum Altitude	60	60	40	1
Maximum Altitude	762	530	920	972
Average Altitude	287	270	245	257

Sources: TDA

2.2.2 Geology, hydrogeology and soils

20. Once again, the South-East costal areas (Togo and Benin) of the basin have the same features in terms of geology and soils (Figure 2). In this part, the geology of the Volta basin is essentially made up of the following geological formations: Archean formations, the Dahomeyan series of upper proterozoic, Atacora series, Buem series as well as formations of the upper cretaceous period.

21. The Dahomeyan series is made up of late metamorphic Archean rocks under granulite and amphibolites facies conditions.

22. The Buem series is subdivided based on its lithology into two groups: Korontier group and Manta group.

23. The formations of the early cretaceous period rest on very dislocated Precambrian rocks with very pronounced angular discordance.

24. Further south and south west and a little in the north of the basin, however, there is a complete collection showing the basement inherited from the eburnean orogenesis which affected Africa during the proterozoic period.

25. The hydro geological context is marked by aquifers which are widespread but under varied storage and accessibility conditions. In addition, there are difficulties in assessing correctly these water resources.

26. The types of soil across the basin are: ferralitic soils, iron-bearing soils, tropical iron-bearing soils, gross mineral soils, less developed soils, vertisols and paravertisols, eutrophic mull or brown soils, hydromorphic soils, iron and manganese sesquioxyde soils, sodic and salsodic soils. .

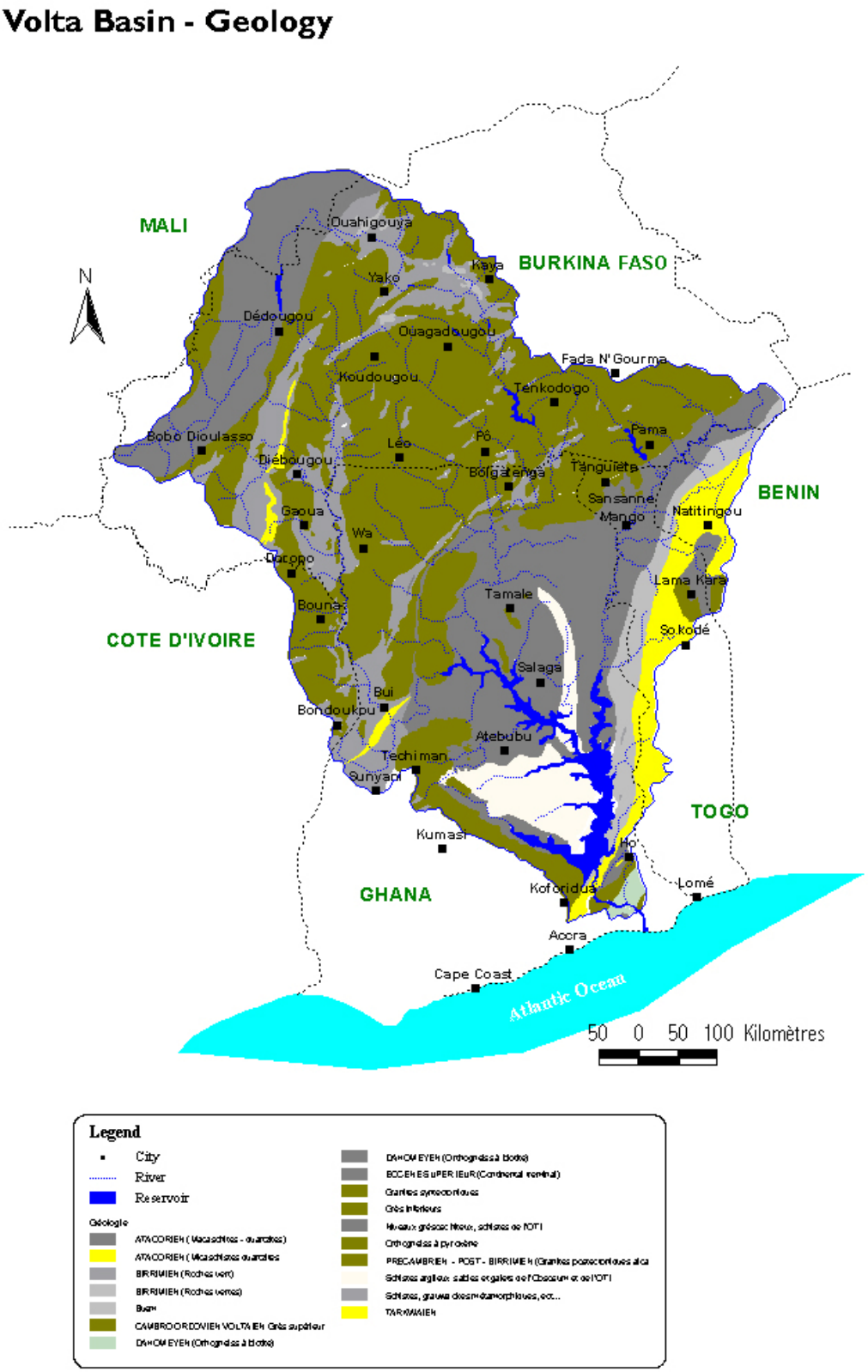

Figure 2: Volta Basin Geology

2.2.3 Climate

27. There are three types of climate in the basin :

- In the North, the climate is a tropical type with a unimodal rainfall regime comprising a dry season and a wet season. The dry season lasts from November to April and the rainy season from May-June to October with its peak in September.
- In the South, there are two closely related types of climates, one being of the humid type similar to bimodal subequatorial Guinean climate with two rainy seasons, the second is the Sudano Guinean type with a transitional period between two rainy seasons.

28. In all three cases, the average rainfall ranges from 300mm in Mali to 1500mm in Togo. These three types of climate record different temperatures: the annual average temperature varies from 28° C to 36° C and can reach 43° C to 45° in April-May. In both cases, the lowest temperature recorded ranges between 15° C and 20° C.

29. The other parameters of the climate are as follows

- The average duration of sunshine ranges between 6.62 and 8 hours a day.
- The annual average evapotranspiration ranges from 2500mm/annum in North of the basin to 1500 mm/annum in the coastal area.
- The relative humidity ranges between 90% for the maximum values and 28% for the minimum values.
- The average wind speed ranges from 1,93m/s to12 m/s

Table 4: Climate in the Volta Basin

Country	Rainfall				Temperature			
	Av.	Min	Max	Normal	Av.	Min	Max	Normal
Benin				1164 1340	28	15	41	
Burkina Faso	750	400	1100		28	13	43	
Cote d'Ivoire				1154 1174	25	10	40	
Ghana	1220	876	1565		25,5	23	28	
Mali	500	300	700		29	15	43	
Togo	1300	1000	1600		26	24	28	

2.2.4 Hydrography

30. The Volta Basin is drained by the following major rivers: River Mouhoun, Nakanbe and Nazinon formerly known respectively as Black Volta, White Volta and Red Volta and their tributaries, River Oti as well as Lower Volta. While River Oti with a permanent flow has its source in the Benin hills at an altitude of 600m, rivers Mouhoun, Nakambe and Nazinon all have their source in Burkina Faso. The table 5 below presents the state of major water bodies on country basis.

31. It is worth noting the major projects executed to mobilize surface water in the basin, namely :

- Sourou (300.10^6 m^3), Ziga (200.10^6 m^3), Kompienga (2050.10^6 m^3), Bagré (1700.10^6 m^3) in Burkina Faso,
- Akossombo (150.000.10^6 m^3), Kpong (105.10^6 m^3) in Ghana,
- Kara in Togo.

Table 5: Major water bodies in the Basin

Number	Country	Major Water Bodies	Area in km^2	Length in km
1	Benin	Pendjari Kara Kéran Binao Koumangou	1340 6192 2337 1047 3464	440 31 77 32 59
2	Burkina	Mouhoun Nakanbe Nazinon,	91 036 81 932 172968	997 592 343
3	Cote d'Ivoire	Cavally Sassandra Bandama Comoe	15000 67000 - 57300 139300	700 650 1050 1160
4	Ghana	Lower Volta White Volta Black Volta Daka Oti	59414 45804 35107 9174 16213	489 1098 1361 412 904
5	Mali	Sourou	-	80
6	Togo	Oti	-	176

2.2.5 Vegetative cover

32. The vegetation in the basin can be divided into four categories :

- Wooded and grassy steppes area in the extreme north of the basin ;
- Wooded and grassy savannas which cover Burkina Faso, Northern Togo and Benin;
- Wooded and grassy savannas with humid forests which occupy South West of Burkina Faso and the greater part of Ghana, Togo and Benin ;

- The dense forests which cover the southern belt of Ghana and the eastern belt of mountains in Togo.

2.3 Major environmental problems in the Volta Basin

33. An analysis of major environmental problems in the Volta Basin helped to draw the following conclusions (Table 6) :

- The combined effects of drought recurring for more than three decades and growing demographic pressure have led to serious threats to the ecological balance of the areas. The effects are :
  - Silting-up of lakes due to the acceleration of various types of erosion ;
  - Deforestation leading to land degradation and loss of biodiversity;
  - Extinction of animal and plant species in some areas and the appearance of invasive plant species (water hyacinth) in lakes and other water bodies.
- These environmental problems and major risks exist in varying degrees in all countries of the basin. These problems are mainly due to a growing population living in increased poverty and compelled to exploit in an abusive manner natural resources for their survival and to move to marginal lands. This imprudent use of resources in the basin is attributed, among others, to lack of equity in the distribution and access to resources. Besides, the development of small and large scale water works in all the riparian countries in the basin has led to significant changes in the environment, mode of consumption and livelihoods of people living upstream and downstream these projects.

34. The table of major problems in the basin gives an overview of major challenges and constraints that development actors must address in order to achieve sustainable improvement in the living conditions of people.

35. To attain this objective, communication and exchange of data and information among countries within the basin are very essential. This involves on one hand, knowing the reliable data and statistics available on the basin that could help monitor and address these problems and on the other hand, the operationalisation of a regional system for exchange of data and information on the basin as proposed within the framework of this consultation.

Table 6: Summary of major environmental problems in the basin by theme

Theme		Diagnostic
Climate Change		Drought High rainfall variability Floods
Water Resources		Pollution of water tables
		Reduction in the availability of water resources (Disruption of the hydrological regime, depletion of underground water tables)

		Degradation of wet lands
		Silting-up/drying up of lakes and water bodies
		Disappearance of permanent ponds
		Invasive plants / loss of ecological functions of the ecosystem
Soil Resources		Land degradation (Formation of glacis, sand dune and salinisation)
		Reduction in soil fertility
		Water and wind erosion
Plant Resources		
		Occupation of pastoral land by farmers
		Deforestation, clearing
		Colonisation of areas by xeric and/or useless species
		Loss of biodiversity
Wildlife and floral Resources		Degradation and depletion of wildlife and fisheries resources
Marine Resources		Pollution of sea waters
		Degradation of costal areas
Urban areas		Increased Urbanization Pollution Urban waste

3 State and Analysis of Data and Information available on the Basin

3.1 Institutional mechanisms for data collection and management

36. Most of the institutional mechanisms for collecting data on the basin are managed by government agencies which most often collect, analyze and store data both up stream and down stream. These agencies are essentially ministerial departments.

37. The ministerial designations are the same in almost all the countries, these are key ministries in charge of environment, agriculture, mines, water, finance for socio-economic data as well as data on public works, energy, livestock production and fishing.

38. Keys ministries such as ministries of environment, agriculture and livestock have regional and district offices depending on the countries, but there is lack of technical and financial resources to ensure comprehensive and regular collection of data for which they are the main depositaries.

39. In all the countries, the mechanisms for data collection can be divided into three categories: public or state structures comprising government or ministerial departments, parastatal sources which have a national component in the funding of their activities and the category of private agencies, NGOs and associations. This last category provides private services directly to local populations and is often not known by public authorities. Under this study, only public and parastatal data will be considered as matter of priority.

