

Policy options

This section aims to identify feasible policy options that target key components identified in the Causal chain analysis in order to minimise future impacts on the transboundary aquatic environment. Recommended policy options were identified through a pragmatic process that evaluated a wide range of potential policy options proposed by regional experts and key political actors according to a number of criteria that were appropriate for the institutional context, such as political and social acceptability, costs and benefits and capacity for implementation. The policy options presented in the report require additional detailed analysis that is beyond the scope of the GIWA and, as a consequence, they are not formal recommendations to governments but rather contributions to broader policy processes in the region.

Modification of stream flow: Case of the Volta Basin

In the previous sections, modification of stream flow was identified as one of the key international water issues in the Guinea Current region. In particular, the Volta River has been singled out as a typical example of an international river system in the Sahel region, suffering from freshwater shortages, due to modification of the stream flow.

The root causes behind modification of stream flow in the Volta Basin

In the Causal chain analysis, presented in the previous section, primary root causes in relation to freshwater shortage and modification of stream flow in the Volta Basin were identified:

- Adverse climatic conditions, with natural average annual rainfall reduced by 30% within the last 40 years, and a corresponding

- reduction in average annual stream flow of approximately 50%;
- Demographic trends in the form of rapid population growth and extensive transmigration from rural to urban areas in search of jobs and improved living conditions;
- Technology constraints due to lack of appropriate and innovative farming practices for rain-fed agriculture under arid conditions. Similarly, there is a lack of water saving technologies and practices in the urban sector;
- Governance constraints by the absence of an efficient policy and legal and institutional framework for local, national and international water management.

Identification of possible policy options

A large number of policy alternatives to address the root causes and mitigate the freshwater shortage problem may be identified. For convenience, the policy options have been discussed separately, seen in relation to each of the four particular root causes. However, it should be emphasised that efficient policies should be comprehensive and linked to achieve a maximum of implementation synergy.

Addressing the climatic evolution in the Sahel region

The issue of climatic change is strongly related to the actual magnitude of the water resources, and the ultimate limits of this resource, and correspondingly, the number of people and water-related activities that may be sustained in the Basin.

If the causes of climatic change could be identified - and subsequently controlled by policy intervention - such a policy option might become extremely promising. Some scientists propose addressing the land depletion and over-grazing issue, with the intent of achieving a positive feedback on rainfall. But unfortunately, there is extremely little evidence to support the effect of such ideas (IPCC 2001).

However, there are other ways of addressing the climatic changes through policy responses. First and foremost by establishing a close monitoring framework of the actual trends and by identifying their impacts on the development of the Basin, but also by advocating robust policies with a minimum of risk of failure due to adverse climatic conditions: in short, by accepting as an unchangeable fact, that a major part of the Basin has a severe, water-related handicap as compared to many other regions.

Controlling the population growth in the Basin

This option includes the classical population control policies. With less people, the water demand would decrease. And obviously - in spite of many decades of extensive efforts on family planning, birth control, education and awareness - the continued growth pattern in the Basin calls for further actions. The reason for this may be, as pointed out above, that high fertility rates are caused by many more factors than lack of contraception, education and awareness (Dasgupta 2000). Policies for control of demographic trends must address all these factors, including important cultural conditions.

Correspondingly, improved control of the transmigration patterns from farms to towns through regulation, incentives and awareness campaigns, would be a valuable instrument to alleviate unforeseen and unwanted developments in water demand in the urban sector. Unfortunately, very limited experience is available of successful cases from the Volta Basin. Moreover, policies for demographic control are usually beyond the control - and competence - of the water sector. But it is important to raise political and public awareness and transparency about the intimate links between water policies and population policies: people and crops need water; more people and more crops need even more water.

Improving water sector technology

Given the very likely scenario that neither demographic, nor climatic trends are readily controllable by policy interventions within a short term time horizon, a realistic response would be to look into technological developments to increase the efficiency of the water use; consume less water per capita, and produce more crop value per volume of water used (UNCED 1992).

The situation is comparable to the energy crisis in the 1970s, where the shortages of fossil fuels gave rise to many innovative ways of saving energy.

Some regional institutions, such as CREPA (Centre Régional pour l'Eau Potable et l'Assainissement à faible coût) in the French speaking

countries, are fully involved in the research of innovative technologies for low cost water supply and sanitation and for water saving.

The urban water supply sector has many policy opportunities for technological water savings, such as:

- Minimisation of losses in distribution pipes through leakage monitoring and leakage remediation. New, on-site techniques for rehabilitation of water pipes are available and have been successfully introduced in many developing countries.
- Water recycling is a potential tool, but it is often prohibitively costly in both investment and operation for use in developing countries.
- Industries may be enticed to introduce water-saving technologies and practices. Demand side management, such as extension services for small and medium-sized enterprises (SMEs) and selective pricing of wasteful and non-productive uses may serve as useful tools. As has been seen in the energy sector, such technologies will often pay for themselves, and therefore have a high potential for sustainability.
- Construction and operation of reservoirs may be further optimised, with respect to reducing evaporation losses through a trade-off with supply reliability.
- Conjunctive use of surface- and groundwater may minimise the need for surface storage and thus reduce evaporation losses.

Correspondingly, the important water consumers in the agricultural sector can also be addressed by promotion of technological innovations through the development of: more drought resistant crops through breeding and genetic modification; efficient water harvesting techniques, appropriate for local conditions; reliable dry-season water supply options for cattle herds, to avoid competition with settled farmers and their water supply systems; and development of water-efficient, small-scale irrigation methods, in particular drip irrigation and sprinkler irrigation. Such techniques must be developed in close cooperation with local farmers to ensure acceptance from the practitioners, and financial mechanisms for investment must be established.

