

Volta River Basin

**A Programme of the Governments of the Volta River Basin Countries, with the assistance
of the Global Environment Facility (the United Nations Environment Programme)**

Volta River Basin

**Preliminary
Strategic Action Programme**

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Preface

The Volta River Basin is a globally significant environment that is marked by poverty, high population growth rates, land and water use conflicts, and low industrialization levels. The fledgling democracies of the six riparian countries of the basin (Mali, Burkina Faso, Benin, Togo, Côte d'Ivoire, and Ghana) face social problems with respect to inequitable access to resources, including inadequate healthcare and low literacy rates. These social problems are compounded by the harsh climate of droughts and periodic flooding, which are conditions that breed tropical diseases and inhibit sustainable livelihoods from the land.

The Volta River Basin is a critical resource for the riparian countries, both economically and ecologically. Although the riparian countries have different economic bases, the areas of the countries located within the Volta River Basin depend almost entirely upon land and water resources through agriculture, animal husbandry, and forestry. Thus, the approximately 20 million people currently inhabiting the 400,000 km² basin area are heavily dependent on the health of the basin's soil and water resources. Additionally, much of the energy that fuels the restricted economic development occurring in the region comes from hydroelectric dams in the basin. As a result, the national economies of Ghana, Burkina, Faso, Togo, and Benin are strongly linked to the adequacy of water supplies reaching the downstream dams. These resources, however, are now facing transboundary threats, which include land degradation, water quality degradation, water scarcity, biodiversity loss, and flooding.

The six countries of the Volta River Basin recognize the need to come together to protect the valuable basin environment and at a workshop in 1999 signed a declaration to combine their efforts for integrated management of the ground and water resources. The countries of the region sought the assistance of UNEP and the Global Environment Facility (GEF) in preparing a Transboundary Diagnostic Analysis (TDA) of the major perceived issues and problems and their root causes. This process, begun in 2001 and undertaken in accordance with the GEF Operational Strategy, has served as the basis for this Draft Preliminary Strategic Action Programme. National TDA reports were completed by country experts, regional meetings were held to synthesize the information, and a draft preliminary TDA was produced. In May 2002, consultants undertook the revision of the earlier TDA and the resulting final draft was issued on 4 November 2002. In undertaking this process, the region both benefited from and complemented the African Process MSP and the New Partnership for Africa's Development (NEPAD). In addition, the project will form a substantial basis for the implementation of NEPAD's environmental component. Further, the project adheres to the World Summit on Sustainable Development Plan of Implementation.

The present Draft Preliminary Strategic Action Programme is based on the findings of the draft preliminary TDA that represents a regional synthesis of major issues identified from the national reports and regional meetings. The draft preliminary TDA identifies the priorities among land and water-related problems and concerns, their socio-economic root causes, the sectoral implications of actions needed to mitigate them, and the extent to which the problems are transboundary in either origin or effect.

A key element of the Volta River Basin project must be actions that will lead to the further elaboration and development of the present Draft Preliminary Strategic Action Programme. It is the intention of participating governments that this process of development will take place during the full GEF project arising from these activities.

The methodology applied in this SAP has been to develop priorities based on information (sparse in some areas though it may be) developed in the draft preliminary TDA. In the TDA, major perceived problems and issues were identified, as were the socio-economic root causes. In order to frame interventions for each of these MPPIs with its appropriate root causes, this SAP made use of Environmental Quality Objectives (EQOs). EQOs are commonly used in Europe, for instance, to achieve a consensus position on vision for the environment. The EQOs envision encapsulating not only the major areas of the environment where value is placed by the populace, but also on the uses to be made of that aspect of the environment (e.g., clean air, provision of sustainable resources, recreational use). This approach is a powerful one in that it states quite simple objectives that the Region agrees to, as a basis for defining actions. The next step is to identify quantitative targets for each EQO. Those targets are precise, succinct, have an associated timeline (next five to ten years), and have indicators associated with them. The targets are generally not the only ones needed to achieve the EQO, but rather represent a step towards satisfying the EQO. Once the targets are agreed, then specific actions or interventions leading to achievement of the targets within the stated time period are identified. These targets, likewise, must be precise, and achievable. How they are to be achieved, and by whom, must be negotiated amongst the stakeholders. The GEF has a role to play in those interventions that address transboundary aspects, and that therefore are incremental.

The actions proposed in the Draft Preliminary Strategic Action Programme are wide-ranging in class of intervention. Some of the interventions proposed are policy/legal interventions. Some are demonstration projects. Some are capacity building. Some represent institutional strengthening. Some represent scientific studies or data management. Overall, the diversity of interventions is required to provide a sustainable SAP, and sustainable long-term efforts at environmental protection. Successful implementation of the SAP will require active participation by a variety of stakeholders at all levels and of all types: regional/national/local governmental levels, international partners, private sector, non-governmental organizations, both international and bilateral, and others. UNEP's mandate is to facilitate this process, and to help assure synergies between participating partners and projects are maximized, to the benefit of the environment.

1.0 Background and Rationale

The Volta River Basin Region comprises four coastal states (Côte d'Ivoire, Ghana, Togo, and Benin) and two land-locked countries (Burkina Faso and Mali). Although the six Volta River Basin nations overall are at varying stages of political and economic development, the economy of the Volta River Basin watershed is fairly homogeneous throughout the region as it is based on agriculture and animal husbandry. Nonetheless, the region is one of the poorest in the world.

The countries are linked by a common need for the valuable land and water resources of the Volta River Basin. While there is no single regional convention that addresses management of the Volta environmental resources, the countries are involved in a number of bi-lateral and multi-lateral regional cooperation initiatives. One such initiative is the African Process that is being implemented by UNEP through a GEF Medium Sized Project and is serving as the environmental component of the New Partnership for Africa's Development (NEPAD).

Understanding that a regional approach is urgently needed to halt degradation of the environment of the Volta River Basin, the countries of the region sought the assistance of UNEP and the GEF in preparing a TDA and SAP. The draft preliminary TDA identified the priorities among land and water-related problems and concerns, their socio-economic root causes, the sectoral implications of actions needed to mitigate them, and the extent to which the problems are transboundary in either origin or effect. This draft SAP draws upon the draft preliminary TDA to develop and prioritize interventions for addressing the major problems and issues. At the end of this series of SAP interventions, the countries should be closer to addressing their national land and water environmental issues, so as to be more effective in the achievement of regional solutions to transboundary problems.

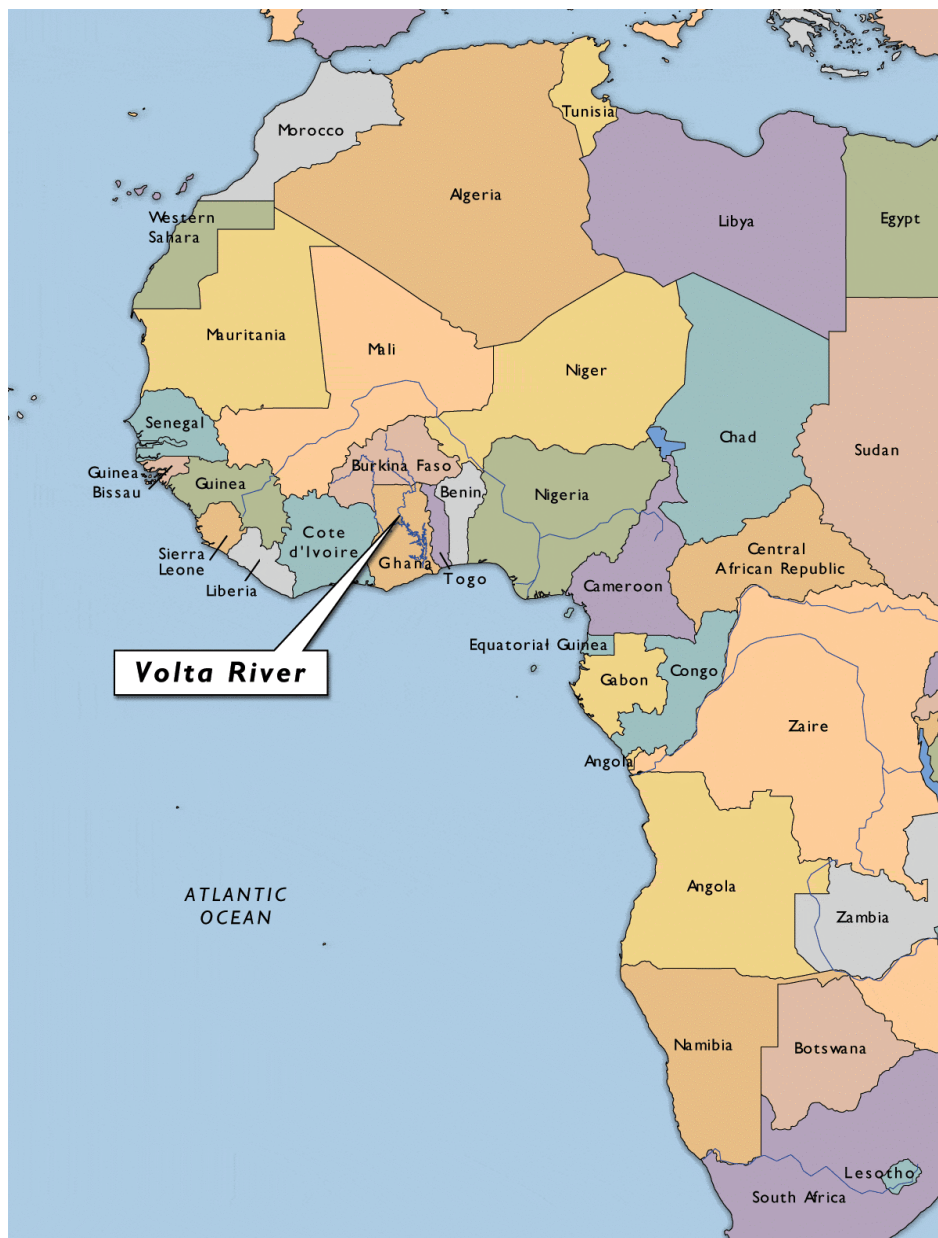
This draft SAP is organized in the following manner. Section 1 provides the background and rationale for the SAP, and includes a discussion of the process by which the SAP was put together.

Section 2 provides a brief review of the major perceived problems and issues identified by the TDA, and the root causes of degradation and threats to the environment. This section briefly summarizes some of the major findings of the draft preliminary TDA. It sets the stage for the development of the SAP, by indicating the major problems, root causes, and threats, which the SAP is designed to address.