40. Several observations were made on how these mechanisms function and are organized:

- Most of them operate in isolation without any institutional arrangement for coordinating data production and collection; this raises issues of coherence, reliability and quality of data.
- Data collected on the field during surveys, and recordings made by measuring instruments are kept in hard copies though sometimes small computer units are available.
- Most of the data on the basin are in analogue format, which does not facilitate the exchange and optimum use of the data. Efforts must be made to digitize data on the basin, particularly within the framework of the planned regional exchange system which gives precedence to digital methods.
- Updating of data is a problem due to the exorbitant costs of data collection and sometimes to political conflicts as was the case in Togo and Cote d'Ivoire.
- 40. Finally, there is also the problem of lack of norms and standards in data production, making the data non comparable and non superimposable for purposes of analysis. This is a general problem in the entire basin, however, it is worth noting the laudable initiative by Mali through its Permanent Technical Secretariat of the Institutional Framework for the Management of Environmental issues which tries to harmonize the various sector orientations and all interventions in terms environmental information management and Burkina Faso which conducted as far back as 1996 an exercise to standardize concepts for the production of data on land occupation. On the whole, there is the need to adopt norms and standards or reorganize some types of data to make

them comparable and superimposable. Table 7 provides the list of major institutions responsible for environmental data collection.

Table 7: Groups of data collected by national institutions

Country	Sector of activity	Data and information produced	System of data collection	Institutions
BENIN	Agriculture	- Agro-pastoral Statistics - Statistics on agricultural input	- Field survey - Census	MAEP, DANA, CENATEL, INSAE, INRAB, DAGRI, Dir of livestock farming , Dir. of waters and forests
	Water	- Statistics on village water systems - Statistics on urban water systems - Hydrology and hydrogeology - Chemical and physical quality of waters - Statistics on dammed waters	- Census - Measuring instruments - Scale reader - Taking samples and testing - Census	General Directorate for water , SONEB
	Energy	- Statistics on hydrocarbon consumption	- Measuring instruments - Meters - Census	SBEE, General Directorate for Energy SONACOP.
	Meteorology	- Statistics on climate - Statistics on air navigation parameters	- Measuring instruments - Scale readers	ASECNA
	Basic information on remote sensing and mapping	- Inventory of basic topographic maps - Inventory of satellite images - Inventory of aerial photos - Inventory of thematic maps	- Mapping Fund - Ecological and forestry inventory - Census	IGN, CENATEL, CENAP OBRGM
	Land allocation and	- Statistics on biodiversity - Statistics on land occupation	- Census - Field surveys - Ecological and	Dir of water and forestry, INSAE, CENATEL, UAC

Country	Sector of activity	Data and information produced	System of data collection	Institutions
	forestry		forestry inventory	
	Socio – Economic	- Statistics on population - Statistics on economic analysis - **Surveys** - **Modular**	- Census - Field surveys - Inventory of activities	INSAE, MAEP and other key ministries, UAC, UP
	Hygiene	- Information on hygiene ; Promotion of autonomous sanitation - Control of standards and directives on hygiene and sanitations ; - Control of vectors	- Census Execution of sanitation projects	DHAB, CREPA
MALI	Water systems	- Statistic on the flow of water bodies, rise in water levels - Technical features of modern water sources (boreholes, water tanks, wells, drinking water pipelines and stand pipe) - Socio-economic data - Statistical data on water quality	- Measuring, observations - Field surveys	DNH
	Agriculture	- Agricultural statistics - Statistics on agricultural inputs	- Field surveys	CPS/MA – DNA, DNPIA, DNSI
	Livestock production	- Livestock statistics - Statistics on animal production	- Field survey - Census	CPS/MA – DNPIA, DNSI
	Forestry	- Statistics on plant formations, their production and productivity - Cubage of wood - Volume and types of wood available	- Inventory - Surveys	DNCN

Country	Sector of activity	Data and information produced	System of data collection	Institutions
	Climate	- Rainfall - Temperature - Humidity - Sunshine - Wind - Evaporation	- Measuring Observations	DNMeteo
COTE D'IVOIRE	Environment forestry Institutional framework for policy and management of environmental and water resources ; Environmental Impact Studies	- Area of formations - Plants - Type of land occupation - Species – degraded/ replanted areas - Assessment of water resources	From institutions keeping these data	Ministry of Environment , Water and Forestry de DRE -DPIF – DISA ANDE
	Hydrometric measurements Potable Water Systems	- Flow, temperature, depth of runoff	Analogue recordings by stations at various sites	Ministry of Economic Infrastructure (MIE) DHH (*direction de l'hydrologique humaine*)
	Agricultural data, development of sustainable agriculture	- Areas, production,- rate of land occupation	Field survey	Ministry of Agriculture (PNR)
	Livestock and fish production	- Livestock,	Field data, site visits	Ministry of Animal Fisheries Resources (DGERA)
	Economic activities	- Project Data	Field data	Ministry of Finance and Economic Planning
	General administration	- Administrative data	Field survey (collected from people)	Ministry of the Interior and Decentralization

Country	Sector of activity	Data and information produced	System of data collection	Institutions
	Design, development and planning of national policy for development programmes	- Statistics on social and economic life (education, health agriculture, cattle breeding ...)	Field survey (collected from people)	Ministry of Planning and Development
	Mineral resources	- Production Tonnage, gold, diamond, ...	Field data	Ministry of Mines
	Health Infrastructure -number, level of patronage, coverage rate	- Prevalence of diseases in the region, number of births, mortality, morbidity rate	Field data	Ministry of Public Health and Population (INHP) (INSP)
	Forestry – Environment	- Species -types	Field Research	Université d'Abobo-Adjamé
	Environment, socio economy, climate	- Theses, memoires, research findings	Evaluation, field survey	Université de COCODY (IGT) (FSE) (CURAT) (IES)
	Forestry – water –soil Socio economic	- Quantitative and qualitative assessment of resources (Area of plant formations – type of land occupation)	By satellite imaging Field survey Aerial Photos	National Committee for Remote Sensing and Geographic Information (CNTIG)
	Forestry change in the allocation of lands, water , socio economic	- Area of plant formations	By satellite imaging	BNETD / CCT
	Forestry	- Species – replanted/degraded areas	By satellite imaging Field data	SODEFOR
	Climate	- Rainfall – temperature - wind	Field data	SODEXAM
	Population	- Census (socio-economic data on the population)	Surveys	INS

Country	Sector of activity	Data and information produced	System of data collection	Institutions
	Socio-economic data	-		CIRES
	Agricultural Research-Agricultural statistics extension services	- Coverage rate – production rate	Field survey and data	ANADER
	Mineral Prospecting	- Location of mineral deposits	Prospecting	SODEMI and Geology
	Research : Climate -vegetation – soil -water Socio-economic	- Area of plant formations –soil occupation	By satellite imaging Field data	IGT
	Forestry – Change in land allocation	- Species – degraded/replanted areas	Field	CNRA
	Change in land allocation	- Environmental	Field	CRE - LAMTO
	Forestry	- Species – areas	Field	CNRA (ex IDEFOR)
	Vegetation – Pedology	- Area of plant formation – pedology	Field	CNRA (ex-IDESSA)
	Forestry/ biodiversity	- Species – areas	Field Research	CRE
	Forestry - Agriculture	- Species – areas	In situ	INHP/ENSEA
	Forestry – Artificial lake	- Species – areas	Field survey	CRO
	Changes in land allocation and socio-economic situation	- Human Development Research and Natural Resources	Field data	CSRS
	Water policy	- Sampling	Field	CIAPOL
	Forestry, water, soil, environment, socio economic situation	- Reports, statistics , results from publications	Field data by a network of institutions (partners)	Environmental or economic assistance NGOs

Country	Sector of activity	Data and information produced	System of data collection	Institutions
	Forestry, water, soil, socio economic situation ,	- Reports, statistics , results from publications	Field data by a network of institutions (partners)	Research Centres (IRD) Research and consultancy firms International, regional organizations
GHANA	**WATER CYCLE**	- - Rainfall, Temperature, Evapotranspiration, Humidity, Wind , Soil Temperature	-	Ghana Meteorological Agency
		- Level of water in rivers and **discharge**	-	Hydrological Services Dept.
		- Quality of surface water	-	Hydrological Services Dept. & Water Research Institute (WRI)
		- Sediment discharge	-	Hydrological Services Dept.
		- Soil Humidity	-	Water Research Institute
		- Data on ground water	-	Water Research Institute
		- Flora & Fauna in aquatic ecosystems	-	Water Research Institute
		- Quality of groundwater	-	WRI/CWSD
	PHYSIO-GRAPHIC	- Topography	-	Survey Dept.
		- Drainage, lakes, reservoirs	-	Survey Dept.
		- Plant and Animal Species	-	Forestry Commission
		- Soils	-	Soil Research Inst.
		- Land occupation/land use	-	Forestry Commission, CERSGIS, EPA
		- International, national, regional and	-	

Country	Sector of activity	Data and information produced	System of data collection	Institutions
		provincial boundaries and boundaries of the river basin		Survey Department; CERSGIS
		- Geology	-	Geological Survey Dept.
	SOCIO-ECONOMIC	- Population	-	Ghana Statistical Services of MFEP
		- Shelter (Urban & Rural)	-	Ghana Statistical Services of MFEP
		- Routes	-	Ghana Highway Authority, Dept of Urban & Feeder Roads
		- Water infrastructure (water supply, irrigation, hydro-power, and navigation)	-	GWCL, CWSA, GIDA, VRA, VLTC.
		- Agriculture – harvest, livestock breeding, fishing	-	
		- Sources and use of energy	-	
		- Waste disposal and environmental sanitation	-	
		- Employment, agriculture, industry and mines, services	-	
		- Ownership right and land ownership	-	Traditional Authorities, Families, Individuals/Lands Commission

Country	Sector of activity	Data and information produced	System of data collection	Institutions
		- Farming systems		
BURKINA FASO	Forestry and forest seeds	- Data on rainfall, temperature, humidity, sunshine and wind - Data on water content of plants - Data on forestry species and seeds - Characteristics and location of settlements - Changes in vegetation, - Research data on the impact of human activities on flora and vegetation	Field Research	National Centre for Forest Seeds (CNSF)
	Forestry	- Strategy for the spread of forestry techniques Methodology for planning the developments of forest and forest plantations	Field Research Aerial photos Satellite Images	Directorate for ecological monitoring
		- Data on forest and wildlife resources : land occupation map in graded areas and lands, inventory map of Senegal acacia	Inventory Field Aerial photos	Forest Directorate
	Cartography	- Basic topographic data, national base of topographic data –BNDT – Aerial pictures – Geological Network –BDOT	Research Field Aerial photos Satellite images	Geographic Institute of Burkina (IGB)
	Sols / Occupation des sols	- Soil data – Soil maps soil aptitude maps, land occupation map, land degradation map	Research Field Aerial Photos Satellite images	National Bureau of Soils
		- Administrative, population and socio-	Field survey	National Statistics and

Country	Sector of activity	Data and information produced	System of data collection	Institutions
	Socio-economic situation	economic data, national accounts- data base on localities in Burkina Faso , - BDLB	Computerization Research	Population Institute
	Land occupation/vegetation	- Analysis and use of SIG data	Research Field Aerial photography Satellite Images	National Institute of Environment and Agricultural Research
	Physical geography	- Data on human and physical geography – land occupation map	Research Field Aerial photography Satellite Images	Geography Department of Université de Ouagadougou
	Development	- Development scheme, regional plans and economic regions	Field Research	
	Water resources	- Data on surface water, ground water, distribution and potentials	Research Field Aerial photography Satellite Images	General Directorate of Water Resource
	Mapping Socio-economic situation	- Data on land management - Data on maps - Data on vegetation - Aerospace supports - Data base on localities in Burkina	Research Field Aerial photography Satellite Images	National Land Management Programme
	Grazing land / animal resources	- Data base on biomass, pasture, grazing sites, transhumance monitoring	Research Field	Directorate for Land and Pastoral Sites Direction des
	Agriculture	- Statistics on agriculture, production and outputs	Field Survey	General Directorate for Agricultural Projections

Country	Sector of activity	Data and information produced	System of data collection	Institutions
	Climate	- Data on climate parameters (Rainfall, temperature, humidity, wind, atmospheric pressure, sunshine radiance, vapour pressure, evaporation, evapotranspiration, phenology , air quality, visibility, nature of clouds, hydrometry)	Field	Meteorological Directorate
	Mines	- Aerial and land data on geology, mining geophysics and geochemistry	Field	Department of Mines and Geology of Burkina Faso
	Urban Planning	- Data on landscape development and sanitation	Field Research	General Directorate for the improvement of living conditions
	Infrastructure	- Data on road infrastructure	Field	Land and Maritime Transport Directorate
	Urban statistics	- Digital data and definition of standards for human settlements	Field Research	Directorate of urban statistics analysis
	Mapping / Hydrology	- Research data on natural resources (water, soil, vegetation)	Research Field Aerial Satellite images	Development Research Institute
	Biodiversity	- Data on biodiversity conservation	Field	NATURAMA
	Agronomy	- Data on agricultural research	Field	CIRAD
	Health	- Data on health	Field	UNICEF
	Development	- Data on development plans and standard equipment for rational use of national resources ;	-	Ministry of Agriculture, Livestock Production and Fisheries Directorate of Rural Development and

Country	Sector of activity	Data and information produced	System of data collection	Institutions
TOGO				Implements (DAER),
	Mapping / Soils	- Inventory of studies, mapping soil conservation and restoration, testing of soil, plant, water and fertilizer samples	-	Department of Laboratories of Togo Institute of Agricultural Research (Soil land Mapping Division)) – ITRA
	Agricultural statistics	- Documentation and statistics on agriculture	-	Directorate of Statistics, Information and Documentation
	hydrogeology	- Studies and research on ground water and physical and chemical tests	-	Directorate of Geological and Mining Research (DRGM) and Directorate of Mining and Petroleum (DLMP)
	Climate	- Meteorological assistance to all economic actors in Togo, general policy for meteorological development, management and use of the entire meteorological network, coordination and harmonization all kinds of meteorological projects.	-	National Meteorological Directorate (DMN),

3.2 State of information systems available in the basin

41. There is a great potential of spatial data and information systems in the basin area (Table 8 and 9); in Ghana for instance, the greater part of the data is geocoded and therefore in digital format. The same applies to most data in Burkina Faso. This an important advantage to be considered within the framework of the exchange mechanism and future observatory of the basin. What remains is to address compatibility, geographical reference systems and format issues.