There are no limits to this list, in particular if the right environment and incentives for private sector involvement, and local farmer initiative and creativity, is being facilitated.

Improving water governance

Numerous case histories - and the state-of-the-art consensus in the water sector recently reconfirmed through numerous sessions and the Third World Water Forum in Kyoto - points to the crucial importance of efficient water governance. The creation of a favourable "enabling environment" in the form of appropriate legal and policy frameworks

is a first and necessary step to ensure a rational and optimal allocation of water resources, not least when these resources are scarce and under heavy pressure as in the Volta Basin. But equally important is the establishment of an institutional framework to ensure the proper enforcement of regulations and implementation of policies and plans, and to facilitate the actual participation and cooperation of all stakeholders in Government, communities and the private business sector (UNCED 1992).

Such governance shall address local, national and international issues in a comprehensive and transparent way by involving all appropriate stakeholders. General issues to be addressed may be:

- Agreement on a joint and comprehensive water policy for the Volta Basin, including visions, goals and targets for various players in the water sector;
- Establishment of a comprehensive and transparent legal framework for water allocations and water rights at local, national and international levels;
- Establishment of an improved institutional framework for the management of the water resources of the Basin, linking management issues at both international and national levels in relation to user demand on a comprehensive basin scale;
- Establishing appropriate management instruments in the form of mapping and monitoring of available water resources, regulations for allocation, incentives for efficient use, water savings initiatives, market based fees and charges, conflict resolution and awareness raising.

It is important to establish the governance framework on an international scale, as the Volta River is an international river, i.e. with a top-down component. But to ensure impact in the field, it is equally important to ensure a stakeholder oriented involvement at the local level, i.e. a bottom-up component. The resolution of these opposites in the particular international and socio-cultural context may pose a major challenge for the policy makers.

Nevertheless, it appears obvious, that one of the most urgent policy initiatives could - and should - be directed towards improvement of water governance. A successful implementation of this option will be a crucial prerequisite for successful implementation of the other proposed policy options.

Immediate policy option: Creation of a Volta River management framework

Based on the considerations in the previous section, it is proposed to put initial emphasis on a policy for improvement of water governance. As mentioned above, such an initiative appears to be a prerequisite

for successful initiatives in relation to the other policy options. Also, it can build on existing frameworks, through a comprehensive capacity development process.

Such a policy should comprise:

- Establishment of an international basin agreement on shared water resources management, specific for the Volta Basin key issues. The agreement shall address international water allocation issues and provide a framework for conflict mediation and resolution.
- Creation of a basin management institution co-managed by the six countries of the Basin. The experiences of the Niger Basin Authority may be useful in the initial phases of this activity. The new institution shall be authorised to:
 - Monitor all pertinent water issues related to both supply and demand and present critical issues for the governments of the Basin with proposed alternatives for action;
 - Facilitate specific resolution of international conflicts;
 - Assist national authorities in capacity building of national water authorities within a uniform framework for the entire basin;
 - Facilitate multidisciplinary research and development of improved technologies for efficient water uses;
 - Elaboration of a number of national - but internationally linked - action plans for Integrated Water Resources Management (IWRM) in the countries of the Basin.
- Funding of the priority actions, with particular emphasis on solving the water scarcity problems in the human settlements that face the most critical situation (e.g. Ouahigouya in the White Volta Basin).

Performance of the policy option recommended

The performance of the proposed policy for improvement of water governance has been evaluated based on the general information available from corresponding initiatives in West Africa.

The elaboration of national IWRM plans was recognised at World Summit on Sustainable Development in Johannesburg (WSSD 2002) as the best way to solve the problems of equitable sharing of the available resources in the long term. This goal was selected to be the target to obtain for all African countries in 2005 (WEHAB 2002).

The Government of Burkina Faso already approved an IWRM plan early in 2003. The same process is under way in Ghana. An IWRM process is foreseen in Benin and it is envisaged in Côte d'Ivoire and Mali.

This type of plan comprises for example the following actions:

- Establishment of an enabling environment for good governance of water:

- Formalisation of a national IWRM policy;
 - Reform of the legal and regulatory framework with special emphasis on establishment of transparent and equitable water rights;
 - Reform of the institutional framework particularly through the creation of basin committees, water fora for participation and involvement of stakeholders, creation of information channels and reinforcement of the representation of women and basic groups.
- Continuous monitoring of the resource and utilisation of collected data in decision support models (quantity and quality);
 - Establishment of fiscal incentive measures (subventions) or dissuasive measures (penalties) to direct the water demand towards the most profitable uses for the communities;
 - Establishment of financial mechanisms to guarantee the economic sustainability of the water management system itself.

Such an effort is expected to have a high effectiveness, through its direct impacts in the form of legal improvements, improved knowledge base for decisions, more optimal and transparent allocations of the limited resource, conflict resolutions, public participation, and decentralisation. There are certainly specific risks and obstacles in the form of lack of political concern, population apathy and lack of participation of the end users. Nevertheless, due to the severe impact of the water shortages - both now and in the future - significant improvements of the water situation are likely to be achieved over a 10-15 year period, since the problems will only get worse and more socio-economically critical, if not addressed properly.

Also, the efficiency is expected to be significant, as the benefits are related to a rational allocation of one of the key factors of economic development in an arid region: water. Therefore, they are directly related to improvement of economic growth of the riparian countries. In this context, the direct costs are minimal (compared to the potential benefits from improved water allocation and water use efficiency), as seen from a GNP perspective. They are basically related to the staffing costs of the establishment of a policy framework and an institutional framework.