Section 3 discusses how the major interventions are derived through the use of overarching policy-level Environmental Quality Objectives (EQOs) and associated targets. The EQO is the bridging mechanism to move from the understanding of the primary problem areas, root causes, and threats (analysis phase of the TDA/SAP process) into the Action Phase of the SAP, where specific national and transboundary actions and interventions must be identified and agreed. This bridging mechanism links the actions/interventions to specific OUTCOMES that are agreed regionally: the EQOs. Each EQO, while overarching, has specific targets assigned to it to meet the needs of the timeframe of the SAP (5-10 years). Each target has an associated environmental indicator, which is the metric that will be used to determine whether that target has been

achieved or not. The environmental indicator might be one of three kinds: Process Indicator, Stress Reduction Indicator, or Environmental Status Indicator.

Figure 1. Volta River Basin Area



Section 4 then discusses the Priority Actions and Interventions that will lead to achievement of the various targets, and step towards satisfaction of the EQOs (on a longer-term basis). The priority actions and interventions are presented in two ways. First, they are listed according to EQO and the specific target that they support. Second, each action/intervention is categorized into the appropriate type of intervention (policy, legal/regulatory, institutional strengthening, capacity building, investment, scientific investigation, data management process), and listed

according to category. This second presentation makes much clearer the close parallelism in approach towards satisfying the three different EQOs for the Volta River Basin, demonstrating that each has policy, legal, capacity building, etc., interventions and actions.

Section 5 is an outline of a cost-benefit analysis to support the actions/interventions of the SAP. Lacking adequate information from the draft Framework, the cost-benefit analysis cannot be completed at this stage. It will be completed during the full GEF project as the list of actions/interventions are refined, and as the methodology for evaluating resource valuations is agreed within the region.

Section 6 is a brief listing of the top areas of priority regional (Transboundary) and national actions, culled from the tables of Section 4.

ICARM

The priority actions are consistent with the Integrated Coastal Area and River Basin Management (ICARM) approach. ICARM requires the adoption of goals, objectives and policies and the establishment of governance mechanisms which recognise the interrelationships between the two systems with a view to environmental protection and socio-economic development. The *goals* of integrated coastal area and river basin management fall within the framework of sustainable development according to which environmental conservation is of equal importance to economic efficiency and social equity, all sought in a long-term perspective on the basis of intergenerational equity. In this context planning acquires a special role in establishing a process of governance and a strategic framework of goals, policies and actions.

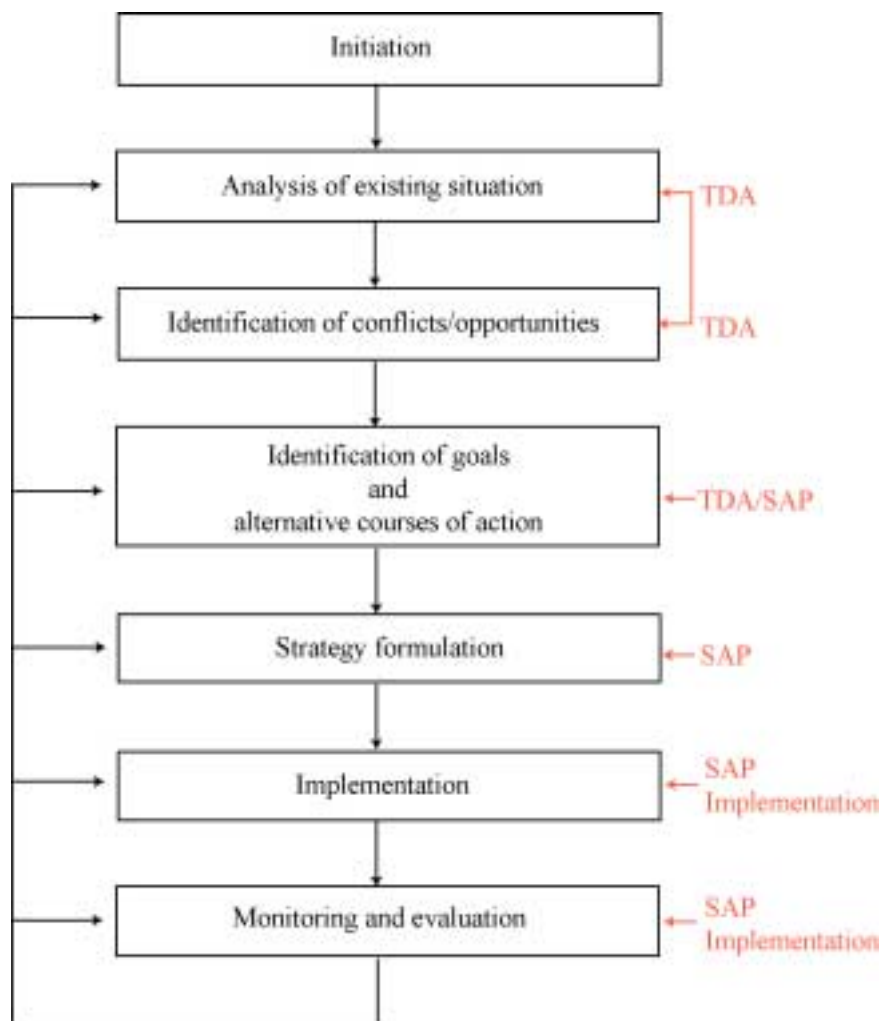
Phases of the Process

Planning is a cyclical process following a sequence of basic steps from analysis to synthesis and action which for the purposes of these guidelines can be distinguished as follows (see Figure 2):

- *Initiation*
This is the basic inception task, which involves organisation and mobilisation for planning.
- *Analysis of the existing situation*
This step involves essentially a reconnaissance survey of basic characteristics in terms of the structure and dynamics of natural and human ecosystems. Therefore, it deals with the critical processes and factors, their extent and spatial distribution, etc.
- *Identification of conflict and opportunities*
This step deals with the interaction between natural and human ecosystems today and in the future. It includes the analysis of needs of and the pressures on the basic stakeholders; these influence decision making in development and environmental management.
- *Identification of goals and alternative courses of action*
This step involves an analysis of critical factors and processes, conflicts and opportunities in order to identify basic management goals and objectives. These should be formulated with a long-term perspective in the context of sustainable development principles. Alternative courses of action can be then identified reflecting the different priorities which may be placed on goals and objectives.

- *Development of a strategy*
A selection is made, in the context of public policy making, from among the alternative strategies identified above in order to translate the goals and objectives into targets and policy measures, with the aim of developing a guidance system for environmental management. The institutional setting influences such decisions as it identifies stakeholder responsibilities and legal/administrative procedures. This step involves commitment to mobilise resources and priorities in the form of a programme of action.
- *Implementation*
This phase involves the actual implementation of the programme of action and is strongly linked to the next step.
- *Monitoring and evaluation*
This provides for administrative procedures and mechanisms to review periodically progress towards the achievement of goals and objectives, through assessment, of the state of the environment and policy implementation.

Figure 2. Planning Process of ICARM



1.1 Global and Regional Significance of the Volta River Basin

The Volta River Basin is rich in natural resources and has significant potential for development, but is held back, in part, by low human capacity that stems from high population growth rates, low literacy levels, malnutrition, and the prevalence of water-borne diseases. The riparian states are among the poorest countries in the world, and although there are disparities in GDP among them, they do not indicate significant variation in levels of development. Only Ghana is ranked among the states with Medium Human Development, whereas the remainder of the basin countries are classified as having Low Human Development.

Table 1. Human Development Statistics

Country	Human Development Index Ranking 2001	GNP/Capita (\$) (1999)
Benin	147	380
Burkina Faso	159	240
Côte d'Ivoire	144	710
Ghana	119	390
Mali	153	190
Togo	128	320

Sources: UNDP Human Development Report 2001 (HDI), World Development Report 2000/2001 (GNP)

The land and water resources of the Volta Basin supply the basin states with much-needed food, minerals, and energy. The Volta River Basin with its vast agricultural lands, pasturelands, and forests, provides much of the food and timber products for the areas of the riparian states outside the basin. Additionally, the waters of the Volta River and its tributaries provide the vast majority of the electricity through hydropower dams that fuel economic development in much of the rest of the basin states.

As the table below indicates, however, the region has extremely high population growth rates that threaten future use of the basin's natural resources. The basin population is expected to increase by as much as 80%, to 34,000,000 people, by the year 2025. Some regions are not currently meeting water and land resource demand; this problem will only be exacerbated as population pressure continues to grow. For comparison, the population growth rate of the more developed countries is less than 1%.

Table 2. Growth Rate Statistics

Country	2000	Projected in 2025	Growth Rate (%)	P/km ² Density		
			2000	2000	Urban %	Rural %
Benin	476,775	820,000	2.27	43.4	36	64
Burkina Faso	8,874,148	15,997,351	2.38	41.53	22.6	77.4
Côte d'Ivoire	397,853	717,672	2.53	8 - 22	23	77
Ghana	6,674,376	11,696,054	2.5	26 - 104	16	84

Country	2000	Projected in 2025	Growth Rate (%)	P/km ² Density		
			2000	2000	Urban %	Rural %
Mali	625,000	1,260,000	2.78	45 - 75	12.2	87.8
Togo	1,594,446	3,385,266	2.80	66	30	70
Total	18,642,598	33,876,343				
Average			2.54	48.5	23.3	76.7

The expanding population is already putting pressure on available natural resources. Currently, farmers in many areas are no longer able to set aside land to lie fallow for a sufficient period of time to allow the soil to regain valuable nutrients, thus quickening the pace of land degradation. Populations in some areas are being forced to grow crops on marginal lands that quickly experience erosion or degradation. Expanding animal husbandry also affects the land as forested areas are cut to provide fodder for the cattle and uncontrolled bushfires are spread across borders. This sometimes unsustainable use of the land reduces future availability of natural resources.

The region's water resources are also being used at an increasing rate at the same time that sources are diminishing due to changes in the hydrological balance and detrimental land-use patterns. Water resources are provided by rivers and groundwater. Most rivers flow only 3-4 months of the year, encouraging construction of unauthorized dams, often inappropriately designed, to create more permanent surface water sources. Due to the combination of geology and low rainfall, groundwater sources are not abundant, and are frequently deeper than rural wells can be drilled without improved technology. Seasonal water scarcity is a regional problem. In recent years, a shortage in the amount of water reaching the Akosombo Dam created a scarcity of electricity that had far-reaching economic implications. As Burkina Faso and Ghana build additional hydroelectric dams and further increase dependence on hydropower, adequate water resources could potentially become a source of conflict in the region.

This extensive land and water resource use takes a toll on the biodiversity of the basin. Within the basin there are a number of national parks and protected areas that serve as habitat for globally significant species, including endangered and threatened species. Many of these areas are being encroached upon, however, and poaching and habitat destruction threaten to wipe out some species. The Volta River and some of its tributaries contain important fisheries resources. Water quality degradation, overfishing, damming of the rivers, and aquatic weeds threaten these limited resources.