42. Tough the above data bases played an important role in decision making and planning at a point in time, majority of them do not have any mechanism for systematic update, thus, some have been are being kept as archives. They were most often developed as part of time bound projects in terms of financing without monitoring and projections for its use after the project. There is therefore the need to seize every opportunity for a regular update.

43. On the other hand, they are essentially sector related and in some cases very specialized. They are all regional or multi regional or provincial or multi provincial data. It is therefore difficult to combine all relevant data and information necessary for the management of the basin.

44. In addition, what is striking is the heterogeneous nature of the data and their spread among institutions as well as the absence of links between producers and users of the data. Each institutions collects its data and carry out its investigations based on its needs and resources without taking into account a reference framework in terms of production plan, harmonization of definitions, concepts, standards and nomenclatures. Data formats are different; the same applies to geographical references and collection tools. Even when the format are digital, they are produced with varied computer systems, making the exchange between system very difficult.

45. Finally, with regard to modalities for accessing these data, aside meteorological data, public institutions provide most of them free of charge upon a simple application addressed to officials of institutions responsible for the production. This is a great asset for the establishing and sustaining the future regional system for exchange of data and information.

Table 8: Data bases and information systems in the basin

Country	Name of data base or mechanism	Name of agency	Department
	CLIMBASE, designed for data on climate	National Meteorological Service	Ministry of Equipment and Transport
	SIGMA 2	Directorate of Water Schemes Mali	Ministry of Energy, Mines and Water
	HYDRACCES, hydrological and hydrometric data	National Directorate of Water	

Country	Name of data base or mechanism	Name of agency	Department
MALI	SIFOR, Forestry Information System	National Directorate for Nature Conservation	Ministry of Environment and Sanitation
	RIPE, Computerised Directory of Environmental Projects	Permanent Technical Secretariat of the Institutional Framework for Management of Environmental Issues	
	SIPSA, on livestock breeding and pastoralism in the Sahel	National Directorate of Animal Production and Industries	Ministry of Livestock Breeding and Fisheries
	AGRIBASE, agricultural data, sub sectors and agricultural production systems	Planning and Statistical Unit for Agriculture, Livestock Breeding and Fishing	Ministry of Agriculture
	MALI KUNAFON, on socio-economic data	National Directorate of Statistics and Computer Science	Ministry of Trade, Industry and Planning
GHANA	CLICOM for meteorological data	Ghana Meteorological Agency	METEROLOGICAL SERVICES AUTHORITY
	HYDATA designed for the management of hydrometric data	Hydrological Services Division	Ministry of Water Resources Works and Housing
	Ground Water for Windows (GWW), data base designed for the management of groundwater	Rural Water Division and WRI	
	CSPro (Census and Survey Processing).	Ghana Statistical Services	
	GIS databases	Survey Department	
	GIS databases	Geological Survey Department.	
	GIS databases	Environmental Protection Agency.	
	Oracle Database system	Volta River Authority	
	GIS databases and ERDAS Images	Centre for Remote Sensing and Information Services (CERSGIS)	
`	Ap3a SGBD version 5.2	Early warning project and Projection of Agricultural Production Ap3a)	AGRHYMET Regional Centre
	Project on « Adaptation to	AGRHYMET Regional	Support Project for

Country	Name of data base or mechanism	Name of agency	Department
BURKINA FASO	climate change for hydrological systems of Sahelian rivers and catchment areas of their tributaries	Centre	adaptation to climate change in the Sahel
	« HYDROM » : Hydrological data base of DGRE	General Directorate of Water Resources	Ministry of Agriculture, Water and Fisheries Resources
	« InvNat2005 » : Data base on the national inventory of national water and sanitation works (INOH 2005).	General Directorate of Water Resources	Ministry of Agriculture, Water and Fisheries Resources
	Data base « PIEZO » on monitoring piezometric data	General Directorate of Water Resources	Ministry of Agriculture, Water and Fisheries Resources
	« CASPEA » data base (Support Unit for Private Water and Sanitation Sect_	General Directorate of Water Resources	Ministry of Agriculture, Water and Fisheries Resources
	« BEWACO » : Data base on water resources of the DGRE	General Directorate of Water Resources	Ministry of Agriculture, Water and Fisheries Resources
	Data base on « Small dams »	General Directorate of Water Resources	Ministry of Agriculture, Water and Fisheries Resources
	Status of water resources in Burkina Faso, Future management measures and commitments	General Directorate of Water Resources	Ministry of Agriculture, Water and Fisheries Resources
	Monitoring systems for fisheries statistics	General Directorate of Fisheries Resources	Ministry of Agriculture, Water and Fisheries Resources
	« GEO-GIS'98 » : Data base on water resources and demand	National Department of Water and Sanitation (ONEA)	Ministry of Agriculture, Water and Fisheries Resources
	Data base of the central laboratory for water testing		
	Data base on « SOILS » of Burkina Faso	National Department of Soils (BUNASOLS)	Ministry of Agriculture, Water and Fisheries Resources
	AgriStat (Data base on agricultural statistics)	General Directorate of Agricultural Statistics and Projections (DGPSA)	Ministry of Agriculture, Water and Fisheries Resources

Country	Name of data base or mechanism	Name of agency	Department
	« BDLB » : Data base on localities in Burkina Faso	National Land Management Programme	Ministry of Agriculture, Water and Fisheries Resources
	BDOT : Data base on Land Occupation		
	Analysis of results of annual surveys on living conditions of households and poverty monitoring	National Statistics and Population Institute	Ministry of Economic Planning and Development /
	System for monitoring the contribution of the forestry sector to the national economy and poverty reduction	General Directorate of Nature Conservation	Ministry of Environment and Living Conditions
	Ecological monitoring and support system for sustainable management of forestry resources in the south west, east and west central regions	PROGEREF	Ministry of Environment and Living Conditions
	Production of basic maps for the development of the territory	Geographic Institute of Burkina (IGB)	Ministry of Infrastructure
	SNIE : National Information System on the Environment	Permanent Secretariat of the National Council on Environment and Sustainable Development (SP/CONEDD)	Ministry of Environment and Living Conditions
	SNIST : National Information System on Earth Sciences	Department of Mines and Geology of Burkina Faso (BUMIGB)	Ministry of Mines and Quarries and Energy
	BDSME : Sector Data Base on Mines and Environment	Department of Mines and Geology of Burkina Faso (BUMIGB)	
	« CLICOM » - « CLIMBASE » - « CLIDATA » Data bases on climate	Meteorological Service (DM) / Climate Department	Ministry of Transport
	- Data base on land occupation ARC-MAP - Data base on soils (Nil)	ITRA/DL/Soil and Mapping Division /AGHRYMET	
	Geological Data Base ARCVIEW GIS	Directorate of Mines	
	- Geodatabase Access	- Directorate of Planning	Ministry of

Country	Name of data base or mechanism	Name of agency	Department
TOGO	- Data base for the management of natural and environmental resources **(Togo Info)** - Data base for the management of forest resources (**STATFORBOIS)** - Data base for the organization of data on community infrastructure **(VIPS-PPMR et SYSGESS)**	- For the entire department - ODEF - PPMR	Environment
	- Data base for the storage and processing of data on water resources (**HYDROM**) - Data base for the management of water points in rural and semi-urban areas (**PROGRES)**	Directorate of Planning for Water Resources	
BENIN	SISEI	Benin Environment Agency (ABN).	Ministry of Environment
	BDI	General Directorate of Water	
	HYDRACCESS	ABN	Ministry of Environment
	Hydrom	ABN	Ministry of Environment
	PROGRES	General Directorate of Water	
	SSPRO	INSAE	Ministère Délégué chargé du Développement de la Prospective (Ministry in charge of Development

Country	Name of data base or mechanism	Name of agency	Department
			Research)
	MAPPING AND INVENTORY OF CLASSIFIED FORESTS IN NORTHERN BENIN	-	Ministry in charge of Rural Development
COTE D'IVOIRE	HYDROM, Manager of hydrological and hydrometric data	(DHH) Direction de l'Hydraulique Humaine (Directorate of Potable Water Schemes)	Ministry of Economic Infrastructure
	WATBAL (Water Balance Model) Manager of climate variation in case of climate change	Climate Change Project (GFL-2328-2724-4846)	Ministry of Environment, Water and Forestry
	SYGEPAS ; Système de Gestion du Patrimoine de la Santé	Directorate of Computer Science, Equipment and Maintenance	Ministry of Health
	Directory of energy statistics	Directorate of Energy	Ministry of Mines and Energy
		Directorate of Energy Movements	
	LOGAM ; Software for the Management of Meteorological applications	Data Bank Division of the Meteorological Directorate	Ministry of Economic Infrastructure
	ARCVIEW ; ARCGIS, Bandama Information System	Directorate of Water Resources	Ministry of Environment, Water and Forestry
	ARCVIEW, Forest development area below the 8th parallel	Directorate of Forestry Production and Reforestation (DPIFER)	Ministry of Environment, Water and Forestry
	MAPINFO, Project on Participatory Management of Natural Resources and Wildlife (GEPRENAF) for biodiversity management	Nature Directorate	Ministry of Environment, Water and Forestry
	General Population and Housing Census	INS (National Statistics Institute)	Ministry of Planning and Development

Table 9: Proportion of data bases per theme and per country

Themes Pays	Benin	Burkina Faso	Cote d'Ivoire	Ghana	Mali	Togo
Meteorology /climate	x	x	x	x	x	x
Type of soil	x	x (partial)	x	x	x	x
Vegetation		x	x	x	x	x
Water resources	x	x	x	x	x	x
Land occupation		x	x	x	x	x
Geology		x	x	x		
Geomorphology		x		x		
Demography	x	x		x		
Animal Resources		x				
Fisheries resources	x					
Administrative boundary	x	x	x	x	x	x
Socio- economic		x	x			

3.3 Review of data production programmes and projects

46. Environmental and socio-economic data on land and water degradation must be considered as data within the scope of sustainable development since they are obtained from strategic areas of sustainable development (Agriculture, environment, water and sanitation etc.).

47. Country reports show that structures concerned both at the level of sector ministries or related agencies operate one way or the other in these areas.

48. Thus, there are no projects in the basin that are essentially aimed at collecting and managing data specific to the basin. This the role future observatory will play to at least encourage regular production of data for monitoring resources in the basin.

49. There are state or parastatal projects which are implemented by governments in collaboration with their partners but they are mostly programmes to provide support to local communities for the management of natural resources or specifically, projects related to the development of water resources. Very few of them have a component on "data production and management" which is most often the preserve of governments. On the other hand, when it comes to international or sub regional research institutions that are engaged in data collection, one can mention IRD and former ORSTOM for data on soils and IUCN for biodiversity data, etc.