If the IRWM process is properly followed, the proposed political reforms all proceed in the direction of more equity as a result of more transparent information and more participation by the various stakeholders in water resources management.

And fortunately, concerning political feasibility, several factors are currently favourable:

- The six countries sharing the Basin have a long experience of cooperation on water resources management. They all participate in the West African Water Partnership founded in Bamako in May 2000 with the support from Global Water Partnership;
- The settlement of the basin agreement will be facilitated by: 1) the implementation of the UNEP/GEF project on the Volta Basin, which also has this objective included in the preparation of the project; and 2) the coming implementation of the West African Regional Action Plan on Integrated Water Resources Management (the ECOWAS¹⁶ countries to which all the riparian countries to the Volta Basin belong);
- The funding of priority actions shows presently favourable perspectives within the NEPAD¹⁷ framework as well as other initiatives.

As always in sub-Saharan Africa, the implementation capacity is of concern. The present water institutions definitely need re-organisation and expansion, and certainly a lot of capacity development of their institutional policies, strategies, structures and capacities. But this development is an inherent part of the proposal. In particular, the capacity changes should be related to political commitment, institutional structures, authority and staffing.

Modification and loss of ecosystems: Case of the Niger Basin

In the previous sections, modification of ecosystems was identified as one of the key international water issues in the Guinea Current region. In particular, the Niger River has been singled out as a typical example of an international river system, suffering from deterioration in aquatic biodiversity. To a certain degree, the results are applicable to the Volta River, and – in many aspects related to land degradation – to the Congo Basin.

The root causes behind modification and loss of ecosystems in the Niger Basin

During the past three to four decades, important aquatic ecosystems, such as the flood plains of the Niger, the inland delta in Mali and the delta in Nigeria have suffered significant reductions in productivity and biodiversity. In the Causal chain analysis, a number of primary root causes in relation to modification of ecosystems in the Niger Basin were identified:

¹⁶ Economic Community Of West African States ¹⁷ New Partnership for Africa Development

- Adverse climatic changes have radically changed the basic ecological factors and the stream flow within last 40 years, resulting in reductions in average annual stream flow of up to 60%. Also, flood and drought intensities and frequencies have been altered.
- Rapid population growth has put additional pressure on the sustainable use of the scarce land and water resources in the Basin, causing land erosion and increased sediment loads in rivers and reservoirs.
- Lack of appropriate and innovative farming practices for sustainable rain-fed agriculture under arid conditions further aggravates the problems. Also destructive herding practices in the arid savannahs of Sahel are causes of bush clearance and desertification.
- Extreme poverty levels limit the ability of the population to introduce and invest in more sustainable land practices. The economic constraints are aggravated by the market failures in international agricultural trade through excessive support schemes in the developed countries, making sustainable economic development of the crucial agricultural sector virtually impossible.
- Governance constraints due to the absence of an efficient legal and institutional framework for local, national and international land and water management.

Identification of possible policy options

A large number of policy alternatives to address the root causes and mitigate modification and loss of ecosystems may be identified. For convenience, the policy options have been discussed separately, seen in relation to each of the five particular root causes. However, it should be emphasised that efficient policies should be comprehensive and linked to achieve a maximum of implementation synergy.

Addressing the climatic changes

The issue of climatic change is strongly related to the health and productivity of the ecosystems. Prolonged droughts, causing depleted wetlands, lakes and floodplains, are a significant threat.

If the causes of climatic change could be identified - and subsequently controlled by policy intervention - such a policy option may become extremely promising (IPCC 2001).

However, this is not very likely, but still, there are alternative ways of addressing the climatic changes through policy responses. First and foremost by establishing a close monitoring framework of the actual trends and next by identifying their impacts on the development of the ecosystems of the Basin. But also by advocating robust policies with a minimum of risk for failure due to adverse climatic conditions: in short, by accepting as a unchangeable fact, that a major part of the Basin has a severe, water-related handicap as compared to many other regions.

Controlling the population growth

With less people, the excessive land pressure, and its associated impact on the aquatic ecosystems, would decrease. Evidently - in spite of many decades of extensive efforts on family planning, birth control, education and awareness - the continued growth pattern in the Basin calls for further actions. This important option should comprise a wide framework of policies, not only the classical population control policies, in particular related to improving poor farmers assets and economic security. All significant - and region specific - social, cultural and economic reasons for the population growth must be considered (Dasgupta 2000).

Improving agricultural and land use technology

Given the very likely scenario that neither demographic, nor climatic trends are readily controllable by policy interventions within a short term time horizon, a realistic response would be to look into technological developments to increase the efficiency of the land uses in order to minimise the detrimental impact on ecosystems.

The agricultural sector may be assisted by development and promotion of appropriate technological innovations to decrease soil erosion and silting of aquatic ecosystems from agriculture, forestry and mining activities, such as detailed by Moffat & Lindén (1995):

- Implementation of sustainable practices in natural resources exploitation by incentives and by empowerment of rural people:
 - Low-impact rain-fed agriculture, based on rain- and dew harvesting, efficient soil conservation and low-cost irrigation;
 - Development of more appropriate crop varieties, adjusted to the arid conditions;
 - Cattle herding practices in harmony with the carrying capacity of the range lands;
 - Low-impact commercial intensive agriculture for commodity- and cash crops.
- Promotion of new energy technologies and renewable energy as a replacement for wood fuels.

There are actually no limits to this list, in particular if the right environment and incentives for private sector involvement - and for local farmer initiative and creativity - is being facilitated.