Finally, the health of the Volta River, as it flows into the Gulf of Guinea, significantly affects the rich coastal biodiversity. The Volta River carried sediments necessary to keep the river delta intact, but this supply was halted when the Akosombo Dam was constructed nearly four decades ago. As a result, significant coastal erosion has occurred and nesting sites for endangered sea turtles have been destroyed. This also affects Ghana's most species-diverse mangrove forest, which is located at the mouth of the river and serves as a nursery site for commercial marine fishes and shrimps. The Volta River, including its delta, is a globally significant habitat for migrating birds. Altered water and sediment discharges threaten the vitality of this habitat.

Thus, protection of the Volta River Basin environment has not only global significance due to the richness of the basin and coastal biodiversity, but it is also essential for the livelihood of the basin countries which depend on these resources for future economic development and for survival.

1.2 Basis for Preparation of the Strategic Action Programme

The draft preliminary TDA for the Volta River Basin is primarily based on national TDA reports prepared in 2001-2002 by Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, and Togo. During the course of preparing these reports, National Coordinators from each of the six countries met twice to prioritize the many issues and concerns relating to the Volta River Basin environment. A Steering Committee meeting, during which the issues raised at the National Coordinators' meetings were endorsed, followed each of these regional meetings. Following these meetings, the Regional Coordinator drafted an initial version of the TDA, upon which the current draft preliminary TDA draws heavily. Also consulted during the drafting of the draft preliminary TDA were a number of reports prepared for the African Process implemented through the GEF MSP project "Development and Protection of marine and coastal environment of the Sub-Saharan Africa." The draft preliminary TDA provides an assessment of the regional and wider significance of these issues; an analysis of the socio-economic causes of environmental degradation; an evaluation of the sectoral implications of actions needed to mitigate them; and an analysis of priorities from the national and regional perspectives.

The Draft Preliminary Strategic Action Programme (this document) is based on the preliminary findings of the regional Draft Preliminary Transboundary Diagnostic Analysis.

The Preliminary TDA benefited from interaction with numerous groups and projects in the region, including:

- West Africa Technical Committee of Global Water Partnership (WATAC/GWP)
- GLOWA Volta Project on Integrated Assessment of Feedback Mechanism Between Climate, Land Use, and Hydrology
- Green Cross International/Burkina Faso
- World Bank
- Agence Francaise de Développement
- West and Central Africa Action Plan for Abidjan Convention (WACAF)
- Land-Ocean Interactions in the Coastal Zones (LOICZ Afribasins project)
- Center for Africa Wetlands (CAW)

Also, as stated in Section 1, this SAP development is fully consistent with UNEP's ICARM approach.

2.0 Causes of Degradation and Threats to the Aquatic Environment and Resources of the Volta River Basin

2.1 Causes of Environmental Degradation

The draft preliminary TDA identified the following list of major perceived problems and issues. It includes eight existing perceived problems/issues and two emerging problems/issues:

1. Land degradation
2. Water scarcity
3. Loss of biodiversity
4. Flooding
5. Water-borne diseases
6. Growth of aquatic weeds
7. Coastal erosion
8. Water quality degradation
9. Urbanization
10. Increase in Industrial and Mining Activities

The TDA identified **land degradation** as one of the priority issues in the Volta River Basin. The problem of land degradation in the basin encompasses soil degradation, intense erosion, and desertification. As discussed above, the basin's population is heavily dependent upon the land resources of the region for subsistence agriculture and livestock breeding. The increasing demographic pressures have resulted in the overuse and misuse of land resources.

The major transboundary patterns of land degradation can be illustrated as follows:

- Transhumance
- Bushfires
- Deforestation and devegetation
- Population pressure and migration across borders

Major environmental impacts of land degradation include:

- High concentration of suspended solids
- Siltation of waterways and reservoirs
- Increased stormwater runoff
- Reduced water infiltration into soil and aquifers
- Degradation of water quality from increased use and runoff of fertilizers
- Loss of habitats and biodiversity
- Desertification
- Reduction of soil productivity, reduced animal and crop production

The major socio-economic impacts are:

- Reduction in water for irrigation and human needs
- Reduction in productivity of agricultural lands
- Reduction in productivity of pasture lands
- Decreased availability of agricultural and pasture lands
- Decreased forestry resources
- Loss of medicinal plants
- Increased competition over land resources
- Migration of populations to find fertile lands
- Decreased food security and ensuing effects on human health
- Reduction in hydroelectric power capabilities
- Increased poverty and disease

The root causes of land degradation include:

- Insufficient scientific capacity
- Low government priority on environment
- Abuse of power
- Poverty
- Insufficient knowledge/understanding
- Inadequate institutions
- Population pressure
- Inadequate legal/regulatory basis
- Inadequate technical infrastructure
- Insufficient demonstration projects
- Inadequate intersectoral cooperation
- Insufficient economic incentives
- Inadequate political will
- Inadequate water basin management
- Insufficient government power

Another critical area identified in the TDA is **water scarcity**. The water resources in the basin do not currently meet the needs of the population. As the basin population may increase by as much as 80% over the next 25 years, demand for water resources will also increase, resulting in even greater scarcity. This scarcity is likely to be even further exacerbated by decreased availability of water resources due to climatic and anthropogenic factors.

The major transboundary elements of the problem can be summarized as follows:

The drying up of streams in the upper sub-catchment of the basin can induce drying up or reduction of flows in the downstream rivers in other countries. Streams upstream can dry up as a result of human induced actions such as deforestation of the headwaters and the forest gallery along the river channels. Rampant expansion in the number of dams and reservoirs is another

example. Thus, altering land surfaces and stream flows in such a way that results in the drying up of streams is a transboundary issue.

Changes of land cover and poor precipitation reduce recharge of groundwater aquifer systems. In the basin, some of the scarce aquifers are shared among the riparian countries and human activities in the recharge zone can be a transboundary problem. Also, over-exploitation of groundwater resources through poor water resource development and planning can also create transboundary causes to water scarcity. This factor is particularly pertinent since the aquifers are limited in capacity, on average, throughout the basins.

Impoundments and reservoirs lose water through evaporation; the larger the surface area of the reservoir, the greater the evaporation. Reservoir systems constructed with large surface areas and shallow depths because of lack of suitable topography can potentially lose large amount of water and create water deficit downstream (such as Volta Lake in Ghana).

The effects of water scarcity can also be of a transboundary nature. When there is inadequate water for hydroelectric generation, electricity cannot be exported to those countries in need in the basin, resulting in economic loss. Inadequate water supplies for people and livestock have induced significant migration (transhumance) across boundaries in search of water resources.

Major environmental impacts of water scarcity include:

- Loss of biodiversity, including modification or destruction of habitats
- Loss of productivity of soils
- Reduction of fisheries and animal stocks
- Reduction in groundwater

Major socio-economic impacts are:

- Reduction in agricultural production
- Shortage of drinking water
- Increased cost of alternative water supplies
- Decline in drinking water quality
- Decrease in forestry resources
- Decrease in animal husbandry
- Reduction in hydroelectric generation
- Increased costs of electricity
- Migration/transhumance
- Increased poverty and disease

The root causes of water scarcity include:

- Inadequate technology
- Drought
- Low government priority on environment

- Abuse of power
- Poverty
- Insufficient demonstration projects
- Inadequate legal/regulatory basis
- Insufficient economic incentives
- Inadequate intersectoral coordination
- Insufficient regional agreements
- Insufficient knowledge/understanding
- Inadequate institutions

Another critical area identified in the TDA is **loss of biodiversity**. The Volta River Basin has a globally significant biodiversity and diverse habitats that are threatened by anthropogenic sources. Perhaps the greatest threat comes from the clearing of land for farming and animal husbandry, and from forestry practices. Some farmers use bushfires for land preparation, re-growth of vegetation for cattle grazing and hunting, etc., at the expense of the environment. This practice enhances the destruction of habitats, loss of biodiversity, as well as overall deterioration of biotic resources.

The major transboundary patterns of loss of biodiversity can be illustrated as follows:

- Destruction of habitats through bushfires and deforestation occur across borders
- Some forest reserves and protected areas are located at country borders and are vulnerable to poaching and other cross border activities
- Damming of rivers upstream affects the freshwater quality and resources downstream
- Damming of rivers upstream affects the floodplain downstream
- Damming of rivers alters the sediment balance
- Damage to transboundary ecosystems

Major environmental impacts of loss of biodiversity and destruction of habitats include:

- Loss of natural productivity
- Reduction of fish stocks and threat to other species
- Loss of globally significant biodiversity
- Degradation of forest ecosystems
- Degradation of river ecosystems
- Changes to the hydrological regimes
- Increased delta and coastal erosion

Major socio-economic impacts of loss of biodiversity include:

- Reduction in income from fisheries and hunting
- Changes in employment
- Loss of aesthetic value
- Loss of income from tourism industry
- Loss of cultural heritage

- Loss of use of medicinal plants

The root causes of loss of biodiversity and destruction of habitats include:

- Inadequate national and regional legal/regulatory basis
- Poverty
- Inadequate technical infrastructure
- Inadequate political will
- Inadequate human capacity
- Inadequate institutions
- Insufficient scientific capacity
- Low government priority on environment
- Abuse of power
- Insufficient economic incentives
- Insufficient government power

Another perceived problem identified in the TDA is **flooding**. Extremely seasonably variable rainfall rates and the creation of unauthorized dams and barrages without appropriate management practices are normally blamed for the flooding. Land-use conversions can also exacerbate the problem. Soils with significantly reduced vegetation cover that are exposed to the atmosphere elements have little infiltration capacities to reduce storm water runoff. These floods affect the environment of the basin, but also cause significant loss of human life and economic loss.

The major transboundary patterns of flooding can be illustrated as follows:

Flooding has a transboundary cause in the basin as a result of uncontrolled dam releases from the upper part of the basin, e.g., from Burkina Faso to Ghana on the White Volta, and also from Burkina Faso to Mali on the Sorou River as the backwater effect from the management of the Léry dam.

Flooding also causes transboundary migration of people escaping rising waters.

Major environmental impacts of flooding include:

- Inundation of lands
- Erosion
- Loss of habitat
- Degradation of water quality

Major socio-economic impacts are:

- Loss of human life
- Loss of infrastructure
- Water-borne diseases

- Effects on human health
- Loss of agricultural productivity
- Migration
- Disruption of transportation infrastructure
- Increased poverty

The root causes of flooding include:

- Insufficient regional agreements on water
- Insufficient scientific capacity
- Low government priority on environment
- Abuse of power
- Poverty
- Insufficient economic incentives
- Inadequate technical infrastructure
- Insufficient knowledge/understanding
- Inadequate legal/regulatory basis
- Inadequate political will
- Inadequate institutions
- Insufficient government power
- Insufficient demonstration projects
- Insufficient knowledge/understanding
- Population pressure

The fifth major perceived problem is **water-borne diseases**. Water-borne diseases have arisen in the basin largely as a result of the creation of dams and ponds, and of flooding. The natural (pre-impoundment) flow rates of the streams and rivers have been altered (slowed) to suit the breeding of the disease vectors at the banks of the rivers. Additionally, the proliferation of aquatic weeds exacerbates the problem of water-borne diseases as the weeds serve as hosts for disease-causing parasites.