50. In view of the high cost of data production, some environmental data are produced with the support of external funding in the form of cooperation projects or others. Consequently, most of them face traditional post project problems such as the inability

of national beneficiary technical structures to systematically take over, especially in terms regular update, management and dissemination of the information.

4. Thematic Analysis and Diagnosis of Existing Data

4.1 Analysis of hydro-environmental data

4.1.1 Meteorological data

51. Meteorological data are part of the category of important primary data that is required by all countries especially within the current context of climate change. In fact climate data are used in early warning systems in the area of food security and are taken into account in agricultural projections.

52. In the Volta Basin, the network of meteorological observation is made up of thirty-nine (39) synoptic stations, (74) climate stations, (73) agro-meteorological stations and (484) rainfall stations (Table 10) with some being more specialized than others.

53. The conversion of all these data into spatial data on the entire basin has brought out areas that need to be covered by either rainfall stations or posts. Nevertheless, in terms of observation, monitoring and coherence of data, it is advisable that each national portion of the basin is covered by close climate posts irrespective of its area and importance.

54. A review of the table above shows that the density of the network varies from one country to the other, but given the total area of the basin (approximately 400 000 $km^{2)}$, it is obvious that the current network is largely inadequate for a correct characterization of climatic phenomena in the basin. The synoptic stations remain the most important as they helped in recording various climatic parameters compared to other types of stations (Table); however, they are very few in the basin due to their high acquisition and maintenance costs.

55. In some areas of the basin, some posts have broken down or are obsolete and optimum environmental conditions are not observed to ensure optimum operation of some posts.

56. The other peculiarity of meteorological data in some countries is that they attract fees. This is the case in Burkina, Cote d'Ivoire and Ghana. The cost may appear minimal for a set of data but when large areas and various parameters and long periods are involved the cost may become very high.

57. On the whole, and compared to other types of data, meteorological data are the most monitored. In some stations, records date back to the beginning of the century. In fact, the early rainfall data date as far back as 1902, but the onset of data collection is disparate in the basin, 1921, 1950 and 1960. In spite of the delay in the collection of some data, there is some regularity in data collection despite the precarious means available. Almost all the data have been collected until 2007 -2008.

58. Given that all the country are members of the World Meteorological Organization, meteorological data are managed and processed with the same computer software, leading to some harmonization and coherence in this area, an important advantage for the exchange process.

Table 10: State of the meteorological observation network in the basin

Country	Number of synoptic stations	Number of rainfall posts	Number of climate stations	Number of agro-meteorological stations
Benin	1	4	1	1
Burkina	8	119	9	15
Cote d'Ivoire	3 with 1 functioning	3	0	**7**
Ghana	22	300	55	50
Mali	1	-	3 under construction	-
Togo	6	58	6	0
Total	39	484	74	73

Table 11: List of parameters observed based on the type of meteorological station

Rainfall station	Climate station	Agro-climate station	Synoptic station
Rain	Rain	Rain	Rain
	Instant temperature under shade	Instant temperature under shade	Instant temperature under shade
	Instant temperature under shade	Instant temperature under shade	Instant temperature under shade
	Maximum temperature under shade	Maximum temperature under shade	Maximum temperature under shade
	Wet temperature under shade	Wet temperature under shade	Wet temperature under shade
	Piche evaporation	Temperature of water in tank A	Temperature of water in tank A
	Wind direction	Ground Temperature at 10 cm deep	Ground Temperature at 10 cm deep
	Wind force	Ground Temperature at 20 cm deep	Ground Temperature at 20 cm deep

	Minimum humidity	Ground Temperature at 50 cm deep	Ground Temperature at 50 cm deep
	Maximum humidity	Ground Temperature at 100 cm deep	Ground Temperature at 100 cm deep
	Present Time	Piche evaporation	Piche evaporation
		Evaporation in tank A	Evaporation in tank A
		Duration of sunshine	Duration of sunshine
		Wind direction	Sunshine radiance
		Wind force	Cloud coverage
		Minimum humidity	Wind direction
		Maximum humidity	Wind force
		Present time	Horizontal visibility
			Minimum humidity
			Maximum humidity
			Past
			Present time

4.1.2 Data on water resources

59. As the saying goes, water is life within the context of the basin; it is by far the most important data in view of policies on water, the number of institutions involved in data collection and financial resources allocated to it. The activities concerned in this sector are the hydrology, hydrogeology, data on potable water supply infrastructure. This last category of data helps in the calculation of the supply rate, an important indicator for the achievement of the Millennium Development Goal in this sector.

60. The hydrometric network is made up of 135 stations (Table 12) spread across the basin, with obviously the greater number located in the wider areas of the Basin in Burkina Faso and Ghana. The number of stations seems to be linked to the area covered.

61. This does not, however, apply to the number of piezometers installed in this portion of the Volta basin. There are 38 piezometers with the majority located in Burkina Faso. There are areas that do not have any piezometer; this is the case in Togo, Mali and Cote d'Ivoire. Ghana, for instance, has 29 functioning piezometers out of 67; this is a constraint to data collection.

62. Like the meteorological network, the density of the network is low and to make a hydrological assessment, measuring of water level must go along with that of infiltration, rainfall, temperature and evaporation. This is not the case in the basin; there is therefore the need for more investments in monitoring of water resources through the expansion of the hydrometric and rainfall network.

Table 12: State of the water resources observation networks

Country	Number of hydrometric stations	Number of piezometers
Benin	3	14
Burkina	54	29
Cote d'Ivoire	3	0
Ghana	29	0
Mali	2	0
Togo	19	0
Total	135	38

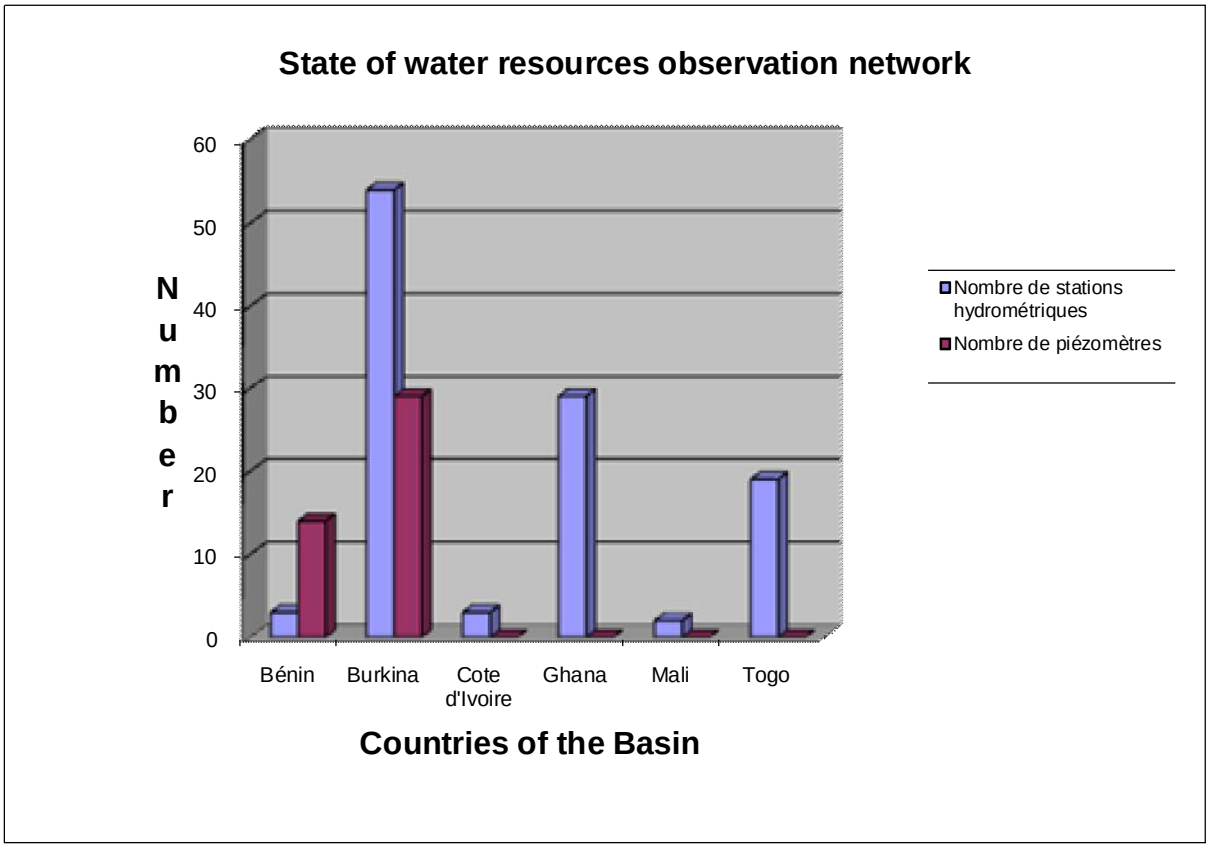

Figure 3: Status of water resources observation network

4.1.3 Data on soils and plant formations

63. This type of data is hardly monitored at the country level. In fact, these are expensive data and difficult to monitor on a regular basis. Nevertheless, particular attention ought to be paid to these data in view of the issue of desertification and depletion of biodiversity resources.

64. Existing Data on types of soil and supporting maps are those produced by the erstwhile ORSTOM at the scale of /200.00, 1/250.000 and 1/500.000 and date back to the colonial period. Aside Burkina Faso which is currently implementing a policy on mapping the type

of soils found on the entire territory at a scale of 1/100000 (80% completed) other recent date on soil are sector related and most of them in analogue format. As a result, there are only:

- Qualitative information describing the types of soil
- Maps of the different types of soils
- Maps on the level of land occupation, human settlements, classified forests and plant formations.

65. In the same vein, knowledge on plant formations, forestry inventories date back to the 80s and cannot be used today to make a correct diagnosis of the vegetative cover in the basin. Initiatives are underway in Mali and Burkina Faso to compile an inventory of the fauna and flora by 2010.

66. Togo and Burkina Faso were able to carry out diachronic evaluation exercises of their plant resources 1992-2002 for Burkina and 1975-2000 for Togo and in all cases, from one period to the other, there has been a downward trend in all forest formations (forest, savannah, rupicol formation, steppe etc.) This is for the benefit of agriculture as areas of arable land are increasing due to population growth in the basin and expansion of degraded areas. There are even variations as high as 40% for the same formation, a trend that is alarming.

67. Special attention must therefore be paid to this type of data. Wood is the main source of energy used in the area. A tool for value addition, decision making and monitoring of plant formations, their production and productivity is essential and should be a system of reference for the management and monitoring of natural resources. This has been successfully achieved in Mali. As part of the establishment of the observatory, data on soils and vegetation in particular are very important indicators of the health of the basin that must absolutely be monitored and evaluated on a regular basis.

Tableau 13: Type of vegetation found in the basin

Type of Vegetation	Main species making up the flora	Observations
Savannah of Sahelian domain	*Adansonia digitata, Acacia albida, Tamarindus indica, Parkia biglobosa, Vitellaria paradoxa, Ficus platiphylla, Kaya senegalensis, Pterocarpus erinaceus, microcarpa lanéa, Combretum glutinosum, Prosopis africana, Bombax costatum, Sclerocarya birrea and Sterculia setigera*	Species found mainly in the northern part of the basin
Savannah of Sudanese domain	*Daniellia oliveri, Issoberlina doka, Ceiba pentandra (kapok tree) Cola cordifolia, accacia spp., combretum spp., terminalia spp., pterocarpus erinaceus etc. Sparse forests are generally made up of local plants such as Isoberlinia doka and/or tomentosa, while the dry forests have plants such as Anogeissus or Monotkerstingii and Uapaca togoensis. There are also agro-forestry parcs with sheanut trees (Vitellaria paradoxa) and/or Parkia biglobosa.*	These are wooded and shrubby savannahs found from the central part of the basin to the northern parts of Ghana, Cote d'Ivoire, Benin and Togo
Sparse forests or mesophile region of Guinean domain	*Khaya grandifolia (cashew), triplochiton scleroxylon (samba), borassus rethiopium (ronier), lophira lanceolata, Crossopterix febrifuga, Terminalia glaucesens, Faurea speciosa, Pterocarpus erinaceus, piliostgma thonningii*	Species found from Southern Burkina Faso to the central part of coastal countries of the basin
Dense forest , **forest gallery** or rupicole formations	*Lophira lanceolata, Crossopterix febrifuga, Terminalia glaucesens, Faurea speciosa, Pterocarpus erinaceus, piliostgma thonningii, Erythrophleum suaveolens, Berlinia grandifolia, santalinoides, Uapacca ssp, cynometra megaphylla, Parinaris congensis, Cola laurifolia*	These species are found along water bodies in the southern part of the basin

4.1.4 Data on wildlife and fisheries resources

68. In this context, fauna refers to wild animals in the basin area. Data on wildlife and fisheries resources are very important due not only to the diversity of species found there but also those that are endangered or close to extinction.