Reducing poverty and addressing lack of investment in land and water conservation

It is commonly accepted that poverty is one of the key constraints for efficient resource management, and for depletion of the natural resources. The links between poverty and environmental degradation are complex, and often contrary to many standard perceptions (Reardon & Vosti 1995). But it is unquestionable that improvement of income

opportunities is an important prerequisite for the farming population to afford to address more than their basic day-to-day needs.

In a predominantly agricultural population, income opportunities and poverty reduction is strongly related to agricultural market access and to product prices. African goods, sold in OECD countries, face tariffs roughly 10 times higher than those levied on goods traded within the OECD. And barriers are steepest in agriculture where Africa has a comparative advantage due to relatively cheap labour and vast amounts of land. Agricultural subsidies to the tune of 320 billion USD (a sum not far short of Africa's annual GDP) in the rich countries like EC and the US have depressed the true market prices; and national trade tariffs in the region have further distorted the agricultural markets (The economist 2004). Also, lag of an efficient transport infrastructure limits market access. Accordingly, a serious consideration of these market constraints is an important prerequisite for poverty reduction.

But also, the likelihood to achieve any success in this field against the powerful farming lobbies in the north appears almost as difficult to address as the climatic issues.

Improving water governance

Numerous case histories, and the state-of-the-art consensus in the water sector, point to the crucial importance of efficient natural resource governance. The creation of a favourable "enabling environment" in the form of appropriate legal and policy frameworks is a first and necessary step to ensure a rational and optimal use of the natural resource endowments, in particular land and water resources; not least when these resources are scarce and under heavy pressure. But equally important is the establishment of an "institutional framework" to ensure the proper enforcement of regulations and implementation of policies and plans (GWP 2001).

In the case of aquatic ecosystems, the importance of land-based activities and an integration of land and water management become crucial. Without addressing the erosion impacts of bad land management, the productivity of aquatic ecosystems cannot be maintained.

Such governance should address local, national and international issues in a comprehensive and transparent way by involving all appropriate stakeholders. General issues to be addressed may be: mapping and monitoring of important aquatic ecosystems and their pressures on a comprehensive basin scale; and establishing appropriate management instruments in the form of regulations, incentives, water savings initiatives, market-based fees and charges, conflict resolution and awareness raising.

It is important to establish the governance framework at an international scale, as the Niger River is an international river, i.e. with a top-down component. But it is equally important to ensure a stakeholder oriented involvement at the local level, i.e. a bottom-up component. The resolution of these opposites in the particular international and socio-cultural context may pose a major challenge for policy makers.

Immediate policy option: Introduction of integrated land & water management in the Niger Basin

Based on the considerations in the previous section, it becomes apparent, that one of the most urgent policy initiatives – in a GEF International Waters perspective – should be directed towards improvement of land use governance. Successful implementation of this option will be a crucial prerequisite for successful implementation of many of the other proposed policy options, such as monitoring of climatic trends and development of appropriate land use practices.

Moreover, the combination of decreasing amount of water and increasing population (and hopefully economic development, which evidently will increase demand) cannot be solved over the short term.

In these conditions, the establishment of adequate mechanisms for water allocation would be among the key policy issues of water management in the Niger Basin and other international basins facing the same issues. This will require appropriate information on the resources and the demands (monitoring and assessment capabilities), cross-sectoral policy development and allocation strategies, demand management and appropriate management instruments (e.g. legal and economic).

It is proposed to put initial emphasis on a policy and a legal framework for introduction of integrated land and water management. As mentioned above, such an initiative appears to be a prerequisite for successful initiatives in relation to the other policy options. Also, it can build on existing frameworks, in particular the Niger Basin Authority, through a comprehensive capacity development process.

The policy option recommended for immediate intervention is legal/regulatory reform focusing on public sector reform and improved stakeholder participation. The objectives are to promote compliance and to enforce agreements and policies, taking into account environmental considerations, and to foster real stakeholder participation. The actions recommended are (WSSD 2002, WEHAB 2002):

- Initiation of monitoring of aquatic ecosystems – including socio-economic driving forces – to collect data to support decision makers;

- Establishment and mobilisation of stakeholder participation frameworks;
- Establishment of comprehensive land-and-water management frameworks, including specific accounting for protection of the productivity of aquatic ecosystems in the entire basin;
- Promotion of improved technologies for erosion control and ecosystem protection;
- Capacity development of public sector institutions;
- Revision and improvement of inadequate legislation, in particular related to land tenure. Local responsibility and care for natural resources is preconditioned on local ownership, to make sure the benefits of the conservation efforts return clear benefits to the involved communities.

Based on the consideration presented above, the following options for improved policies have been identified:

- Short-term options:
 - Improvement of the overall natural resource management of the Basin, including land use, water monitoring and allocation, and ecological issues in a comprehensive framework;
 - Development of more resource-efficient agricultural systems, appropriate for the specific climatic, agricultural and socio-cultural conditions.
- Long-term options:
 - Improved control of population growth to reduce pressures on land and water;
 - Targeted alleviation of rural poverty with a focus on improved community-based natural resource conservation.

Of these options, the improvement of the management framework is considered the most urgent immediate initiative.

Performances of the policy option recommended

The performance of the proposed policy for improvement of water governance has been estimated based on the general information available from corresponding initiatives in West Africa.

A proper implementation can be expected to have definite impacts in the form of improved and coherent natural resource management policies at both national and international level. Associated legal improvements may address land tenure issues and increase the formal protection of the productivity of aquatic ecosystems. Decisions may be based on more solid evidence, and become more transparent to stakeholders. Also, mediation and resolution efforts may reduce the detrimental impacts of land and water conflicts. A successful involvement of stakeholders through public participation and

mobilisation may significantly improve the implementation capacity of the present limited Government resources.