The major transboundary patterns of water-borne diseases can be illustrated as follows:

Water-borne diseases can be transboundary because of the movement and spread of disease vectors in the basin. Diseases have been eradicated in one part of the basin, only to be re-infected from another area of the basin. Additionally, water-borne diseases have been exacerbated by transboundary activities such as the damming of rivers, altering the timing, strength (flooding), and duration of the water flows.

Major environmental impacts of water-borne diseases are:

- Possible damage to fish resources
- Possible decline in biodiversity

The major socio-economic impacts are:

- Loss of human life
- Effects on human health
- Migration of populations to escape water-borne diseases
- Economic loss due to illness in workforce
- Increased poverty and disease

The root causes of water-borne diseases are:

- Insufficient regional agreements
- Inadequate legal/regulatory basis
- Insufficient scientific capacity
- Low government priority on environment
- Abuse of power
- Poverty
- Inadequate economic incentives
- Inadequate technical infrastructure
- Inadequate political will
- Insufficient demonstration projects
- Inadequate intersectoral cooperation
- Insufficient knowledge/understanding
- Poor alternative technology
- Inadequate training
- Inadequate technology

A sixth problem identified in the TDA is the **growth of aquatic weeds**. This has been of particular concern on some of the tributaries, especially on the Oti River, and on a tributary of the Black Volta. The weeds were probably inadvertently introduced into the basin as ornamental plants or were transferred accidentally with fishing gear. The growth of the weeds has been exacerbated by the contamination of the waterways with fertilizers and other pollutants.

The major transboundary patterns of the growth of aquatic weeds can be illustrated as follows:

The causes of aquatic weeds include introduction of alien weeds into the basin, and transfer of watercrafts and fishing gear as a result of trans-migration. Additionally, the runoff of fertilizers and nutrients from farmlands exacerbates the growth of the weeds. In the Oti Basin, aquatic weeds are located in both Togo and Ghana and this could be a transboundary issue.

Major environmental impacts of the growth of aquatic weeds include:

- Reduction in biodiversity
- Degradation of water quality
- Reduction of fisheries
- Increase in water lost through evapotranspiration

Major socio-economic impacts are:

- Reduction in transport along the waterways
- Reduction in power-generating capabilities of hydroelectric plants
- Exacerbation of water-borne diseases
- Increased poverty through loss of income to fishermen

The root causes of the growth of aquatic weeds are:

- Insufficient knowledge/understanding
- Inadequate legal/regulatory basis
- Insufficient government power
- Inadequate institutions
- Insufficient regional agreements
- Abuse of power
- Poverty
- Insufficient economic incentives
- Inadequate technological infrastructure
- Inadequate political will

A seventh problem identified in the TDA is **coastal erosion**. Some coastal countries observed high coastal erosion as a probable result of creation of the Akosombo Dam with the attendant deficit of sediments reaching the coast.

The major transboundary patterns of coastal erosion can be illustrated as follows:

- Upstream dams are affecting the downstream coastline
- Several countries use the electricity generated from the Akosombo Dam, the prime contributor to coastal erosion
- Migratory species' habitat is being degraded

The major environmental impacts of coastal erosion are:

- Degradation of coastal habitats, including migratory bird habitats
- Destruction of sandy beaches used as nesting sites by endangered marine turtles
- Change in coastal waters
- Loss of productivity of waterways
- Reduction in biodiversity
- Degradation of water quality

Major socio-economic impacts include:

- Loss of fish landing sites
- Loss of aesthetic value and tourism

- Loss of coastal resources
- Increased storm damage
- Loss or damage to human life or infrastructure

The root causes of coastal erosion are:

- Insufficient scientific capacity
- Low government priority on environment
- Abuse of power
- Insufficient demonstration projects
- Poverty
- Inadequate political will

The final problem identified in the TDA is **water quality degradation**. The major transboundary patterns of water quality degradation can be illustrated as follows:

Surface water resources are shared throughout the basin, making the degradation of water quality a strongly transboundary problem.

- Pollution is distributed throughout the waterways
- Land clearing in upstream countries have downstream effects

Major environmental impacts of water quality degradation include:

- Loss of biodiversity
- Loss of fisheries
- Harmful effects on coastal waters
- Occasional harmful algal blooms

Major socio-economic impacts are:

- Scarcity of potable drinking water
- Scarcity of non-polluted water for agriculture and animal husbandry
- Effects on human health
- Increase in water-borne diseases
- Loss of fisheries

The root causes of water quality degradation are:

- Insufficient regional agreements
- Inadequate legal/regulatory basis
- Insufficient knowledge/understanding
- Insufficient government power
- Inadequate institutions
- Abuse of power

- Poverty
- Inadequate national legal/regulatory basis
- Inadequate technology
- Inadequate training
- Population pressure
- Insufficient demonstration projects
- Inadequate intersectoral coordination
- Insufficient economic incentives
- Inadequate political will

The Transboundary Diagnostic Analysis provides more detailed information on the root causes and sources of the problems identified.

2.2 Emerging Problems for the Volta River Basin

Two emerging problems have been identified that may affect the environment of the Volta River Basin in the future

2.2.1 Urbanization

Urbanization is occurring, albeit slowly, in the basin and it already has been noted as a problem in Ghana. Problems associated with urbanization relate to increasing populations, including overall national population growth and migration into urban areas. These changes will have significant consequences for waste management and the threat of degradation and scarcity of water supplies.

2.2.2 Increase in Industrial and Mining Activities

While industrial development has been slow in the Volta River Basin, it will continue to increase, particularly as the population expands. This industrial growth can be expected to produce potential new point sources of pollution that will have impacts on land and water resources in the basin. Mining activities in the basin, although currently relatively small in scale, could expand and pose an even greater threat to the environment than they currently do.

The rising population growth and increasing industrial development raise the demand for hydroelectric power. The general tendency in the region will be to continue impounding river basins for electricity generation. This threatens future availability of water resources, as well as the coastline of Ghana.

3.0 Establishment of Environmental Quality Objectives for the Volta River Basin

3.1 General

The national reports and the Draft Preliminary Transboundary Diagnostic Analysis identified the major perceived problems of the Volta River Basin as being land degradation, water scarcity, loss of biodiversity, flooding, water-borne diseases, growth of aquatic weeds, coastal erosion and water quality degradation. Emerging problems were identified as urbanization and increasing industrial activities and mining.

For a number of these issues and problems, quantitative indicators of loss or degradation are not available. In other cases, the data and information are not uniform throughout the region. Thus, further in-depth studies are required in order to establish definitive EQOs for protection and management of the environment and its resources. Nevertheless, recognizing the urgency of the issues and problems, the preliminary EQOs and targets have been established for the key issues identified for priority action in the immediate future.

Underlying the process of degradation of the various resources described in the TDA is the lack of an effective institutional framework at national and regional levels for collective management of the environment and resources. This problem is addressed among the priority actions outlined in this Draft Preliminary Strategic Action Programme.

This section (3) is organized first by providing the objectives of the SAP, then by introducing the concept of Environmental Quality Objectives, and next listing those EQOs for the Volta River Basin land and water focal area. This section ends with a list of the specific targets identified in the 5-to-10 year time frame to move towards achievement of those EQOs.

Section 4 then takes the EQOs and targets, and lists the specific activities that are proposed to achieve those targets in the 5-to-10 year time frame. The activities are not costed yet, but will be costed as this Programme is updated and revised during the full GEF Project. Each activity is classified according to category of intervention (policy, legal/regulatory, institutional strengthening, capacity building, investments, scientific investigation, and data management). An additional table (Table 6) depicts the activities/interventions according to category of intervention, to show the broad-ranging activities within each category.

Section 5 outlines a cost-benefit analysis to support the actions/interventions of the SAP. Lacking adequate information from the draft Framework TDA, the cost-benefit analysis cannot be completed at this stage. It will be completed during the full GEF project as the list of actions/interventions is refined, and as the methodology for evaluating resource valuations is agreed within the region.

Section 6 then identifies the priority Actions and Interventions that are proposed in the immediate term. These Actions and Interventions cover a broad range of needs, but are the priority areas where stakeholder focus must reside in the near term.

3.2 Objectives, Rationale, and Priorities for the SAP

The ultimate goal of the Strategic Action Programme is to halt or slow the current rate of environmental degradation. It contains priority actions that need to be undertaken at both national and regional levels by a variety of stakeholders. It is designed to assist participating states in taking actions individually or jointly within their respective policies, priorities and resources, which will lead to the prevention, reduction, control and/or elimination of the causes of degradation of the freshwater and coastal environment. Achievement of the aims of the SAP will contribute to the protection of human health; promote the conservation and sustainable use of resources; and contribute to the maintenance of globally significant biological diversity.

The general objectives of the SAP are:

- Formulation of principles, approaches, measures, timetables and priorities for action; Preparation of a priority list for intervention and investments;
- Detailed analysis of expected baseline and additional actions needed to resolve each transboundary priority problem;
- Identification of the elements and preparation of guidelines for the formulation of national action plans for the protection of the marine environment and rational use of marine and coastal resources consistent with the regional SAP;
- Foster the involvement of regional and, where appropriate, national Non-Governmental Organizations and the private sector in the implementation of the SAP; and
- Foster collaboration and co-operation between all regional entities having interests in the environment of the Volta River Basin in an attempt to reduce or eliminate duplication of effort and waste of scarce human and financial resources.

The countries of the Volta River Basin have the basic infrastructure necessary for the protection of the environment and for the sustainable use of land and water resources, including competent institutions with authority for protection of the environment, and adopted legislation and regulations. However, the governments of the region have recognised that past actions at national and regional levels have not been adequate to halt the rate of degradation and that a more strategic approach is required. Consequently, regional environmental objectives and targets to achieve these objectives have been defined. These objectives, EQOs, and targets address the major areas of concern identified in the draft preliminary TDA, which are prioritised below:

High Priority

- Land degradation
- Water scarcity

Medium Priority

- Loss of biodiversity
- Water quality degradation

Low Priority

- Water-borne diseases
- Flooding
- Growth of aquatic weeds
- Coastal erosion

3.3 Environmental Quality Objectives, Targets, and Priority Actions

In order to categorize and prioritize interventions for each major perceived problem and issue, the MPPIs were recast into overall Environmental Quality Objectives.