69. Though they are of useful for tourism and the economy, these data are very difficult to observe on a regular basis. There is the need to compile inventories but this is not simple in terms of cost, methodology, reliability and state priorities. The emphasis is rather on domestic animal resources that are economically beneficial for Sahelian countries like Burkina and Mali. In fact, in both cases, there are functional information systems on

animal resources: SIRA for Burkina Faso and SPSA on livestock breeding and pastoralism in the Sahel for Mali.

70. While wild fauna are rare in some parts of the basin like in Mali, it is very important and a source of revenue for people in other part of basin and it is increasingly becoming a valuable resource.

71. Fishing is also a very important activity in the coastal areas of the basin and could account for 40% of GDP (the case of Togo). The peculiarity is that it is still completely practised on a small scale in all countries of the basin.

Table 14: Main elements of the fauna in the basin

Wildlife species	Main species	Endangered species
Wild animals	Ostrich, red fronted gazelle, dama gazelle, cheetah, striped hyena, spotted hyena, common jackal, pale fox, Libyan cat, ratel, zorilla, wart hog, elephant, patas, aardvark, galapo of Senegal, rock hyrax, civet, common genette, mongoose ichneumon, red mongoose hippopotamous, buffalo, sable antelope, bubal, sassaby, western buffon's kob, defassa water buck, redunca, wart hog, ourebi, common duiker, leopard, cheetah, serval, caracal, spotted hyena, Libyan cat, baboon, patas, side striped jackal, ratel, zorilla, common genette, pardine lynx, aardvark, rock hyrax, tortoise Antelope or sable antelope, wart hog, ground squirrel, grass cutter, green monkey, lion Crossarchus obscurus (brown mongoose), Pan troglodytes (chimpanzee), or colobus polykomos, West African black and white colobus, panther, bushbuck,	Maxwell's duiker, leopard, red fronted gazelle, dama gazelle, cheetah,
Birds	Heron, marabou, palmnut vulture, hammerkop	
Reptiles	crocodiles, goannas, pythons, chameleon, green mamba, venomous viper	

4.2 Analysis of socio-demographic data

72. All the countries have national institutions in charge of socio demographic data collection, processing and dissemination. These are very sensitive data which are relatively better monitored thanks to periodic general population and housing censuses organized almost every ten years by member countries with the support of development partners.

73. The major socio demographic data available are summarized in Table 14. They cover mainly :

- Population :

- Population structure based on sex and age: size, age, sex, marital status, households, growth rate, statistics on women and men, statistics on children etc.
- Geographical distribution of the population: density
- Fertility : overall fertility rate,
- Various statistics on marital status and marriage rate
- Various statistics on migration,
- Characteristics of socio cultural, ethnic and religious groups

- Health :
- Mortality: gross mortality rate, infant mortality rate
- Statistics on health infrastructure
- Statistics on the distribution of health personnel
- Epidemiological data

- Literacy and education:
- Statistics on the level of education and school attendance
- General information on educational institutions
- Statistics on literacy

- Collective amenities :
- Living and housing conditions of households
- Disposal of solid waste
- Evacuation of domestic waste water
- Coverage in terms of excreta evacuation facilities
- Coverage rate estimated in terms of household latrines
- Infrastructure and access to potable water (in urban and rural areas)

- Urban sanitation infrastructure

74. Even if these statistics are available, they are in the form of reports and their electronic versions are not accessible. Besides, there are few details on collective amenities as the statistics are mostly aggregated at the regional level or at best at the provincial level.

75. These data are used in the study of the human pressure on environmental resources, assessment of the needs of the population, planning and evaluation of joint actions for development and protection of natural resources.

Table 15: Summary of socio demographic data

Country	Type of data	Institutions in charge	Levels	Period	Gap (%)	Format	Data base
TOGO	Population: Growth rate,	General Directorate of National Statistics (DGSN)	Country, Region, District, Province, urban and rural areas ,	1990-2030	0%	Excel	Excel
	Regions, urban and rural areas, prefecture, districts, villages, farms, hamlet	General Directorate of National Statistics (DGSN)		2007	0%	Excel	Excel
	Population: size, sex, age , marital status, households, growth rate, density	INSAE/MDEF	Country, Region, province, districts, rural and urban areas, village, suburbs	1992-2002	0%	Beninfo	RGPH3
	Fertility :Various fertility	INSAE/MDEF	Country, Region, province, districts, rural and urban areas, village, suburbs	1992-2002	0%	Beninfo	RGPH3
	Mortality : Various mortality rate	INSAE/MDEF	Country, Region, Province	1992-2002	0%	Beninfo	RGPH3
	Statistics on marital status and marriage rate	INSAE/MDEF	Country, Region, Province	1992-2002	0%	Beninfo	**RGPH3**

Country	Type of data	Institutions in charge	Levels	Period	Gap (%)	Format	Data base
BENIN	Statistics on migration	INSAE/MDEF	Country, Region , Town, village, suburb, rural and urban areas	1992-2002	0%	Benininfo	RGPH3
	Statistics on women, children, the aged and disabled	INSAE/MDEF	Benin, Region , Province	1992-2002	0%	Benininfo	RGPH3
	Statistics on literacy, education, school attendance, family factors for enrolment in schools	INSAE/MDEF, SSGI/DPP/MEPS , MECCAG-PD/INSAE	Benin, Region, Province	1992-2002	0%	Benininfo	RGPH3
	Socio-cultural characteristics	INSAE/MDEF	Country, Region , Town, village, suburb, rural and urban areas	1992-2002	0%	Benininfo	RGPH3
	Living and housing conditions of households	INSAE/MDEF	Country, Region, City	1992-2002	0%	Benininfo	RGPH3
	Statistics on disposal of solid waste, evacuation of domestic waste water, coverage in terms excreta evacuation facilities	DHAB, MSP	Benin, Region	1996-2001	-	Winword	Surveys
	Coverage rate in terms of household latrines	DHAB/MSP	Benin, Region, rural and urban areas	2005	-	Winword	
	Statistics on health infrastructure and personnel	SEPD/DDSP Atacora-Donga	Province	Years	-	Winword	Directories

Country	Type of data	Institutions in charge	Levels	Period	Gap (%)	Format	Data base
	Epidemiological data	SEPD/DDSP Atacora-Donga	Province	Years	-		Directories
	AEP Infrastructure	DGeau/MMEE	Province, rural and semi-urban areas	2005	**WEAK**		**BDI**
	Water supply by SONEB	SONEB/MMEE	Country, Region	2005			
	Urban sanitation infrastructure	DUA/MTPT	Country, Region, Town	**2005**			
Cote d'Ivoire	Population: size, distribution by sex, age, marital status, households, growth rate, density	INS/DOIG/MPD	Country, Regions	1990-2006	0%	Excel Ivoir'Devinfo	RGPH98
	Fertility : Various fertility rates	INS/DOIG/MPD	Country, Regions	1990-2006	0%	Excel Ivoir'Devinfo	RGPH98
	Statistics on health infrastructure and personnel	INS/DOIG/MPD	Country, Regions	1990-2006	0%	Excel Ivoir'Devinfo	RGPH98
	Profession : Population by type of occupation, branch of activity (sex and age groups)	INS/DOIG/MPD	Country, Regions	1990-2006	0%	Excel Ivoir'Devinfo	RGPH98
	State and structure of the population (size, sex, age, marital status, household, growth rate, density,	INSD/MEF	Country, region, provinces, districts, towns, suburbs	1985-1996-2006	Nd	Electronic (Excel) and hard copy (reports)	RGPH
	School enrolment and level of		Country, region,	1985-	Nd	Electronic (Excel)	RGPH

Country	Type of data	Institutions in charge	Levels	Period	Gap (%)	Format	Data base
Burkina Faso	education	INSD/MEF	provinces, districts, towns, villages	1996-2006		and hard copy (reports)	
	Fertility (birth rate, average number of children per woman)	INSD/MEF	Pays, Region, Provinces	1985-1996-2006	Nd	Electronic (Excel) and hard copy (rapports)	RGPH
	Migration (internal migration, international migration	INSD/MEF	Country, Region, Provinces	1985-1996-2006	Nd	Electronic (Excel) and hard copy (reports)	RGPH
	Urbanisation (urban population, rural population)	INSD/MEF	Country, Region, Provinces	1985-1996-2006	Nd	Electronic (Excel) and hard copy (reports)	RGPH
	Activities (active population, inactive population)	INSD/MEF	Country, Region, Provinces	1985-1996-2006	Nd	Electronic (Excel) and hard copy (reports)	RGPH
	Population and health Survey EDS III	INSD	Country, Region Provinces	2003		Reports	
	Annual survey on living conditions of households in Burkina Faso	INSD	Country, Region, Provinces	2006		Reports	
MALI	Population: size, sex, age, marital status, households, growth rate, density	DNSI	Country, Region , District, Province, rural and urban areas village suburb	1987 et 1998	0%	Word, Excel, charts, maps	RGPH
	Population and Housing Census: distribution, age & sex structure nationality, birthplace	GSS/MFEP	National, Regional District Locality,	Intercensus	-	Reports with Tables and Charts	

Country	Type of data	Institutions in charge	Levels	Period	Gap (%)	Format	Data base
Ghana	(Ghanaian), ethnicity, household composition and structure. marital affiliation, religious affiliation, literacy, educational attainment, economic activity occupation, industry, employment status, employment sector, stock of houses, dwelling units, construction materials, household facilities and amenities and waste disposal facilities.		Urban Rural				
	Key Social Economic Demographic Indicators: % distribution of urban/rural pop. by sex, age, Structure, sex structure	GSS/MFEP	National Urban Rural	1960, 1970, 1984, 2000	-	Reports with Tables and Charts	

4.3 Analysis of economic data

76. Economic data is available on the entire basin but with varying degree of exhaustiveness and precision. The main economic data cover agriculture and livestock breeding which are the major income generating activities in the study area and to some extent fishing. However, the data are relatively recent and incomplete from one section of the territory to the other. Generally, these data are part of national land development schemes when available.

77. Some of the data listed below are available and are sometimes collected as part of specific projects but generally, there no reliable statistics on the following :

- Agrarian systems
- Types of equipment
- Processing, conservation, and marketing of agricultural, livestock and fisheries produce
- Processing, conservation and marketing of non wood forest products
- Use and impact of inputs
- Correlation between agricultural practices (including livestock production) and the degradation of environmental resources (land and fauna)
- Number of employment generated
- Level of income of farmers, livestock breeders and fishermen
- Use of water for agriculture and livestock production
- Livestock potential and animal diseases
- Fishing practices and effort.

78. This observation is more striking as far as data on formal or informal income generating activities are concerned.

79. The collection of data and their use in the evaluation and definition of actions aimed at a rational management of natural, human and economic resources are preconditions for development. Within the context of management of a common resource but separated by borders, it is important to establish trust for the prosperity of countries sharing this resource.

80. Finally, for each thematic area, data may be sourced from several data bases. There is therefore the need to assess the level of homogeneity and interoperability of these data bases for a particular thematic area. In other words:

- Do data contained in these data bases have the same definitions of given concepts?
- Does the structuring of data in the data bases make room for the merger of some of them?
- Do data bases dealing with the same concepts adopt the same nomenclatures?
- Are the codifications and typologies used by these data bases founded on the same principles?
- Are updating principles and units organizing these data similar? Do they have the same regularity? Is the level of reference to a subject in the various data bases the same everywhere?

81. These are issues that are very important for an exchange mechanism, however, since these data bases are not all described at this stage, this work could be done after the operationalisation of the system or observatory.