There are definite risks and obstacles for a successful implementation, in particular related to political negligence and population apathy, in particular because the general awareness about the importance of the fragile aquatic ecosystems is limited. There are also risks that a proper addressing of crucial issues like land tenure may challenge important political and cultural power structures

However, the win-win situation coming out of reaping the significant economic and social development benefits achieved through improved land management will eventually benefit the biodiversity of the rivers, lakes, wetlands and coastal waters of the Basin. And fortunately - compared to the potential benefits - direct costs are relatively small, as they are related to establishment of "software" such as policy, legal and institutional frameworks (CBD 1992, UNCED 1992, WEHAB 2002).

As for implementation capacity, the existing Niger Basin Authority (NBA) is an obvious candidate as a focal point for improved governance in the Basin, but there is a need to strengthen the mandate and the capacity to address both land management as well as ecological issues, in addition to the present water allocation mandate. The NBA will need expansion, and certainly a lot of capacity development in these fields of expertise, in institutional and political policy and authority, and in strategies, structures and staff capabilities. This development shall constitute an inherent part of the proposal.

At this point, the necessity to have a harmonisation between *one* international basin process and *several* national processes must be emphasised. This appropriateness will be facilitated by the regional West African process towards IWRM (West Africa Regional Action Plan, WARAP-IWRM). The Heads of State and Governments of ECOWAS have adopted this plan. The Programme n° 1 of this plan aims to support the development of National IWRM Action Plans. The Programme n° 3 aims to update the basin agreements to make them comply with IWRM principles adopted by the member countries. The justification of super national entities such as NBA is to solve the transboundary issues and such organisations will have no impact if the countries do not develop their IWRM policy/capacity themselves. Therefore, the two processes must be coordinated and must progress at the same speed.

The ECOWAS process and the GEF project in preparation (ABN/GEF/UNDP/World Bank 2002) would form a good platform to introduce a combination of land and water management in the region.

Eutrophication: Case of the Comoe Basin

In the previous sections, eutrophication was identified as one of the key international water issues in the Guinea Current region. In particular, the Comoe River has been singled out as a typical example of an international river system, impacted by discharges of nutrients (as shown by the concentration in nitrogen and phosphorus) and impacting the GCLME (as shown by algal blooms along the shoreline from the Vridi channel in Abidjan to the Ghana border and beyond).

The root causes behind eutrophication in the Comoe Basin

In the Causal chain analysis above, a number of primary root causes of eutrophication in the Comoe Basin were identified:

- **Demographic:** The eutrophication is proportional to the density of population in the catchment. Moreover, the impact of human excreta is aggravated by the lack of sanitation systems.
- **Knowledge:** The rural populations have no adequate understanding of the causal chain starting from their agricultural practices and arriving at eutrophication and its most visible symptom; the invasion of water bodies by aquatic weeds. Failures in sewage systems have the same effects.
- **Economic:** The method used to clear the vegetation before cultivation (burning) is typical of poor farmers using the most economic method they can find.
- **Socio-cultural:** Clearing the vegetation by using burning is not only practised for economic reasons. It is also a lifestyle in the region and it comes with other traditional (but illegal) activities like poaching the small animals driven away by the fire.
- **Legal:** People generally do not take care of the sustainability of their cultivation practices because they do not own the land. There is no provision for the control of discharges from agro-industrial plants.
- **Governance:** This is the key root cause since the reduction of eutrophication will come through a sound environmental management of the catchment, following IWRM principles.

Identification of possible policy options

The diversity and the complementarity of the profound causes listed above correspond to just as many possible policy options of dealing with the problems.

The different possible policy options for attacking the causes are identified below:

Demographic

It is necessary for each country to carry out birth control policies. However, this is a very long-term option and it will take at least 10 years before the effects will be visible in the eutrophication of the watercourses.

Knowledge/Technology

The important thing is to reinforce the capacities, to explain and to raise awareness. The question of general education should be part of the national educational policies, while the short-term targets are important to convince the populations of the Comoe Basin to develop their cultural practices. It would be wise to make information and awareness campaigns for the farmers concerning the appropriate use of fertilisers (dosing, amounts and spreading periods) as well as the relation between an inappropriate use of fertilisers and the eutrophication of watercourses. Another technological aspect is the design and maintenance of purification systems (e.g. individual latrines, sewage and drainage systems). Efforts have already been made in this respect in the countries of the Comoe Basin, primarily by the CREPA for the French-speaking countries and by other operators, including the NGOs, as for Ghana.

Economic

The financial constraints constitute one of the important profound causes, but the corresponding policy options exceed by far the simple water quality framework. The policies in question are primarily related to macroeconomics at African States level, to protectionism carried out by the industrialised countries on certain products (such as sugar and cotton) as well as the world trade policy as for tropical products, which maintains the farmers of the third world at a level of chronic poverty and dependency.

Socio-cultural

The socio-cultural constraints constitute an important curb on the sound management of land. However, the means to overcome the constraints are to be found in the present social development during which these traditions are progressively and naturally disappearing, particularly in the city areas. Consequently, there is no need for a specific policy option in this respect.

Legal

The questions of land tenure are recognised by all experts in the region as a very important obstacle to a sustainable management of the land as well as to the fight against degradation of land (and as a consequence of water, too). Possible reforms have been studied by the countries of the Basin, and in 1999 Côte d'Ivoire adopted a new forest policy

transferring part of the property rights to the ligneous resources to the farmers (MEF-MPPD 1999). However, this policy of transferring property rights from the State to the farmers met with a strong opposition from foresters and State officials and it has therefore still not come into force. The political situation has contributed to suspending the application of these reforms.