The environmental impacts, socio-economic impacts, and root causes of the various MPPIs overlap to a great extent. Common are their causes: for instance, land-based activities affect water quality and quantity, loss of biodiversity, flooding and growth of aquatic weeds (see Table 3). Therefore, recognizing these overlaps and the priorities that arose from the TDA process, the EQOs were limited to three overarching objectives:

Table 3. Root Causes and Major Perceived Problems and Issues

Root Causes	Perceived Problems							
	MPPI 1	MPPI 2	MPPI 3	MPPI 4	MPPI 5	MPPI 6	MPPI 7	MPPI 8
	Land Degradation	Water Scarcity	Loss of Biodiversity	Flooding	Water-Borne Diseases	Growth of Aquatic Weeds	Coastal Erosion	Water Quality Degradation
Insufficient scientific capacity	√		√	√	√		√	
Low government priority on environment	√	√	√	√	√		√	
Abuse of power	√	√	√	√	√		√	√
Poverty	√	√	√	√	√	√	√	√
Insufficient knowledge / understanding	√	√		√	√	√		√
Population pressure	√			√				√
Inadequate legal / regulatory basis	√	√	√	√	√	√		√
Inadequate technical infrastructure	√		√	√	√	√		
Insufficient demonstration projects	√	√		√	√		√	√
Inadequate intersectoral coordination	√	√			√			√
Insufficient economic incentives	√	√	√	√	√	√		√
Inadequate political will	√		√	√	√	√	√	√
Inadequate water basin management	√							

Root Causes	Perceived Problems							
	MPPI 1	MPPI 2	MPPI 3	MPPI 4	MPPI 5	MPPI 6	MPPI 7	MPPI 8
	Land Degradation	Water Scarcity	Loss of Biodiversity	Flooding	Water-Borne Diseases	Growth of Aquatic Weeds	Coastal Erosion	Water Quality Degradation
Insufficient regional agreements		√		√		√		√
Drought		√						
Inadequate human capacity			√					
Inadequate institutions	√	√	√	√		√		√
Inadequate technology		√	√		√			
Insufficient government power	√	√	√	√	√	√		√
Inadequate training					√			√

1. *Balanced aquatic ecosystem*

Addresses the following MPPIs:

- Loss of biodiversity
- Flooding
- Water-borne diseases
- Growth of aquatic weeds
- Coastal erosion
- Water quality degradation

2. *Stabilized high-quality freshwater supplies*

Addresses the following MPPIs:

- Water scarcity
- Water quality degradation
- Water-borne diseases

3. *Sustainable land use*

Addresses the following MPPIs:

- Land degradation
- Water scarcity
- Destruction of habitats, loss of biodiversity
- Flooding
- Aquatic weeds
- Water quality degradation

Each of these EQOs had specific targets associated with them, with the environmental indicators shown below. Environmental Indicators are a tool used to assure precise evaluation of achievement or satisfaction of the target, demonstrating which metric will be used in the evaluation. Environmental indicators may be of three types, according to GEF terminology: Process Indicator, Stress Reduction Indicator, or Environmental Status Indicator. The timeframe for the targets is a five-to-ten year period.

Balanced aquatic ecosystem

- Achieve adequate surface water quality by 2012 (Indicator: water quality monitoring shows stable water quality by 2012)
- Restore natural surface water flow by 2012 (Indicator: regional water agreements in place for all major rivers in the area by 2012)
- Achieve sustainable fisheries development by 2012 (Indicator: national report on fisheries indicate stabilized fisheries resources by 2012)
- Arrest wetland loss by 2012 (Indicator: wetlands surveys show stability in amount of wetlands by 2012)
- Begin implementation of riverine biodiversity conservation strategy by 2008 (Indicator: biodiversity conservation strategy has been developed and national reports indicate that implementation has begun by 2008)

Stabilized high-quality freshwater supplies

- Achieve adequate freshwater quantity by 2012 (Indicator: regional water agreements in place for all major rivers in the area by 2012)
- Achieve adequate groundwater quality and quantity by 2012 (Indicator: groundwater surveys show stable levels of contaminants of concern and stable water tables by 2012)

Sustainable land use

- Reduce rate of land degradation by 20% by 2012 (Indicator: aerial surveys combined with ground-truthing indicates that the rate of land lost to erosion, desertification and deforestation is reduced by 20% by 2012)
- Reduce coastal erosion rates by 25% by 2012 (Indicator: aerial surveys combined with ground-truthing indicates that the human-induced component of the rate of coastal erosion is reduced by 25% by 2012)

4.0 Priority Actions and Interventions

Following the identification of environmental quality objectives and their associated targets above, specific interventions/actions were identified to achieve first the targets, and ultimately, the EQOs. These priority actions and interventions can be categorized within one or more of the following major groupings:

- Policy actions
- Legislative/regulatory reform
- Institutional strengthening
- Capacity building
- Investment
- Scientific investigation
- Data management

For economy of space, each activity and intervention is listed under only a single EQO and target. In fact, many activities and interventions may address multiple EQOs and targets. The listing of activities and interventions according to category helps to clarify this multiplicity.

This SAP lists and prioritizes these different categories of actions and interventions. Table 3 summarizes the priority interventions within each EQO and target. These actions/interventions will be reviewed and costed during the full GEF project. Each activity is characterized by the root causes that it addresses. Each intervention is categorized by type of intervention.

Table 4 lists the priority actions/interventions according to category of intervention. For instance, all policy actions are listed together; all legal/regulatory actions are listed together, and so on. This table depicts the broad diversity of interventions within each category of intervention across all major EQOs and targets. This table demonstrates that comparable multi-sectoral approaches are being taken to address each of the EQOs and targets.

Table 4. Environmental Quality Objectives, Targets, and Interventions

Environmental Quality Objectives	Targets	Activities	Interventions	Type of Intervention	Root Cause
Balanced Aquatic Ecosystem	Achieve adequate surface water quality by 2012	Establish common methods for assessing water and sediment quality, including bioassays of coastal biota	Develop guidelines for methods of water, sediment, and biota monitoring and assessment (including sampling, analysis, risk assessment)	Legislative/Regulatory	Insufficient scientific capacity
			Implement a first periodic assessment (3-year interval) of the river quality and trends	Investment	
			Develop and establish national/regional land-based activities data and information management system as a tool for contaminant assessment and management	Data Management	
		Fill gaps in knowledge of priority pollutants (contaminant levels) and major sources of pollutants (contaminant inputs)	Conduct regional assessment of priority land-based activities, sources of contaminants, and pollutant levels in water and sediments	Scientific Investigation	Insufficient scientific capacity
			Conduct routine targeted monitoring of riverine sediments and biota for purposes of identifying major hot spots of pollution and land-based activities	Investment	
		Exchange environmental data and information	Develop agreements and technology basis for the free and regular exchange of environmental data and information within the region	Data Management	Insufficient scientific capacity; Inadequate technical infrastructure
		Reduce impacts of urban areas on water quality	Construct or extend sewage collection systems in all major cities in the basin and route discharges to treatment plant	Investment	
			Upgrade/renovate existing treatment plants for mechanical and biological treatment	Investment	
			Expand solid waste collection in all major cities and improve disposal methods so waste does not run-off or leach into waterways	Investment	
	Reduce impacts of industry and mining on water quality	Develop and enforce regulations on the disposal of industrial and mining effluents	Legislative/Regulatory	Inadequate legal/regulatory basis; Inadequate	

Environmental Quality Objectives	Targets	Activities	Interventions	Type of Intervention	Root Cause
					institutions; Insufficient demonstration projects; Inadequate technology of
			Strengthen the capacity of institutions to enforce mining and industry regulations	Institutional Strengthening	
			Implement demonstration projects to bring best technology and practice to industrial discharges (e.g., pre-treatment, source control, process control)	Investment	
			Identify major pollutants affecting water quality, and regulatory levels for those pollutants	Scientific Investigation	
		Halt the spread of aquatic weeds by 2010	Improve knowledge of distribution of aquatic weeds using regional working groups	Scientific Investigation	Insufficient knowledge/ understanding; Inadequate legal/ regulatory basis; Inadequate river basin management
			Develop national and regional aquatic weed management strategies/plans/frameworks combined with monitoring and GIS capabilities	Policy	
			Establish and implement a control system for the import and export of exotic species into and from the Volta River Basin	Legislative/Regulatory	
	Restore natural surface water flow by 2012	Improve water basin management	Agree regionally on extraction of river water and control of river flow regimes	Legislative/Regulatory	Inadequate water basin management; Insufficient regional agreements; Inadequate intersectoral coordination
			Conduct baseline investigation to establish the minimum threshold required for ecosystem function.	Scientific Investigation	

Environmental Quality Objectives	Targets	Activities	Interventions	Type of Intervention	Root Cause
			Manage water release from hydro-electric dams in accordance with natural requirements	Legislative/Regulatory	
			Manage water usage for agriculture and other uses in order to maintain more natural river water level and prevent detrimental impact on the ecosystem	Legislative/Regulatory	
			Develop a regional commission with appropriate policy/legal basis to monitor regional water quantity and quality	Policy	
			Implement regional EIA for water management projects, perhaps through the ESPOO Convention, to enhance broad stakeholder involvement in major water projects	Legislative/Regulatory	
			Develop regional basin water management plan of action	Policy	
			Strengthen the capacity of institutions to implement regional basin water management plan of action.	Institutional Strengthening	
	Achieve sustainable fisheries development by 2012	Strengthen legal basis	Assure that legislation regulating fishing gear, quotas, size limits, seasons and allowed fishing areas are in place	Legislative/Regulatory	Inadequate legal/regulatory basis; Insufficient scientific capacity; Insufficient regional agreements; Inadequate institutions
			Strengthen enforcement of quotas, size limits, seasons, etc., relying on community-based fishery management activities	Policy	
			Help harmonize fishing regulations amongst Volta River Basin countries	Policy	
			Strengthen capacity of institutions to enforce fisheries regulations	Institutional Strengthening	
			Establish “no take zones” either geographically or seasonally	Legislative/Regulatory	