Table 16: Summary of economic data on the basin

Pays	Type of data	Institutions in charge	Level	Period	Gaps (%)	Formats	Data base
BENIN	Professional status : Population per type of occupation, profession, branch of activity (sex, age group)	INSAE/MDEF	Country, Region , Province, village	1992-2002	0%	Beninfo	RGPH3
	Industry : Number of cotton ginneries, and number of enterprises, number of jobs in the industrial sector	INSAE	Province	1992-2002	0%	Beninfo	RGPH3
	Transport services and road infrastructure	MDCT	Inter-province, Region	Years			
	Statistics on access to telephone	MDCNT	Province	1996 and 2004	35% - 50%		
	Production and access to electric power	SBEE	Provincial towns	1994-2003		Reports	
	Potential sites for the development of small hydropower facilities	Directorate of Energy /MMEE	Sites/rivers, host localities	-		Reports	
	Agricultural production : production and output per type of crop, planted areas, use of inputs	Directorate of Agriculture / MAEP	Country, Region, Province	Farming season		Text	Directory
	Market price of agricultural produce, value of production,	CERPA/MAEP	Provinces	variable	80%	Text	Directory

Pays	Type of data	Institutions in charge	Level	Period	Gaps (%)	Formats	Data base
	proportion for sale						
	Livestock breeding : population of domestic animals, health conditions, livestock, animal production, use of water for animal rearing, price of animal products	Directorate of Livestock Production /MAEP	Province, villages	Years	-	-	-
	Trading : Major production centres, agricultural produce sold, sale of livestock products, revenue derived from trading	INSAE	Provinces, villages	Years	-	Beninfo	RGPH3
	Use of water by household	DGeau, SONEB	Country, Region, Province	Years			BDI
	Developed areas : inventory and characterization	DGR/MAEP	Country, Region, Province village	Years		Text	Directory
	Dammed waters :inventory and characterization	DGR/DGE, MAEP	Country, Region, Province village	Years		Text	
	Forest exploitation	DFRN, ONAB/MEPN	Region, Province	1997-2001		Text	
	Industry : Number of cotton ginneries, Number of enterprises and	INS/DOIG/MPD	Country, Regions, Districts	1990-2006		Ivoir'Devinfo Digital	Excel IRGPH98

Pays	Type of data	Institutions in charge	Level	Period	Gaps (%)	Formats	Data base
COTE D'IVOIRE	number of enterprises, number of jobs in the industrial sector					Hard copy	
	Transport services and road infrastructure	INS/DOIG	Country, Regions, Districts	1990-2006		Ivoir'Devinfo	Excel RGPH98
	Statistics on access to telephone	INS/DOIG/CI-TELCOM	Country, Regions, Districts	1990-2006		Ivoir'Devinfo	Excel RGPH98
	Production and access to electric power	INS/DOIG/MME	Country, Regions, Districts	1990-2006		Ivoir'Devinfo	Excel RGPH98
MALI	Production and access to electric power	DNSI	Countries, Regions, Province, **Counties**, rural and urban areas	1994-2008		Word, Excel, chart, map	Socio-economic data base «Malikunafoni»
	Agricultural production (food and cash crops, market gardening) livestock production (meat, dairy, leather and skins), forest products	DNSI	Country, Regions, Counties,	1994-2008		Word, Excel, chart, map	Socio-economic data base «Malikunafoni»
	Mineral Production	DNSI	Country	1994-2008		Word, Excel, chart, map	Socio-economic data base «Malikunafoni»

Pays	Type of data	Institutions in charge	Level	Period	Gaps (%)	Formats	Data base
TOGO	Education and training	Primary, Secondary, Professional and Higher Education Directorate	Country, Regions Prefecture, Province and Villages	1998-2003	0%	Reports	Excel
	Health and nutritional status	Directorate of Health Statistics	Country, Regions Prefecture, Province and Villages	1998 - 2006	0%	Reports	Excel
	Characteristics of poverty : monetary inequality, unequal access, vulnerability	Directorate of Finances and Economic Planning	Country, Regions Prefecture	1998 - 2006	0%	Reports	Excel
	Professional status : Population per type of occupation, profession, branch of activity (sex, age group)	General Directorate of National Statistics (DGSN)	Country, Regions Prefecture, Province and Villages	1998 to 2003	0%	Reports	Excel
	Industry : Number of cotton ginneries, Number of enterprises and number of enterprises,	Chamber of Commerce and Industry	Country , Region Prefecture ,	1998 à 2006	0%	Reports	Excel

Pays	Type of data	Institutions in charge	Level	Period	Gaps (%)	Formats	Data base
	number of jobs in the industrial, trading and handicraft sectors						
BURKINA FASO	Harmonised Consumer Price	INSD	Country, Region Provinces	10 months		Reports	
	Mechanism for regional prices	INSD	Country, Region Provinces	Year		Reports	
	1994 Poverty Profile	INSD	Country, Region Provinces,	1994		Reports	
	1994 Gender and Poverty Profile in Burkina Faso	INSD	Country, Region Provinces	1997		Reports	
	Poverty and Vulnerability	INSD	Country, Region Provinces	1997		Reports	
	Poverty and health in Burkina Faso in 1994	INSD	Country, Region Provinces	1997		Reports	
	Urban Poverty Profile and access to basic social services 1994	INSD	Country, Region Provinces	1998		Reports	
	Education and Poverty in 1994	INSD	Country, Region Provinces	1997		Reports	
	Poverty and Health in 1998	INSD	Country, Region Provinces	2002		Reports	
	Poverty and Vulnerability - 1998	INSD	Country, Region Provinces	2002		Reports	
	Education and Poverty in 1998	INSD	Country, Region Provinces	2003		Reports	

Pays	Type of data	Institutions in charge	Level	Period	Gaps (%)	Formats	Data base
	Gender and Poverty in Burkina Faso in 1998	INSD	Country, Region Provinces			Reports	
	Poverty Profile and Trends in 1998	INSD	Country, Region Provinces	2000		Reports	
	Industrial and commercial census in 1998					Reports	
GHANA	Ghana Living Standards Survey; demographic Characteristics, education, health, employment, migration, housing, household agriculture, non-farm enterprises, total household income & expenditure, credit, assets and savings.	GSS/MFEP	National, Urban Rural Ecological	1987-99 – 1998/99	0%	Reports With table	
	Patterns and Trends of Poverty in Ghana: consumption poverty, patterns and changes in consumption poverty, household assets, access to service, human development	GSS/MFEP	National, Regional Urban Rural Ecological	1991/92 – 1998/99 1991-2006	0%	Reports With tables	
	Core Welfare Indicators:	GSS/MFEP	National,	1997	?	Reports	

Pays	Type of data	Institutions in charge	Level	Period	Gaps (%)	Formats	Data base
	Socio-economic characteristics of household heads, employment, education, health status and satisfaction with health service, household amenities, assets and access to services.		Regional Urban Rural				
	The State of the Ghanaian Economy: fiscal development, monetary and financial, developments, international trade and payments, agric sector, industrial sector, international trade and growth.	ISSER University of Ghana, Legon	National	Annual	0%	reports	

5. Summary of national mechanisms for data management and dissemination

5.1 Major national mechanisms

82. An Analysis of national reports indicates that there are national mechanisms for collecting, processing, analyzing and disseminating data and information on the environment. These information management mechanisms have the following characteristics (Table 17) :

Table 17: Summary data characteristics

Collection	Processing	Storage	Management	Dissemination	General observations
Difficulty in data collection	Disparities in mapping standards	Data spread in various services	Inadequate qualified human resource	Access to data not always easy	Inadequate financial and material resources for data and information gathering
Availability of high- resolution satellite data	Weak integration of data use	Data on some parameters fragmented in time and space	Lack of integrated data base management systems	Inadequate modern and efficient system for the dissemination of available data	Information collected and processed on sector basis
Collection of well standardized meteorological and climate data	Spatialisation yet to be achieved	Lack of harmonizatio n of storage format	Inadequate network for the coordination of data production	Inadequate material and financial resources for data dissemination	Inadequate technical skills
Diversity of sources of information	Inadequate Computer materials	Inadequate **large scale** maps	Lack of data collection policy		Lack of coordination between the various actors involved in data production
Available but outdated topographic maps	Lack of data control				
Lack of specialized tools for the collection and processing of					

data on the environment					

5.2 General conclusions on the state of data and information on the basin

83. Batches of data bases were presented but they were not described in terms of targets, structure, list and contents of files; sometimes, the machinery for collection and frequency of updates are not known for some types of data such as data on soils and vegetation. However, this description of data base would have brought to the fore the coherence and compatibility between the data bases and elements to be taken into account in harmonizing these data and specifying the major information flows between data bases ect.

84. With regard to geographic systems of reference (projection, ellipsoid etc.), it is known through experience that in the same country, geographic reference systems sometimes differ from one institution to the other. Data bases in a country are not always coherent and most countries within the basin experience this problem. However, without this harmonization, the data bases cannot be combined. Consequently, an analysis of geographic reference systems used in the various countries must be an essential component of the basin's common language to be put in place.

85. In the same vein, the means of information production do not have the same spatial precision, the representation scales of the same thematic issues also vary from one country to the other. The notion of scale must be taken into consideration for the representation of thematic issues at the level of the basin. There must be harmonisation in this regard as the integration of data at different scales is a source of inevitable imprecision because of different levels of generalisation.

86. As regards exchange of data, there are no formal or tacit exchange agreements between national institutions within the country. Burkina Faso made a brief attempt as part of the establishment of a National System of Information on the Environment (SNIE) and soon the National System of Information on Water (SNIEau) which is at the finalisation stage would also experiment this approach. Exchange formats also have disparities from one national institution to the other as well as from one country to the other. These are issues that must be taken in account while adopting a common language for the basin.

87. Data are produced by national institutions according to their public interest mission from more or less organized collection networks but as far as the sustainability of the data production in the countries is concerned, only meteorological data seem to be produced in a sustainable manner.

88. Concerning the level of data accessibility and modalities for access, it seems access to most data is free of charge but with the authorization of producing entities. However, access to meteorological data attracts a fee in most of the countries.

89. Efforts are being made to develop means of disseminating data and information but they are still inadequate to have data online. Sometimes, in cases where they are online, there is the thorny issue of updating these data on a regular basis. Therein lies the importance of a regional mechanism for exchange of data on the basin.

90. The various countries have provided a good synthesis on the main actors involved in data

and information production, what is lacking is their description in terms of missions, roles, needs and major constrains.

91. Regarding computer facilities available to stakeholders, there is minimum basic infrastructure (computers for entries, storage of data bases) that must be strengthened under the regional exchange mechanism to be established. The harmonization of data bases is at the early stages, most of which is being done in Access, Excel which are not complete SGBD software applications. With regard to GIS software and cartography, the range of ESRI products is mostly used. There is virtually no application based on free or open source software.

92. Finally, certain structured data bases on water quality, for example, are non-existent.

6. Capacity Building of Data Collection Institutions

6.1 Training needs

93. From the analysis of the prevailing situation, it appears that the human resource deployed for the collection, processing, harmonization and dissemination of data and information is inadequate. The situational analysis of the human resource in the basin may be summarized under the following three points :

94. At the organizational level

- With the exception of Burkina Faso, Mali and Ghana, there are no structures in charge of the coordination, promotion and monitoring of data and information generation processes in the other countries of the basin. National structures operate without efficient communication and exchange mechanisms. Each of them depends on a different government institution. There is therefore superfluous data generation.
- Decentralization of administration poses a challenge in terms of organizing stakeholders to respond to the demands of primary data collection, processing and management.

95. Thematically, departments do not have the full complement of staff for the administration and efficient management of data that come under their thematic area; for example, there are few experts in Geographic Information Systems (GIS) as well as data base and software developers, and where they are available, they are of poor quality.

96. With regard to staffing, in the entire chain of data collection, generation and dissemination on various themes, the human resource is inadequate. This can compromise the much desired regularity with which the environment should be observed and monitored.

97. From the country analysis, it is evident that capacity-building needs concern five (5) areas. These are: 1) use of information to support the management and planning of the basin environment, particularly the capacity to analyze and model environmental phenomena (100%) ; 2) the use of specific capacities, for example in remote sensing, global satellite positioning or in GIS (100%) ; 3) information technologies, particularly the design and management of shared data bases ; 4) the organizational aspects of information systems, including coordination, standards and metadata (75%); 5) aspects relating to the production of dissemination and communication tools, particularly the design of Web sites and Web mapping (cartography on Internet 50%).