Governance/Political

These two major root causes are grouped together here, as the options relating to good governance depend of the enabling environment, which is the responsibility of the state authorities through the water policy. The main policy option is the integrated management of the land and water within the context of the River Basin. This option is already a part of the laws of the countries of the Comoe Basin. Further, the experience gained in Burkina Faso within the IWRM programme shows that the establishment of a basin management structure can be done gradually, by creating an advisory body at an initial stage. Afterwards, when the needs arise, the mandates of the body can be progressively enlarged to consultation, technical management, planning, water allocation and financial management.

Harmful algal blooms in the Guinea Current LME

The eutrophication problem is not limited to watercourses and lagoons. The organic matter is transported by the rivers and arrives at the Ocean through the passes of the lagoons. This is the case for the Vridi Canal in relation to the Comoe-Ebrié lagoon-riversides complex (Mé, Bété, Djibi, Banco, Agnéby). The organic matter is transported to the east along the coast by the littoral current. The high amount of organic matter in the seawater, the heat, and the sunlight cause the increase of algal blooms. Some algae are toxic and constitute a risk to the marine life or to human health, which has resulted in the name HAB: Harmful Algal Blooms.

The possible options of combating the HABs (or reducing their harmful effects) have been studied within the GEF/UNIDO-GCLME project (2003).

Box 7 How to address HABs in the Guinea Current LME.

- Develop and implement best environment practices/best available techniques for agriculture to reduce discharges of nutrients (see technological root causes above).
- Develop an HAB reporting system for the GCLME region as a whole. This is seen as a high priority within the GCLME. It is also essential for the development of a sustainable mariculture industry.
- Community awareness projects linked to national ministries of health to alert the public to dangers associated with potential HAB as needed.
- Develop national/regional HAB contingency plans, which include early warning and guidelines for medical practitioners to deal with HAB and associated problems.
- Improve national capacity to analyse for toxins and identify harmful species by sharing expertise between countries.
- Mitigation of impacts of HABs on mariculture operations (e.g. relocation of mussel rafts, treat blooms with herbicides).

(Source: GEF/UNIDO-GCLME 2003)

It turned out that most of them belong under the options concerning combating the eutrophication of the seawater, which is not treated in this report. The first option, however, is part of the specific options for international basins flowing into the GCLME (see Box 7).

Immediate policy option: Establishment of a management body for the Comoe Basin.

Some of the above mentioned policy options are characterised by having a long-term effect. This is the case for the demographic limitation as well as for the reversal of the political tendencies (e.g. fight against poverty). Other policy options may have a short-term effect and priority must obviously be given to those.

Another criterion for selection of the best policy options is also the relation between their cost and their efficiency. This means that priority should be given to the options that are most likely to give good results and at the same time are the less expensive.

A final recommendation is to choose among the possible options those which are the keys to the others, namely those that should prepare the way for other options.

The most successful option will be the establishment of a management body for the Comoe Basin. Such a body should have the following characteristics:

- Be based on the existing technical organs of the countries such as the Directorate of Water Resources and the CIAPOL (Centre Ivoirien Anti-Pollution in the Côte d'Ivoire), the Water Resources Commission and the Environmental Protection Agency in Ghana, and the DGRH (Direction Générale de l'Inventaire des Ressources Hydrauliques) in Burkina Faso.
- Include in equal numbers representatives from the governments, the territorial communities and the users of the Basin. In order to keep the flexibility and the efficiency of the Committee it is, however, important that the number of members is not too high.
- Have a consultative role in the start-up phase, including for example the following mandates:
 - Constitute an exchange forum concerning the problems of integrated management of land and water resources in the Comoe Basin with the aim of identifying, estimating and prioritising the water problems of the Basin, in particular the eutrophication, which is considered the most serious problem;
 - Seek, through awareness raising and information, the support of the operators in the water sector for the collective management of the water resources of the Basin and for the search for the most environmental friendly agricultural practices;

- Identify the possible disputes that might arise concerning the use of the shared water resources and make suggestions to the national authorities on how to avoid or settle such disputes;
- Identify the financial resources that might allow a consistent long-term functioning of a permanent structure (for example application of the polluter-pays principle, or the search for other resources);
- Make suggestions to the competent authorities on the future permanent management framework for the Comoe Basin, possibly endowed with more wide-ranging powers.

Performances of the policy option recommended

Effectiveness

The recommended policy option can be implemented immediately as provision has been made for it in the national frameworks of water management as well as in the regional framework adopted by the countries of the Basin under the auspices of ECOWAS.

Efficiency

The recommended policy option will be able to produce concrete results within a very short time: First, by creating a forum where the operators of the Basin can exchange problems, experiences and share their knowledge. Secondly, by recommending immediate measures in relation to cultural practices such as moderate use of fertilisers, fight against bush burning, hygiene at village level, protection of water courses against animal excrements and limitation of agro-industrial waste, for example from the sugar manufacturing company of the Upper Comoe Basin. Finally, by making recommendations to the authorities of the riparian countries on the future management framework that might also serve as a model for other basins (e.g. Sassandra, Ouémé or others).

Equity and political feasibility

The proposed policy option is equitable as it aims to include, in equal numbers, representatives from the governments, the territorial communities (municipalities, districts and regions) and representatives from the users. This is a radical change compared to the existing water management practices that are sectoral, centralised and technocratic.

The political feasibility is high due to strong cooperativeness between the countries of the Comoe Basin. Three out of four of these countries (Burkina, Côte d'Ivoire and Ghana) have already cooperated in the Volta project. The four countries are associated in the West-African IWRM process and are used to collaborating on technical, legal and institutional problems.