Environmental Quality Objectives	Targets	Activities	Interventions	Type of Intervention	Root Cause
			Establish criteria for “healthy” fisheries situation	Scientific Investigation	
		Develop site-specific or species-specific management plans that promote sustainable utilization and protect nursery or reproduction areas	Develop management plans, and implement and monitor them with local communities and user groups	Legislative/Regulatory	Inadequate legal/regulatory basis; Insufficient economic incentives; Inadequate institutions
			Strengthen capacity of local communities to implement and monitor management plans	Institutional Strengthening	
		Provide alternative technologies	Develop and demonstrate mechanisms to reduce by-catch	Policy	Inadequate technology
	Arrest wetland loss by 2012	Fill gaps in knowledge of priorities in protecting wetlands	Undertake inventory of selected wetlands sites in the basin to establish extent and condition of habitat and management challenges	Scientific Investigation	Insufficient scientific capacity; Insufficient knowledge/understanding
		Strengthen regional legal basis for protection of wetlands	Review, harmonize, and strengthen relevant local, national, regional, and international legislation and conventions relevant to the conservation and management of wetlands	Legislative/Regulatory	Inadequate legal/regulatory basis; Insufficient regional agreements
		Develop management plans for selected wetlands sites of global and ecological importance by 2007	Develop national wetlands management strategies/plans/frameworks (including community participation and empowerment)	Policy	Inadequate legal/regulatory basis; Inadequate human capacity; Inadequate institutions
			Strengthen the capacity of local conservation groups to conserve wetlands	Institutional Strengthening	

Environmental Quality Objectives	Targets	Activities	Interventions	Type of Intervention	Root Cause
	Begin implementation of riverine biodiversity conservation strategy by 2008	Develop and implement regional biodiversity strategy	Prepare a regional biodiversity strategy document, including a gap analysis, and obtain endorsement by riparian states	Policy	Insufficient regional agreements; Inadequate water basin management; Insufficient knowledge/ understanding
			Implement biodiversity strategy, including species specific action plans	Scientific Investigation/ Investment	
		Prevention of adverse human activity on sensitive areas	Evaluate sensitivity of areas and habitats in the Volta River Basin and evaluate levels of human impacts on them	Scientific Investigation	Insufficient knowledge/ understanding; Inadequate legal/ regulatory basis
			If necessary, develop legislation for the protection of areas not currently covered or included in protected zones	Legislative/ Regulatory	
			Develop and implement action plans for those sensitive areas where human impact is adverse	Investment	
		Reduce impacts of agriculture, land grazing, and hunting on loss of biodiversity	Implement alternatives to agricultural expansion, unchecked grazing, and poor hunting practices, including bushfires and poaching, to conserve biodiversity	Investment	Insufficient economic incentives
Stabilized high-quality freshwater supplies	Achieve adequate freshwater quantity by 2012	Rationing of water use through international agreements on shared water basins	Review and strengthen existing regional river system agreements; develop new agreements	Legislative/ Regulatory	Inadequate legal/ regulatory basis; Insufficient knowledge/ understanding; Insufficient economic incentives; Inadequate water basin management

Environmental Quality Objectives	Targets	Activities	Interventions	Type of Intervention	Root Cause
			Harmonize environmental and economic policy regarding water use	Policy	
			Monitor supply and quality of water in major rivers	Investment	
			Prepare environmental impact assessments (EIAs) for major investments that may affect water quantity or quality	Investment	
			Support freshwater resource tenure and valuation	Investment	
	Achieve adequate groundwater quality and quantity by 2012	Fill gaps in knowledge	Develop common guidelines for periodic assessment of groundwater quality and quantity trends	Scientific Investigations	Insufficient scientific capacity; Insufficient knowledge/ understanding
			Develop and implement a groundwater quality trend monitoring programme	Investment	
			Conduct the first periodic assessment of groundwater quality and its trends	Investment	
			Evaluate sustainable groundwater use rates, and appropriate monitoring systems	Scientific Investigations	
		Improve efficiency and availability of high-quality well water	Based on the sustainable groundwater use rates, improve water extraction and transport systems to rural and urban areas	Investment	Inadequate technical infrastructure; Insufficient economic incentives; Insufficient demonstration projects
			Institute a water use fee structure for all water users	Investment	
		Reduce evaporative losses in drainage basin	Rationalize the use of small dams and barrages for local communities	Policy	Inadequate technical infrastructure
			Revegetate (reforest, replant) the drainage basin to increase natural evapotranspiration processes	Investment	

Environmental Quality Objectives	Targets	Activities	Interventions	Type of Intervention	Root Cause
Sustainable land use	Reduce rate of land degradation by 20% by 2012	Strengthen regional legal basis for preventing land degradation	National review of policy, legal, and regulatory frameworks, and institutional structure for addressing land-based activities (including international conventions such as climate change)	Legislative/Regulatory	Inadequate legal/regulatory basis; Insufficient regional agreements; Low government priority on environment
			Draft Regional EIA process review in a regional workshop; adopt regional EIA	Legislative/Regulatory	
			Develop realistic National Plans of Action for land-based sources and activities	Capacity Building	
			Develop common regional guidelines containing appropriate recommendations for decision makers for management of land-based point and non-point pollutant sources	Scientific Investigation	
			Strengthen capacity of institutions to implement National Plans of Action and EIA process review	Institutional Strengthening	
		Strengthen monitoring capacity for evaluating land degradation rates	Develop a regional commission with appropriate policy/legal basis to monitor regional land degradation	Policy	Insufficient regional agreements; Inadequate training; Inadequate human capacity; Inadequate institutions
			Develop training and educational programs to train regional personnel on monitoring and use of GIS as a planning tool	Capacity Building	
			Develop regional and national institutions to perform ongoing monitoring of land degradation, including geographic areas, causes, and rates	Investment	

Environmental Quality Objectives	Targets	Activities	Interventions	Type of Intervention	Root Cause
			Involve stakeholders, including NGOs and natural resource users, by communicating the results of monitoring and communicating alternative strategies for resource use	Capacity Building	
		Determine and satisfy training needs in region for land-based activities and sources	Conduct survey on training needs and conduct training on land-based activities and sources (for high officials, mid-level government, community, resource users, experts, industry, etc.)	Capacity Building	Inadequate training; Inadequate human capacity
		Improve Stakeholder knowledge of causes of land degradation, and involve the stakeholders in its solution	Develop outreach and public awareness program regarding land degradation	Investment	Insufficient knowledge/ understanding
			Create community-based agent network to educate and advise stakeholders on alternatives to traditional, harmful activities causing land degradation	Investment	
		Develop educational programs at all levels on land-based activities and sources	Conduct survey on educational needs to support reduction of land-based activities and sources and implement the activities to address three top priority regional educational needs, in appropriate languages	Capacity Building	Insufficient knowledge/ understanding; Inadequate training; Inadequate technology
			Develop necessary training at different levels on public awareness, applying Best and Cost Effective Technology, Best Agricultural Practices, Integrated Pest Management, increasing irrigation efficiency and fertilizer use, etc.	Capacity Building	
		Develop Regional/ Governmental/ Private Sector partnerships on LB activities and sources	Integrate private sector into activities of this project, as appropriate, as sub-contractor, consultant, or co-sponsor of specific activities	Policy	Insufficient economic incentives
		Strengthen legal basis and institutional capacity to reduce impacts of agriculture and animal husbandry	Develop and enforce land use codes for agriculture and animal husbandry	Legislative/ Regulatory	Inadequate legal/ regulatory basis; Inadequate institutions

Environmental Quality Objectives	Targets	Activities	Interventions	Type of Intervention	Root Cause
			Strengthen institutional capacity to support rangeland management; develop community rangelands	Institutional Capacity	
		Develop programs to reduce impacts of agriculture and animal husbandry	Riparian countries agree to a list of banned agrochemicals and develop a program to destroy stored banned products	Legislative/Regulatory	Insufficient regional agreements; Inadequate training; Inadequate legal/regulatory basis; Inadequate technology; Insufficient scientific capacity
			Riparian countries agree on limits to the application of agrochemicals and develop strategies to encourage the sustainable use of organic manure fertilizer	Legislative/Regulatory	
			Riparian countries agree on regional controls on bushfires for agriculture, pasturage, and hunting, and enforce the controls	Policy	
			Conduct training courses at farmer and industry level to apply the most appropriate and new findings in their practice by 2008	Capacity Building	
			Strengthen and enforce regulations on the disposal of animal waste	Legislative/Regulatory	
			Develop more efficient ways to use existing land, increasing yields through better land management, crop rotation, or crop selection	Investment	
			Develop basin-wide corridors for seasonal migration of livestock through adjacent countries, based on historical common use zones	Policy	
			Develop community-based agricultural/ animal husbandry networks for transfer of technology and best practice	Institutional Strengthening	

Environmental Quality Objectives	Targets	Activities	Interventions	Type of Intervention	Root Cause
			Establish regional and national capacities to monitor, examine causes, and map (using GIS) geographic locations of agriculture and animal husbandry, including protection objectives. Broadly disseminate the results to rural inhabitants.	Investment	
		Establish and maintain a network of well-managed protected areas in the Volta River Basin	Establish a functioning regional protected area working group for protection and management functions, financial arrangements, recommending new protected areas and addressing management of protected areas located along international borders	Institutional Strengthening	Inadequate institutions; Insufficient regional agreements; Insufficient knowledge/understanding; Inadequate legal/regulatory basis; Insufficient economic incentives; Inadequate training; Insufficient scientific capacity
			Obtain government endorsement for the recommended protected areas	Policy	
			Evaluate the priority targets for protection in each protected area and how these fit into regional priorities	Scientific Investigation	
			Review and propose revisions for national legislation on protected areas to permit environmentally friendly uses of the protected areas	Legislative/Regulatory	
			Allocate a zone within protected areas or adjacent to them for ecotourism activities	Legislative/Regulatory	
			Provide training in national protected area management and development of ecotourism	Capacity Building	

Environmental Quality Objectives	Targets	Activities	Interventions	Type of Intervention	Root Cause
			Reduce poaching in protected areas by ensuring that legislation regulating hunting equipment, quotas, seasons and allowed hunting areas are in place and strengthening enforcement of these regulations	Legislative/Regulatory	
			Increase stakeholder participation, including community ownership, of protected areas	Capacity Building	
			Establish regional and national capacities to monitor, examine causes, and map (using GIS) geographic locations of protected areas, including protection objectives. Broadly disseminate the results to rural inhabitants.	Investment	
		Reduce rates of deforestation	Identify main contributors to deforestation, including public and private sector, as well as legal and regulatory failures	Scientific Investigation	Insufficient demonstration projects Insufficient economic incentives; Insufficient knowledge/understanding; Inadequate legal/regulatory basis; Inadequate human capacity
			Identify alternative sources for products historically produced from forests, and link with appropriate incentives and disincentives	Scientific Investigation	
			Identify means to increase efficiency and reduce waste in use of forest products, through demonstration projects	Investment	
			Establish legislation to reduce rates of deforestation based on economic incentives and disincentives	Legislative/Regulatory	
			Establish reforestation programs and begin their implementation in affected areas, at village, community, national, and regional levels	Investment	