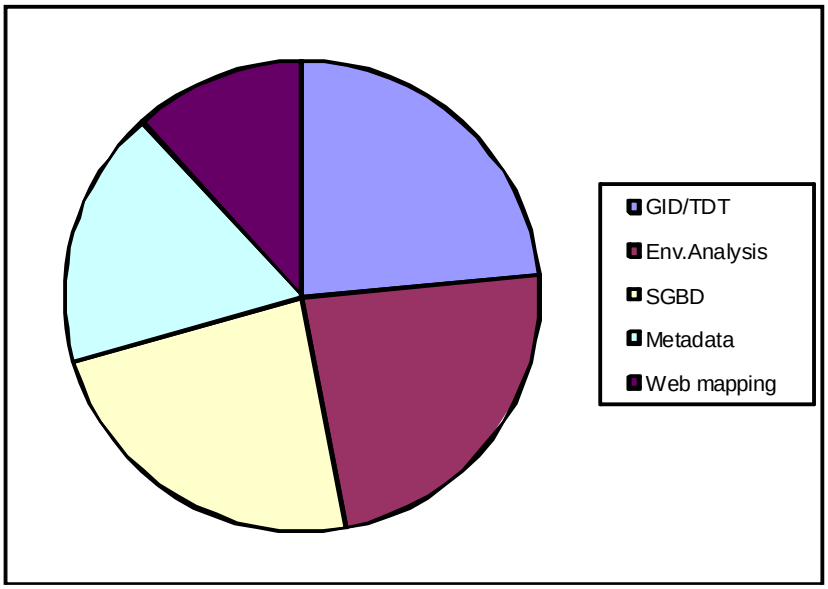

Figure 4: Distribution of training needs per area

6.2 Capacity Building Plan

98. In the light of prospects and expectations for future developmental needs and updating of existing mechanisms, and the needs of the regional exchange mechanism, substantial efforts in capacity-building should be envisaged.

99. In view of gaps in the country reports on the preparation of capacity-building plans, we are proposing the present plan which can be improved upon to suit individual countries (Table 17). The plan deals, first of all, with public administrative structures which deal directly with natural resource development and management.

100. **Training objective:** The plan aims to make national structures that produce and manage data, operational and sustainable.

Table 18: Proposal on a training plan

GENERAL OBJECTIVE	SPECIFIC OBJECTIVES	THEMES / MODULES	TARGET BENEFICIARIES / PUBLIC	DURATION	INSTITUTIONS
Make national institutions, producers and managers of data, operational and sustainable	Enhance the capacity to analyze and model environmental phenomena	Introduction to digital analysis	Senior executives of data generation and management structures 4-year post-A Level	1 month	2IE ex EIER/ETHSER Ouagadougou
		Complex statistics	Senior executives of data generation and management structures 4-year post A-Level	1 month	Local universities
		Spatio-temporal modelling	Senior executives of data generation and management structures 4-year post A-Level	2 months	AGRHYMET Regional Centre-Niamey Ecological Monitoring Centre (CSE) - Dakar
		Spatialisation (GIS)	Senior executives of the data generation and management structures 4-year post A-Level	1 month	AGRHYMET Regional Centre - Niamey Ecological Monitoring Centre (CSE) - Dakar
	Enhance remote-sensing capacities in global	Processing of images and use of GPS and Integration of GPS data	Middle-level executives 2-year post A-Level	2 months	AGRHYMET Regional Centre-Niamey

GENERAL OBJECTIVE	SPECIFIC OBJECTIVES	THEMES / MODULES	TARGET BENEFICIARIES / PUBLIC	DURATION	INSTITUTIONS
	positioning through satellite and in GIS	into a GIS			
		Design/implementation of a GIS project	Middle-level executives 2-year post A-Level	3 months	AGRHYMET Regional Centre - Niamey
	Enhance the capacity to design and manage shared data bases	Design and implementation of a shared data base	Senior and Middle-level executives of the data and information generation and management structures	2 months	2IE ex EIER/ETHSER - Ouagadougou
		Processing of statistical data by ACCESS	Senior and Middle-level executives of the data and information generation and management structures	2months	2IE ex EIER/ETHSER - Ouagadougou
	Enhance skills in the organizational aspects of information systems, including coordination, standards and metadata	Establishment of Information Systems Network	Senior and Middle-level executives of the data and information generation and management structures	1 month	Private Bureau + Experience in PNGIM (Burkina Faso) or in NAFGIM (Ghana) to be shared
		Elements for the preparation of norms and standards for information generation	Senior and Middle-level executives of data and information generation and	0.5 month	Experience in PNGIM (Burkina Faso) or in NAFGIM (Ghana) to be

GENERAL OBJECTIVE	SPECIFIC OBJECTIVES	THEMES / MODULES	TARGET BENEFICIARIES / PUBLIC	DURATION	INSTITUTIONS
			management structures		shared
		Elements for the preparation of metadata	Senior and Middle-level executives of the data and information generation and management structures	0.5 month	Experience in PNGIM (Burkina Faso) or in NAFGIM (Ghana) to be shared
	Enhance capacities in tools for the dissemination and exchange of data	Designing of Web sites, linking a data base to a Web site.	Middle-level data managers	1 month	Local Private Firm

7. Actions required for better data management

7.1 Promoting data collection, processing and storage activities

101. The success of soil and water degradation control measures and conflict reduction in the Volta Basin depends largely on the availability of relevant information that provides a better knowledge of the state of resources, their dynamics, management and impact on their sustainability and socio-cultural frictions.

102. However, the analysis of spatial or non spatial environmental and socio-economic data available on the basin shows that such data are rarely monitored and are not unavailable for certain parameters of interest.

103. And yet, without reliable and compatible data to be exchanged, the most cutting-edge exchange mechanisms will remain an empty echoless box. To avoid bottlenecks in the operationalisation of the regional data and information exchange mechanism in the Volta Basin, this process must be seriously promoted by providing appropriate support to national or state structures to enable them take sustainable measures to generate information and data that will serve three purposes: to develop indicators of the future observatory; feed the regional exchange mechanism; and monitor and evaluate natural resources at the national level.

7.2 Promoting information drive in the Basin

104. The implementation of strategies to improve the economic and social environment of the Basin requires data and information on the state of natural resources as well as the capacity to identify environmental changes and monitor these through performance indicators. Consequently, the strengthening or the establishment of national systems that meet these needs is an essential component of these strategies.

105. Support for national systems in the Volta Basin should focus on the following points :

- First, support the strengthening or the establishment of structures to coordinate the generation and promotion of environmental information; to achieve this objective, there must be :

o Agreement on norms and standards in the generation of information in order to ensure data interoperability. This would mean that:

o The data bases will have to share certain standards;

o Institutions should avoid explicit or implicit duplication of entities produced by others: this require that:

o Specific institutions be recognized as responsible for the production and maintenance of specific entities ;

o Institutions in charge generate and disseminate data bases for which they are responsible;

o All the other institutions agree to use these entities in their own data bases;

o At the international level, this interoperability has its own meaning, particularly for the management of a large basin like the Volta Basin and the management of coastal areas. This actually involves the exchange of data from six countries.

- The establishment of a monitoring and evaluation system for the various data collection, management and exploitation activities.

- Secondly, to support the national institutions with modern data collection and production tools. This material support demands considerable financial resources. This should be done gradually and in the very short-term. This support will have a positive impact only if the various measuring instruments are monitored and used to gather data at regular time intervals.

7.3 Establishment of the Observatory

106. An environment observatory aims generally, through knowledge management and an environment observation mechanism, to inform decision-makers and the people about the state of the environment and its changes for years and even decades to come. To this end, it develops a broad partnership approach (that brings together the State, technical departments, communities, the academic world and researchers, professional organizations and representatives of associations and civil society) that helps to go beyond sectoral and thematic measures of the various stakeholders in order to develop a comprehensive approach and promote a more coherent understanding of the phenomena, problems and/or implications.

107. Although this study is not specifically geared towards the establishment of the basin observatory, the present project cannot be fully designed outside the observatory to be established by the Basin Authority. Indeed, it would be judicious if the data generated under the exchange mechanism can also be used by the Observatory to calculate indicators.

108. To anticipate the establishment of the observatory, it is known that basic data in their raw state cannot be used in decision-making. Managers of the basin environment or the observatory need indicators that provide simple information, easier to understand and show whether there is improvement or otherwise. However, these indicators are rarely direct measures, but have to be derived from the basic data, sometimes after a complex processing of large volumes of data. Again, these indicators often allude to value thresholds that indicate risk levels. One of the products to be developed regularly could be the report on the state of the Volta Basin environment (REEBV), and why not a specific environment code for the basin.

7.3.1 What information is required for the Volta Basin Observatory?

109. Irrespective of the magnitude of work, certain “basic” data are indispensable for the overall management and planning activities of the basin environment. A clear appreciation of the environmental phenomena cannot be undertaken without these data. These basic data include information on the environmental entities, their spatial area and importance, for example the use of soils and biodiversity, socio-economic parameters by national basin, locality or administrative entity.

110. For example, with regard to hydro-environmental data, there is the need to monitor among others :

- Water resources and key weather parameters
- Changes in soil patterns and use of soils

- Soil fertility
- Changes in vegetation cover, biomass and wood resources
- Changes in fauna resources
- Changes in fish resources
- Sedimentation in hydrographic networks

111. To analyze the deep-seated causes of anthropic pressures on environmental resources and identify people's needs, one is requires economic data, and for each sector of economic activity the large batches of data to be collected periodically at the departmental or community level should be in the form of reliable and sufficiently comprehensive statistics on agriculture, livestock, cottage industry and tourism, forestry, mining, hunting, transport infrastructure, power domestic water use, household incomes.

112. Finally, reliable and comprehensive statistics on socio-demographic data, which are relatively well monitored. Emphasis should be laid on education and access to social infrastructure.

7.3.2 What information exists already for the observatory?

113. Although there is a substantial amount of information on the basin, coverage at all levels remains inadequate. All countries of the basin have maps and tabular data at the national level. For example, Ghana inherited complete topographical coverage on a scale of 1/50,000 and took an inventory of over ten batches of data under this study. Almost all countries of the basin have a topographical map, a vegetation map or land occupation map, geological maps, population census maps by locality, maps on agricultural statistics or surveys, as well as maps on rainfall and other weather data. However, few of these data are converted into data bases or into digital format.

8. Conclusion and recommendation

114. The following conclusions can be drawn from the foregoing:

- Any development and management strategy for the environment is mainly based on information on the environment. Since this information is across-the- board, it is useful for all sectors of development. One essential point to note is that all the countries recognize that information, particularly on the environment, is a prerequisite for any short-, medium- and long-term viable development policy and strategy. The level of data and information in member countries of the Volta Basin varies from one country to another.
- In all countries there are data bases, GIS and some socio-economic data prepared sometimes under specific projects.
- The collection of data on environmental factors is not regular in all countries, except data on the weather and water.
- Relevant data and information still exist in analogue format. These should be digitized as early as possible so that they become part of the chain of data and information to be exchanged under the yet to be established mechanism and observatory.
- The organization of a national unit in charge of environmental data differs from one country to the other, and there are countries where there is a coordination unit and others where there is none.
- Often, the collection of data on environmental factors does not take place or is suspended for lack of financial resources.
- Existing data and information on the basin can help to start the regional exchange system and the observatory in a modest way. But it is expected that some of the constraints mentioned above will be eased, if not completely eliminated, with the gradual implementation of these two mechanisms.

115. The following major recommendations can be adopted at both the national and basin levels:

- Support for the organization of national structures identified to enable them to play their full role as suppliers of information and data; exchange mechanism and the observatory will be operational only if national networks are themselves operational.
- The effective establishment of the observatory which can play the role of technical coordination in the generation of data and indicators; the Basin Authority based in Ouagadougou will be an effective institutional base.
- The observatory will not only see to the exchange procedure among national institutions, but also serve as focal point for international programmes on data and information on the basin.
- The observatory can rely on thematic commissions or working groups that will study the environmental data collection and processing procedures, norms and standards.
- Harmonization of information gathering, processing and dissemination tools in the basin is strongly recommended.

9 Appendices

9.1 Appendix A: Terms of Reference for the study on the establishment of a regional data and information exchange system in the Volta catchment area

Background

The GEF-Volta Project entitled "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 the natural resources of the Volta catchment area in the six riparian countries (Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali and Togo). The project has been specifically designed to solve the **priority** regional transboundary problems identified during a preliminary Transboudary Diagnostic Analysis (TDA). It is also meant to develop a more coordinated management approach based on IMWR IMWR principles at the national and regional levels, taking into account the involvement of all key stakeholders.