Implementation capacity

The four riparian countries provide sufficient human resources to appoint representatives having an adequate knowledge of the principles of integrated basin management and having at the same time the capacity to handle international matters.

However, due to economic reasons and in order to avoid a permanent mobilisation of highly specialised human resources (for example modelling experts), the Basin Committee will have no technical means of its own. It should base its activities on the existing technical structures of the different countries, of which several are mentioned above.

Chemical pollution: Case of the Guinea Current LME

The root causes behind chemical pollution in the Guinea Current LME

Different types of pollution impact the GCLME. Among the various pollution issues, the land based chemical pollution is considered to be one of the most severe hazards for the marine environment.

In the Causal chain analysis, the main root causes of land-based chemical pollution have been identified. They can be summarised as follows:

- **Technological:** The processes used by industry and mining in Africa use polluting methods and machinery. Financial constraints do not allow the replacement of old installations with modern more efficient ones.
- **Knowledge:** The sources and the levels of chemical pollution are not well known. The technicians working at these plants are not trained in clean technologies and the controllers do not know the industrial processes they have to monitor. The populations are not aware of the dangers they face.
- **Governance:** The budgets devoted to environmental monitoring are very limited. The administrative practices are not efficient. Corruption may be the cause of lack of control of polluting plants. The exact number of polluting industries and the nature of pollutants is not well known. The pressure groups that could change the situation do not play their roles fully. The development policy favours production at low cost rather than clean production. For different reasons developed in the section on Performance of the policy option recommended, environmental laws and regulations (EIAs and environmental audits) are not well applied.
- **Socio-cultural:** Rules of modern societies for addressing technical issues are often in conflict with traditions, religions and African life-style.

- Poverty/Economic: Poverty is an aggravating factor to pollution, since people or enterprises do not have the financial means to change their practises. The selling prices of their production do not motivate the adoption of less harmful but more costly techniques. There are not enough motivating (subsidies) or dissuasive (taxes) mechanisms.

Identification of possible policy options

The different possible policy options for approaching the profound causes listed above have been identified as follows:

Technological

The policy options in this respect should concentrate on introducing clean technologies in the industries as well as in the mines. A particular effort should be made in relation to the informal sector in order to put an end to the gold extraction techniques based on mercury amalgamation.

Knowledge

There is a lack of knowledge at different levels: (1) ignorance of the sources of pollution; (2) ignorance of the present state of pollution; (3) ignorance from the polluters (industry and mining) of the causal chains leading to the present state; and (4) ignorance of the population and their representatives (politicians) of the risks incurred.

Several options are available to mitigate these shortcomings:

- Cumulative impact assessment for the Guinea Current LME: an overall impact assessment of industries and mines is needed (industry co-funding would be welcome).
- Monitoring of the present state of pollution in the GCLME:
 - The present status of chemical pollution in the GCLME and its impacts on marine ecosystems requires proper documentation, and establishment of a baseline at regional level;
 - Cooperative training will be needed for the effective management of impacts.
- Development of the capacities of the industries and mines:
 - Develop mechanisms of cooperation between industries, mines, ministries and other stakeholders, and strengthen capacity to reduce sources of pollution.
- Development of sanitary awareness and of alarm/indicator systems:
 - Establish/identify regional parameters for approaches to early warning systems and associated quality performance standards.

Governance/Political

The management capacities for the coastal area should be reinforced. As a first step, needs-assessment must be carried out to improve coastal management expertise. The institutional framework should be harmonised with the legislation (see below) and designed according to the available human resources. In addition, the problems in relation to management of the rivers and the coastal area should be coordinated with lessons learned from the UNEP-FreshCo initiative. Laws must be reviewed or reformulated according to the identified problems, the special socio-cultural features of the region and the financial capacities of the actors. Finally, regulations should be drawn up according to the existing law.

Socio-cultural

Socio-cultural traditions are progressively and naturally fading (though still enduring) concurrently with the development of the African communities. Consequently, there is no need for a specific policy option in this respect.

Poverty/Economics

As for reduction of pollution there are three levels of economic (short-term) options: development of dissuasive measures (e.g. polluter-pays tax) in order to discourage the polluting productions and generate revenues to be reinvested in subsidies; development of subsidies or fiscal incentives (e.g. exemptions) in order to help industries invest in clean technologies; and an increase of the price of raw materials and basic products.

Mitigation measures and cross-cutting policy options

Besides the policy options addressing the root causes, other policy options have been identified by the GEF/UNIDO-GCLME project (2003) to address the impact/symptoms of the pollution. Most of these options can also be applied to other issues under the pollution concern (e.g. oil spills) and contribute to the enhancement/restoration of biodiversity in the GCLME:

- Regional (GCLME) policy on aquaculture/mariculture should be developed and then harmonised with those of neighbouring countries, including the Canary and Benguela Current LME regions;
- Regional (and national) management plan for biodiversity conservation must include a framework for assessment and prediction of environmental impacts;
- Identification of marine protected areas; attention can also be given to possible marine protected areas that have transboundary implications;
- Identify genetic structure of populations; an essential component of a regional biodiversity conservation management plan. This has

important implications for fisheries management (do countries manage the same or different stocks of individual species?).

Immediate policy option: Implementation of regional monitoring system for chemical pollution of the Guinea Current LME.

The recommended policy option(s) to combat land-based sources of pollution in the Guinea Current LME must address the root causes identified above and must also be based on the actual institutional regional framework, the ongoing regional projects and on the options and measures already taken within these frameworks and projects.