Environmental Quality Objectives	Targets	Activities	Interventions	Type of Intervention	Root Cause
			Establish regional and national capacities to monitor, examine causes, and map (using GIS) rates and geographic locations of deforestation and reforestation. Broadly disseminate the results to rural inhabitants.	Investment	
		Reduce rates of loss of land to desertification	Increase awareness of local populations of the desertification process, perhaps working through existing mechanisms	Capacity Building	Insufficient knowledge/ understanding; Inadequate legal/ regulatory basis; Insufficient scientific capacity; Insufficient demonstration projects
			Improve legal basis in each country for combating desertification, including: criteria to define land degradation; amended laws on forestry, water resources and land; and, strengthened legal mechanisms such as EIA and planning procedures	Legislative/ Regulatory	
			Develop a desertification monitoring system and widely disseminate results	Capacity Building	
			Demonstrate ways to reverse desertification	Investment	
		Reduce land degradation due to mining	Evaluate national legislation addressing mining and use of non-living resources	Scientific Investigation	Inadequate legal/ regulatory basis; Inadequate intersectoral coordination; Insufficient regional agreements; Insufficient demonstration projects

Environmental Quality Objectives	Targets	Activities	Interventions	Type of Intervention	Root Cause
			Create regional working group on land degradation due to mining, and recommend specific common regional improvements to policy and legislation	Policy	
			Implement recommendations of regional working group in national laws and regulations	Legislative/Regulatory	
			Perform demonstration projects of ways to avoid adverse environmental impacts of mining	Investment	
		Develop culturally-adapted improvements to land tenure systems/property rights in the region	Perform investigation of the policy, legal, and cultural basis for land tenure policies in the Volta River Basin	Scientific Investigation	Inadequate legal/regulatory basis; Insufficient economic incentives
			Develop more effective methods of land tenure to reduce tendency for migration to fresh lands, and to encourage “investment” in lands (e.g., efficient irrigation, improved crop methods)	Policy	
			Implement environmentally sustainable land tenure systems in the region, perhaps as a “special planning zone”	Investment	
	Reduce coastal erosion rates by 25% by 2012	Fill gaps in knowledge	Conduct assessment of the effects of Akosombo Dam on coastal erosion on the Gulf of Guinea coast	Scientific Investigation	Insufficient knowledge/understanding
		Develop coastal erosion management plan through a participatory process	Promote environmental and community-based tourism	Capacity Building	Insufficient economic incentives; inadequate human capacity
		Strengthen legal basis for protection of coastline	Review, harmonize and strengthen relevant local and national policies and legislation regarding coastal zone and river basin management	Legislative/Regulatory	Inadequate legal/regulatory basis; Inadequate intersectoral coordination

Table 5. Priority Actions within Each Category of Intervention

Category	Environmental Quality Objectives	Interventions	
Policy Actions	I. Balanced Aquatic Ecosystem	Develop national and regional aquatic weed management strategies/plans/frameworks combined with monitoring and GIS capabilities	
		Develop a regional commission with appropriate policy / legal basis to monitor regional water quantity and quality	
		Develop regional basin water management plan of action	
		Strengthen enforcement of quotas, size limits, seasons, etc., relying on community-based fishery management activities	
		Help harmonize fishing regulations amongst Volta River Basin countries	
		Develop and demonstrate mechanisms to reduce by-catch	
		Develop national wetlands management strategies/ plans/ frameworks (including community participation and empowerment)	
		Prepare a regional biodiversity strategy document, including a gap analysis, and obtain endorsement by riparian states	
		Develop a regional commission with appropriate policy/legal basis to monitor regional water quality and quantity	
		II. Stabilized high-quality freshwater supplies	Harmonize environmental and economic policy regarding water use
			Rationalize the use of small dams and barrages for local communities
		III. Sustainable land use	Develop a regional commission with appropriate policy/legal basis to monitor regional land degradation
			Integrate private sector into activities of this project, as appropriate, as sub-contractor, consultant, or co-sponsor of specific activities
Riparian countries agree on regional ban on bushfires for agriculture, pasturage, and hunting, and enforce the ban			
Develop basin-wide corridors for seasonal migration of livestock through adjacent countries, based on historical common use zones			
Obtain government endorsement for the recommended protected areas			
Create regional working group on land degradation due to mining, and recommend specific common regional improvements to policy and legislation			
Develop more effective methods of land tenure to reduce tendency for migration to fresh lands, and to encourage “investment” in lands (e.g., efficient irrigation, improved crop methods)			
Legislative / Regulatory Actions	I. Balanced Aquatic Ecosystem	Develop guidelines for methods of water, sediment, and biota monitoring and assessment (including sampling, analysis, risk assessment)	
		Develop and enforce regulations on the disposal of industrial and mining effluents	
		Establish and implement a control system for the import and export of exotic species into and from the Volta River Basin	
		Agree regionally on extraction of river water and control of river flow regimes	
		Manage water release from hydro-electric dams in accordance with natural requirements	
		Manage water usage for agriculture and other uses in order to maintain more natural river water level and prevent detrimental impact on the ecosystem	

Category	Environmental Quality Objectives	Interventions
		Implement regional EIA for water management projects, perhaps through the ESPOO Convention, to enhance broad stakeholder involvement in major water projects
		Assure that legislation regulating fishing gear, quotas, size limits, seasons and allowed fishing areas are in place
		Establish “no take zones” either geographically or seasonally
		Develop management plans, and implement and monitor them with local communities and user groups
		Review, harmonize, and strengthen relevant local, national, regional, and international legislation and conventions relevant to the conservation and management of wetlands
		If necessary, develop legislation for the protection of areas not currently covered or included in protected zones
	II. Stabilized high-quality freshwater supplies	Develop common regional guidelines for periodic assessment of river water quality and groundwater quality
		Review and strengthen existing regional river system agreements; develop new agreements
	III. Sustainable land use	National review of policy, legal, and regulatory frameworks, and institutional structure for addressing land-based activities (including international conventions such as climate change)
		Draft Regional EIA process review in a regional workshop; adopt regional EIA
		Develop and enforce land use codes for agriculture and animal husbandry
		Riparian countries agree to a list of banned agrochemicals and develop a program to destroy stored banned products
		Riparian countries agree on limits to the application of agrochemicals and develop strategies to encourage the use of organic manure fertilizer
		Strengthen and enforce regulations on the disposal of animal waste
		Review and propose revisions for national legislation on protected areas to permit environmentally friendly uses of the protected areas
		Allocate a zone within protected areas or adjacent to them for ecotourism activities
		Establish legislation to reduce rates of deforestation based on economic incentives and disincentives
		Improve legal basis in each country for combating desertification, including: criteria to define land degradation; amended laws on forestry, water resources and land; and, strengthened legal mechanisms such as EIA and planning procedures
		Implement recommendations of regional working group in national laws and regulations
		Review, harmonize and strengthen relevant local and national policies and legislation regarding coastal zone and river basin management
		Reduce poaching in protected areas by ensuring that legislation regulating hunting equipment, quotas, seasons and allowed hunting areas are in place and strengthening enforcement of these regulations
Institutional Strengthening Actions	I. Balanced Aquatic Ecosystem	Strengthen the capacity of institutions to enforce mining and industry regulations
		Strengthen the capacity of institutions to implement regional basin water management plan of action.

Category	Environmental Quality Objectives	Interventions
		Strengthen capacity of institutions to enforce fisheries regulations
		Strengthen capacity of local communities to implement and monitor management plans
		Strengthen the capacity of local conservation groups to conserve wetlands
	II. Stabilized high-quality freshwater supplies	None
	III. Sustainable land use	Strengthen capacity of institutions to implement National Plans of Action and EIA process review
		Strengthen institutional capacity to support rangeland management; develop community rangelands
		Develop community-based agricultural/ animal husbandry networks for transfer of technology and best practice
		Establish a functioning regional protected area working group for protection and management functions, financial arrangements, recommending new protected areas and addressing management of protected areas located along international borders
Capacity Building Actions	I. Balanced Aquatic Ecosystem	None
	II. Stabilized high-quality freshwater supplies	None
	III. Sustainable land use	Develop realistic National Plans of Action for land-based sources and activities
		Develop training and educational programs to train regional personnel on monitoring and use of GIS as a planning tool
		Involve stakeholders, including NGOs and natural resource users, by communicating the results of monitoring and communicating alternative strategies for resource use
		Conduct survey on training needs and conduct training on land-based activities and sources (for high officials, mid-level government, community, resource users, experts, industry, etc.)
		Conduct survey on educational needs to support reduction of land-based activities and sources and implement the activities to address three top priority regional educational needs, in appropriate languages
		Develop necessary training at different levels on public awareness, applying Best and Cost Effective Technology, Best Agricultural Practices, Integrated Pest Management, increasing irrigation efficiency and fertilizer use, etc.
		Conduct training courses at farmer and industry level to apply the most appropriate and new findings in their practice by 2008
		Provide training in national protected area management and development of ecotourism
		Increase stakeholder participation, including community ownership, of protected areas
		Increase awareness of local populations of the desertification process, perhaps working through existing mechanisms
		Develop a desertification monitoring system and widely disseminate results
		Promote environmental and community-based tourism
Investment Actions	I. Balanced Aquatic Ecosystem	Conduct routine targeted monitoring of riverine sediments and biota for purposes of identifying major hot spots of pollution and land-based activities

Category	Environmental Quality Objectives	Interventions
		Construct or extend sewage collection systems in all major cities in the basin and route discharges to treatment plant
		Upgrade/renovate existing treatment plants for mechanical and biological treatment
		Expand solid waste collection in all major cities and improve disposal methods so waste does not run-off or leach into waterways
		Implement demonstration projects to bring best technology and practice to industrial discharges (e.g., pre-treatment, source control, process control)
		Implement biodiversity strategy, including species specific action plans
		Develop and implement action plans for those sensitive areas where human impact is adverse
		Implement alternatives to agricultural expansion, unchecked grazing, and poor hunting practices, including bushfires and poaching, to conserve biodiversity
	II. Stabilized high-quality freshwater supplies	Implement a first periodic assessment (3-year interval) of the river quality and trends
		Monitor supply and quality of water in major rivers
		Prepare environmental impact assessments (EIAs) for major investments that may affect water quantity or quality
		Support freshwater resource tenure and valuation
		Develop and implement a groundwater quality trend monitoring programme
		Conduct the first periodic assessment of groundwater quality and its trends
		Based on the sustainable groundwater use rates, improve water extraction and transport systems to rural and urban areas
		Institute a water use fee structure for all water users
		Revegetate (reforest, replant) the drainage basin to increase natural evapotranspiration processes
	III. Sustainable land use	Develop regional and national institutions to perform ongoing monitoring of land degradation, including geographic areas, causes, and rates
		Develop outreach and public awareness program regarding land degradation
		Create community-based agent network to educate and advise stakeholders on alternatives to traditional, harmful activities causing land degradation
		Develop more efficient ways to use existing land, increasing yields through better land management, crop rotation, or crop selection
		Establish regional and national capacities to monitor, examine causes, and map (using GIS) geographic locations of agriculture and animal husbandry, including protection objectives. Broadly disseminate the results to rural inhabitants.
		Establish regional and national capacities to monitor, examine causes, and map (using GIS) geographic locations of protected areas, including protection objectives. Broadly disseminate the results to rural inhabitants.
		Identify means to increase efficiency and reduce waste in use of forest products, through demonstration projects