The long-term objective of the GEF-Volta Project is to enhance the capacity of countries to undertake the sustainable planning and management of environmental resources of the Volta catchment area.

The project has three major components, to which are added the specific objectives identified during the preparation of the initial project document and updated at the beginning of the project. These are:

- Specific objective No. 1: Capacity-building, improvement in knowledge and involvement of the public in support of the efficient management of the Volta catchment area.
- Specific objective No. 2: Develop legal, regulatory and institutional frameworks, as well as management tools for the Volta catchment area and the downstream coastal area.
- Specific objective No. 3: Implement national and regional measures in order to control transboundary environmental resource degradation in the Volta Basin.

The project aims to contribute to regional integration, promote dialogue among all the riparian countries in the river basin and encourage involvement of the local populations and stakeholders in the management and exploitation of resources in the Volta catchment area.

Unfortunately, to-date, there is no basic environmental data and information exchange mechanism for sustainable management of the basin. Access and use of data and information on transboundary basins for diverse and varied purposes by countries along the river basin are indispensable for the development of management tools and the conduct of scientific activities. To attain this objective, there are plans under the GEF-Volta Project to compile various sets of data, establish database for the project and put in place a system to facilitate access to data and information by decision-makers and for other purposes.

Activities

The overall objective of the study is to develop a regional data and information exchange system, together with recommendations on the mechanism required to ensure efficient management of the information system. Six national experts selected by each of the

countries along the basin and a regional expert selected by the Project Coordination Unit (PCU) will be recruited by UNOPS as consultants to analyze in detail national and regional institutions (including identification of needs and proposal of a training plan) and prepare the cooperation plan with on-going or planned projects and programmes. To attain these objectives, the consultants will undertake the following activities in close collaboration with PCU and national coordinators:

1. **Inventory and analysis of existing national and regional data in the Volta Basin:**
   - Inventory and analysis of institutions, projects and programmes that generate and manage data and information.
   - Inventory and analysis of data, data bases and other forms of relevant national and regional information (including GIS, maps, documents, etc.) in order to solve transboundary problems in the Volta catchment area.
   - Review of the existing structure of information systems and presentation of concrete proposals for improvement.
   - Inventory and analysis of available national and regional human resource for collection and management of data and information.
   - Identification and classification of potential information systems users at the national and regional levels.
   - Identification of data and information needs of each group of users and definition, with their involvement, of formats required for similar data.

2. **Development of a training plan for national institutions on data management:**
   - Assessment of capacities of national institutions in data and data base management.
   - Identification of training needs in the management and analysis of data on the Volta catchment area at the national and local levels.
   - Priority training needs in management and analysis of data on the Volta catchment area.
   - Development of the training plans for national institutions on data management and analysis.
   - General overview of the various pieces of information and training manuals on data management and analysis that could help in the preparation of training modules.

3. **Establishment of the national and regional system for data and information dissemination:**
   - Define the data and information groups to be exchanged at the national and regional levels.
   - Consult, in collaboration with PCU the mains institutions responsible for data and information collection and analysis, and define how national and regional stakeholders will have access to data and information.
   - Identify measures required for the harmonization and dissemination of data.
   - Identify data and information dissemination activities to be undertaken, and propose, where possible, an outline of the work plan.
   - Define the structure of the regional data and information exchange system to be established, as well as the management plan required for the system.
   - Propose an implementation and monitoring strategy for the national and regional data and information dissemination mechanism.

- Identify potential bottlenecks and value added of the data and information dissemination mechanism.

The regional consultant will be in charge of coordination of the consultation mission. He will have to ensure the quality of national reports, summarize these and develop the mechanism for dissemination of data and information on the basis of activities described in these TOR.

National consultants will be in charge of national studies and production on the basis of activities described in the current TDR: i) report on the analysis of national/regional data and information available on the Volta catchment area ; and ii) training plan of national institutions on data management

Main outcomes expected from the study

- Inventory and analysis of national/regional data and information available on the Volta basin finalized and approved by PCU and the National Focal Points.
- Capacity-building needs of national data management institutions are identified and the training plan developed and approved.
- National and regional data and information dissemination system developed and approved by PCU and the National Focal Points.

Key considerations:

Consultants will have to propose a detailed and sufficiently clear methodology that will help to achieve the objectives of the study and yield the expected outcomes. To that end, the following information are provided to guide the study:

Consultants must take into account on-going studies and activities (more specifically data collection and management initiatives) in order to take into account synergies and complementarities required for the preparation and implementation of the data and information dissemination system and national institutions capacity-building plans.

Consultants must maintain regular contact with national and regional institutions, national project coordinators and certain stakeholders or groups of stakeholders. The involvement of national consultants is essential not only to take into account national specificities, but also for the development of ties and ownership of cooperation and training plans by national stakeholders during their implementation.

All documents available to PCU will be placed at the disposal of the consultants. The PCU will also provide the consultants with a list of institutions involved or that may be involved in the management of data on the Volta Basin.

Experience required and qualifications of consultants

The study will be undertaken by a regional consultant and one expert each from the Volta Basin countries, with more than ten (10) years experience in the areas of competence required for the study. Consultants must also have undertaken activities similar in nature and complexity, especially under projects financed by WEF.

Consultants must have the following qualifications and experience:

- Regional Consultant: higher degree in land management, environmental resource management or statistics, and experience in data management, institutional development and IWRM.
- National Consultant: higher degree in environmental sciences or statistics, experience in data management, institutional development and IWRM.

Besides, the following qualifications will be an advantage:

- Previous experience in the development of data and information dissemination mechanisms.
- Experience in implementation of natural resource management projects.
- Must be conversant with the objectives and procedures of GEF.
- Work experience in the production of documents in English and French.

Duration of mission, reports and schedule

Consultants will have to produce reports presented in the table below. A total of twenty (20) days is planned for the regional consultant and thirty (30) days for each national consultant. The study must be completed before the end of January 2008, according to the following schedule:

Task	**Deadline**	**Groups/Persons in charge**
Signing of contract	1 November 2008	UNOPS, Consultants
Preliminary report describing the work plan and methodology	15 November 2008	Consultants, PCU
First draft of the reports of the consultants submitted to PCU/UNOPS	15 December 2008	Consultants
Evaluation of the consultation reports	30 December 2008	PCU, GEP, PFNI
Final Draft of the Consultation Reports	20 January 2009	Consultants
Validation of the Final Draft of the Consultation Reports	29 January 2009	PCU, PFNI
End of Contract	29 January 2009	UNOPS, Consultants

This project implementation schedule may be reviewed by mutual consent **between** the consultants and UNOPS.

The consultants will submit to PCU/UNOPS electronic version of the reports in English and French in accordance with the schedule indicated above.

Submission of applications

Candidates, who qualify as national experts, must send their application, including a letter of motivation, methodology proposed and Curriculum Vitae, in accordance with directives contained in the call for applicants of each member country.

Candidates, who qualify as regional experts, must send their application, including a letter of motivation, methodology proposed and Curriculum Vitae to Mme. Angelika Quaye, via e-mail to: angelikaq@unops.org.

9.2 Appendix B: Stations and meteorological data managed in countries within the basin

Country	Station	Institution in charge	Type of data	Starting Year	Year of ending	Gap (%)	Format	Data base
BENIN	Natitingou	NMD	Temperature	1950	continues	0.4%	TXT	CLICOM
			Wind	1950	continues	0.4%	TXT	CLICOM
			Humidity	1950	continues	0.4%	TXT	CLICOM
			Evaporation	1950	continues	0.4%	TXT	CLICOM
			ETP	1950	continues	0.4%	TXT	CLICOM
			Sunshine	1950	continues	0.4%	TXT	CLICOM
	BIRNI	NMD	Rainfall	1953	continues	12.18	TXT	CLICOM
	BOUKOUMBE	NMD	Rainfall	1923	continues	8.55	TXT	CLICOM
	DASSARI	NMD	Rain	2001	continues		TXT	CLICOM
	PORGA	NMD	Rain				TXT	CLICOM
	SEMERE	NMD	Rain				TXT	CLICOM
	TANGUIETA	NMD	Rain				TXT	CLICOM
MALI	Mopti	ND Meteo	Instantaneous Rain	-	-	-	-	-
			Daily Rainfall	1921	Continues	-	Excel	Clim base
			Monthly accumulation	1921	Continues	-	Excel	Clim base
			Yearly accumulation	1921	Continues	–	Excel	Clim base
COTE D'IVOIRE	Station de Bondoukou	SODEXAM	Temperature	1961	2008		TXT	ACCESS
			Wind	1968	2008		TXT	ACCESS
			Humidity	1981	2008		TXT	ACCESS
			Monthly Piche Evaporation	1994	2008		TXT	ACCESS
			ETP Decade	1983	2008		TXT	ACCESS
			Sunshine	1955	2008		TXT	ACCESS
TOGO	SOKODE	NMD TOGO	Temperature	1960	2007	0%		
			Wind	1971	2007	0%		
			Humidity	1971	2007	0%		
			Evaporation	1971	2007	0%		
			ETP	1961	1990	0%		
			Sunshine	1961	1992	0%		
BURKINA		Meteorological Directorate	Rainfall data	1902	2007		digital (dbf, Excel)	CLICOM
			Evaporation data. A-Level	1960	2007		Digital (dbf,	CLICOM

Country	Station	Institution in charge	Type of data	Starting Year	Year of ending	Gap (%)	Format	Data base
FASO (Extrait)			« A »				Excel)	
			ETP data	1961	2007		Digital (dbf, Excel)	CLICOM
			Data on stations (station code)	-			Digital (Excel)	ECXEL Medium
Ghana (Extract)	Bole	Meteorological Agency	Monthly Rainfall	1961	2005		Digital and analogue	CLICOM
			Daily Evaporation.	1961	2005		Digital and analogue	CLICOM
			Relative Humidity c	1961	2005		Digital and analogue	CLICOM
			Mean Daily Temp. °	1961	2005		Digital and analogue	CLICOM
			Wind Speed	1961	2005		Digital and analogue	CLICOM
	Kete Krachi		Monthly Rainfall	1961	2005		Digital and analogue	CLICOM
			Daily Evaporation.	1961	2005		Digital and analogue	CLICOM
			Relative Humidity c	1961	2005		Digital and analogue	CLICOM
			Mean Daily Temp. °	1961	2005		Digital and analogue	CLICOM
			Wind Speed	1961	2005		Digital and analogue	CLICOM
	Tamale		Monthly Rainfall	1961	2005		Digital and analogue	CLICOM
			Daily Evaporation.	1961	2005		Digital and analogue	CLICOM
			Relative	1961	2005		Digital	CLICOM

Country	Station	Institution in charge	Type of data	Starting Year	Year of ending	Gap (%)	Format	Data base
			Humidity c				and analogue	
			Mean Daily Temp. °	1961	2005		Digital and analogue	CLICOM
			Wind Speed	1961	2005		Digital and analogue	CLICOM
	Navrongo		Monthly Rainfall	1961	2005		Digital and analogue	CLICOM
			Daily Evaporation.	1961	2005		Digital and analogue	CLICOM
			Relative Humidity	1961	2005		Digital and analogue	CLICOM
Ghana (Extract)			Mean Daily Temp. °	1961	2005		Digital and analogue	CLICOM
			Wind Speed	1961	2005		Digital and analogue	CLICOM
	Wa		Monthly Rainfall	1961	2005		Digital and analogue	CLICOM
			Daily Evaporation.	1961	2005		Digital and analogue	CLICOM
			Relative Humidity c	1961	2005		Digital and analogue	CLICOM
			Mean Daily Temp. °	1961	2005		Digital and analogue	CLICOM
			Wind Speed	1961	2005		Digital and analogue	CLICOM
			Monthly Rainfall	1961	2005		Digital and analogue	CLICOM
			Daily Evaporation.	1961	2005		Digital and analogue	CLICOM

Country	Station	Institution in charge	Type of data	Starting Year	Year of ending	Gap (%)	Format	Data base
	Yendi		Relative Humidity c	1961	2005		Digital and analogue	CLICOM
			Mean Daily Temp. °	1961	2005		Digital and analogue	CLICOM
			Wind Speed	1961	2005		Digital and analogue	CLICOM

9.3 Appendix C: References

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