Category	Environmental Quality Objectives	Interventions
		Establish reforestation programs and begin their implementation in affected areas, at village, community, national, and regional levels
		Establish regional and national capacities to monitor, examine causes, and map (using GIS) rates and geographic locations of deforestation and reforestation. Broadly disseminate the results to rural inhabitants.
		Demonstrate ways to reverse desertification
		Perform demonstration projects of ways to avoid adverse environmental impacts of mining
		Implement environmentally sustainable land tenure systems in the region, perhaps as a “special planning zone”
Scientific Investigation Actions	I. Stabilize surface water quality by 2012	Conduct regional assessment of priority land-based activities, sources of contaminants, and pollutant levels in water and sediments
		Identify major pollutants affecting water quality, and regulatory levels for those pollutants
		Improve knowledge of distribution of aquatic weeds using regional working groups
		Establish criteria for “healthy” fisheries situation
		Undertake inventory of selected wetlands sites in the basin to establish extent and condition of habitat and management challenges
		Implement biodiversity strategy, including species specific action plans
		Evaluate sensitivity of areas and habitats in the Volta River Basin and evaluate levels of human impacts on them
	II. Stabilized high-quality freshwater supplies	Develop common guidelines for periodic assessment of groundwater quality and quantity trends
		Evaluate sustainable groundwater use rates, and appropriate monitoring systems
	III. Sustainable land use	Develop common regional guidelines containing appropriate recommendations for decision makers for management of land-based point and non-point pollutant sources
		Evaluate the priority targets for protection in each protected area and how these fit into regional priorities
		Identify main contributors to deforestation, including public and private sector, as well as legal and regulatory failures
		Identify alternative sources for products historically produced from forests, and link with appropriate incentives and disincentives
		Evaluate national legislation addressing mining and use of non-living resources
		Perform investigation of the policy, legal, and cultural basis for land tenure policies in the Volta River Basin
		Conduct assessment of the effects of Akosombo Dam on coastal erosion on the Gulf of Guinea coast
Data Management Actions	I. Stabilize surface water quality by 2012	Develop and establish national/regional land-based activities data and information management system as a tool for contaminant assessment and management
		Develop legislation and technology basis for the free and regular exchange of environmental data and information within the region
	II. Stabilized high-quality freshwater supplies	None
	III. Sustainable land use	None

5.0 Cost Benefit Analysis of Programme Actions

In this section the evaluation is focused on:

- The economic and ecological valuations of the resources;
- The costs of the actions to meet the targets as identified in Sections 3 and 4;
- The value saved by meeting the targets identified by specific actions of the project;
- The benefits obtained after the GEF project is complete.

The actual cost-benefit analysis is not performed as part of this preliminary SAP, for several reasons:

- a) Insufficient knowledge is available about the status of the specific resources in question, so percent improvements as listed in the Targets cannot be quantified.
- b) The interventions proposed by the SAP have not been costed out fully yet. This costing exercise will take place as part of the full GEF project, and will contribute to the updated SAP.
- c) Lacking either the valuation of natural resources, or the cost with and without the alternative, a cost-benefit analysis cannot be made.

However, the following section briefly describes how the cost-benefit analysis would take place.

5.1 Valuation Considerations

The approach to the valuation of the resources of the Volta River Basin will estimate the value of ecosystems in terms of ecological functions and economic values which follows that used in Costanza *et al.* 1997 (The value of the world's ecosystem services and natural capital. *Nature*, 387, 253-260). Alternative valuation methods are time intensive and quite expensive, requiring considerable work at the site. During the full GEF project, both Costanza's evaluation methodology and more complete evaluation methodologies will be applied to the SAP alternative.

5.2 Valuation of Resources

Using the methodology of Costanza et al., or an alternative valuation methodology developed during the full GEF project, the following valuations will be performed:

- 5.2.1 **Habitat Values**
- 5.2.2 **Biodiversity Values**
- 5.2.3 **Pollution**

5.3 Estimated Cost of Strategic Action Programme

As Table 3 indicates, the costs of the various interventions has not been established. These will be established as part of the full GEF Project. Once these costs have been established, the cost-benefit analysis can be completed.

6.0 Priority Regional and National Actions to Address the Causes of Environmental Degradation and Threats to the Environment of the Volta River Basin

In this section the priorities of the Strategic Action Plan are presented. These priorities must be agreed by the stakeholders in order for the GEF/SAP interventions to be effective. The prioritization exercise with stakeholders will take place during the full GEF project. At present, only governmental “stakeholders” have agreed to these priorities.

6.1 Priorities

The following priorities have been established:

I. Policy Actions

- a. Develop regional basin water management “plan of action”
- b. Prepare a regional biodiversity strategy document, including a gap analysis, and obtain endorsement by riparian states
- c. Harmonize environmental and economic policy regarding water use
- d. Develop a regional commission with appropriate policy/legal basis to monitor regional land degradation
- e. Riparian countries agree on regional control on bushfires for agriculture, pasturage, and hunting, and enforce the control
- f. Develop more effective methods of land tenure to reduce tendency for migration to fresh lands, and to encourage “investment” in lands (e.g., efficient irrigation, improved crop methods)

II. Legislative/Regulatory Actions

- a. Develop guidelines for methods of water, sediment, and biota monitoring and assessment (including sampling, analysis, risk assessment)
- b. Agree regionally modalities for extraction of river water and control of river flow regimes
- c. Manage water release from hydro-electric dams in accordance with natural requirements
- d. Implement regional EIA for water management projects, perhaps through the ESPOO Convention, to enhance broad stakeholder involvement in major water projects
- e. Review, harmonize, and strengthen relevant local, national, regional, and international legislation and conventions relevant to the conservation and management of wetlands
- f. Review and strengthen existing regional river system agreements; develop new agreements
- g. Draft Regional EIA process review in a regional workshop; adopt regional EIA
- h. Develop and enforce land use codes for agriculture and animal husbandry
- i. Establish legislation to reduce rates of deforestation based on economic incentives and disincentives
- j. Improve legal basis in each country for combating desertification, including: criteria to define land degradation; amended laws on forestry, water resources and land; and, strengthened legal mechanisms such as EIA and planning procedures

III. Institutional Strengthening and Development Actions

- a. Strengthen the capacity of local conservation groups to conserve wetlands
- b. Establish a functioning regional protected area working group for protection and management functions, financial arrangements, recommending new protected areas and addressing management of protected areas located along international borders
- c. Establishment of a basin commission to manage land and water resources of the Volta Basin
- d. Strengthening local and national institutions for the management of land and water resources of the basin

IV. Capacity Building Actions

- a. Develop training and educational programs to train regional personnel on monitoring and use of GIS as a planning tool
- b. Involve stakeholders, including NGOs and natural resource users, by communicating the results of monitoring and communicating alternative strategies for resource use
- c. Develop necessary training at different levels on public awareness, applying Best and Cost Effective Technology, Best Agricultural Practices, Integrated Pest Management, increasing irrigation efficiency and fertilizer use, etc.
- d. Conduct training courses at farmer and industry level to apply the most appropriate and new findings in their practice by 2008
- e. Increase stakeholder participation, including community ownership, of protected areas
- f. Increase awareness of local populations of the desertification process, perhaps working through existing mechanisms
- g. Develop a desertification monitoring system and widely disseminate results

V. Investment Actions

- a. Conduct routine targeted monitoring of riverine sediments and biota for purposes of identifying major hot spots of pollution and land-based activities
- b. Implement biodiversity strategy, including species specific action plans
- c. Implement alternatives to agricultural expansion, unchecked grazing, and poor hunting practices, including bushfires and poaching, to conserve biodiversity
- d. Implement a first periodic assessment (3-year interval) of the river quality and trends
- e. Prepare environmental impact assessments (EIAs) for major investments that may affect water quantity or quality
- f. Support freshwater resource tenure and valuation
- g. Conduct the first periodic assessment of groundwater quality and its trends
- h. Institute a water use fee structure for all water users
- i. Revegetate (reforest, replant) the drainage basin to increase natural evapotranspiration processes
- j. Develop regional and national institutions to perform ongoing monitoring of land degradation, including geographic areas, causes, and rates
- k. Create community-based agent network to educate and advise stakeholders on

alternatives to traditional, harmful activities causing land degradation

- l. Establish regional and national capacities to monitor, examine causes, and map (using GIS) geographic locations of agriculture and animal husbandry, including protection objectives. Broadly disseminate the results to rural inhabitants
- m. Establish regional and national capacities to monitor, examine causes, and map (using GIS) geographic locations of protected areas, including protection objectives. Broadly disseminate the results to rural inhabitants
- n. Establish reforestation programs and begin their implementation in affected areas, at village, community, national, and regional levels
- o. Establish regional and national capacities to monitor, examine causes, and map (using GIS) rates and geographic locations of deforestation and reforestation. Broadly disseminate the results to rural inhabitants.
- p. Demonstrate ways to reverse desertification

VI. Scientific Investigation Actions

- a. Conduct regional assessment of priority land-based activities, sources of contaminants, and pollutant levels in water and sediments
- b. Identify major pollutants affecting water quality, and regulatory levels for those pollutants
- c. Implement biodiversity strategy, including species specific action plans
- d. Evaluate sensitivity of areas and habitats in the Volta River Basin and evaluate levels of human impacts on them
- e. Perform investigation of the policy, legal, and cultural basis for land tenure policies in the Volta River Basin

VII. Data Management Actions

- a. Develop and establish national/regional land-based activities data and information management system as a tool for contaminant assessment and management
- b. Develop legislation and technology basis for the free and regular exchange of environmental data and information within the region

Appendix A

List of Abbreviations

CAW	Center for Africa Wetlands
EIA	Environmental Impact Assessment
EQO	Environmental Quality Objective
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIS	Geographic Information System
GWP/WATAC	Global Water Partnership/West African Technical Advisory Committee
ICARM	Integrated Coastal Area and River Basin Management
LBA	Land-Based Activities
LOICZ	Land-Ocean Interactions in the Coastal Zones
MSP	Medium Sized Project
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organization
SAP	Strategic Action Programme
TDA	Transboundary Diagnostic Analysis
UNEP	United Nations Environment Programme
WACAF	West and Central Africa Action Plan for Abidjan Convention