The Abidjan Convention (1981) and its "Protocol on Cooperation in Combating Pollution in Cases of Emergency" constitutes the legal components of the West and Central African (WACAF) Action Plan. The Convention expresses the decision of the WACAF region (from Mauritania to Angola at the time of adoption) to deal individually and jointly with common marine and coastal environmental problems. The Convention also provides an important framework through which national policy makers and resource managers can implement national control measures in the protection and development of the marine and coastal environment of the WACAF region.

Since its entry into force in August, 1984, parties to the Abidjan Convention have, with UNEP's assistance, undertaken a number of activities including the development of programmes for marine pollution prevention, monitoring and control in cooperation with e.g. IMO, FAO, UNIDO, IOC-UNESCO, WHO and IAEA.

However, despite all the efforts made in the implementation of the Abidjan Convention, a certain degree of uncertainty still prevails in assessing the pollution load in general, because of the paucity of reliable, detailed and historic scientific data on coastal, marine and freshwater environments in the GCLME region. There is an urgent need for precise qualitative and quantitative assessment of the significant sources of land-based pollution.

Therefore, the policy options recommended must be focused on better knowledge of the situation that is the key to defining the other policy options which have more probability of being successful.

The recommended policy option is the implementation of a regional monitoring system for the chemical pollution in GCLME based on the results from the GEF/UNIDO-GCLME Project 2003:

- Establishment of a convention between the 16 coastal states, the representatives of the polluting industries (including the mining

companies), the local communities (the large coastal cities), and the coastal populations (e.g. fishermen villages, sea farmers);

- Registration and monitoring of the polluting installations;
- Environmental assessment of the pollution impacts and definition of the indicators of pollution/water quality, including a regional examination of pollutants in the sediments and the tissue of living organisms;
- Establishment of a specialised institutional network in the field of water quality and aquatic environment (including ecosystems and biodiversity);
- Installation of a series of systematic observation points along the coasts and definition of an observation frequency;
- Definition of a financial mechanism for the monitoring activities. It seems inevitable to start with a project based on foreign finance from major donors like e.g. the GEF. But eventually the system ought to find its own financing within the profession and aim at a budgetary balance in the long term.

Other policy options could already be outlined at this stage, provided that they are defined more precisely later on, based on the observations of the previous system:

- Improvement of the technological processes of the industries and mines;
- Prohibition of environmentally harmful techniques (e.g. mercury amalgamation of gold);
- Reinforcement of the enforcement of laws and regulations, including reinforcement of the control of polluting installations;
- Introduction of encouraging mechanisms (subsidies, tax exemptions) for the non-polluting industries;
- Introduction of dissuasive mechanisms (taxes and penalties) for the polluting industries;
- Training of main operators;
- Information of the coastal populations and the consumers.

Performances of the policy option recommended

Effectiveness

Thanks to the GEF/UNIDO/GCLME Project (2003), the coastal countries are used to collaborating and therefore a monitoring system could be implemented immediately.

Efficiency

The extent of the monitoring system must be carefully proportioned to the problems to be dealt with as well as to the financial resources available long term. Considering these two conditions the system will be able to produce an annual report on the chemical pollution situation of the GCLME. The permanent follow-up and the comparison of key

indicators from one year to another will have three immediate results:

- The possibility of alerting the local/national authorities in case of pollution;
- Definition of the sources and impact areas to be dealt with first;
- Evaluation of the effect of measures taken in order to suppress or reduce the pollution sources and to restore/compensate the affected areas.

Equity and political feasibility

The present regional institutional framework is likely to give priority to the actions planned by the governments of the riparian countries of the Guinean Current region. The association between industries and the riparian populations constitute a guarantee of the balance and openness of the process.

Implementation capacity

Most of the countries of the GCLME have sufficient human resources and equipment to carry out such a programme. Attention should be paid particularly to the importance of upgrading the countries that, until now, have not participated much in the regional efforts (e.g. Sierra Leone and Guinea-Bissau).

Overexploitation of fish: Case of the Guinea Current LME

The root causes behind overexploitation of fish and other living resources in the Guinea Current LME

In the section Causal chain analysis, the main root causes of overexploitation of fish and other living resources in the GCLME were identified. They can be summarised as follows:

Knowledge

Lack of knowledge concerning the complexity of ecosystem and high degree of variability and an insufficient capacity development (human and infrastructure and training) contribute to overexploitation of fish.

Governance/Legal

Lack of efficient governance and legislation is mainly caused by: poor legal framework at the regional and national levels; inadequate implementation/enforcement of available regulatory instruments; inadequate financial mechanisms and support; and insufficient public/stakeholder involvement, lack of co-management.

Identification of possible policy options

Despite the number of countries involved, joint regional policies and actions would offer the best approach to the effective and efficient management of transboundary fish stocks. Trawl surveys in the Gulf of Guinea offer a possible basis for common regulatory actions. These would include restrictions in the licensing of fishing boats (unnecessary for tuna vessels, because tuna stocks are under-exploited), a strict application of prescribed mesh sizes, the inclusion of turtle excluder devices in trawl nets, and an intensification of enforcement patrols. These measures are expected to have a pronounced positive impact on marine conservation and on the biodiversity in the region.

Two cooperative surveys of demersal fish populations were implemented and conducted by six Gulf of Guinea countries in 1999. Subsequent surveys will determine stock levels, quantify biodiversity and assess contaminant loading in fish tissues. For an evaluation of its progress in reducing habitat loss, preventing overfishing and reducing sources of environmental pollution see GOGCLME (2003). The second phase of the GCLME project is now underway and involves 16 African countries bordering the Guinea Current LME from Guinea-Bissau to Angola (GEF GCLME/UNDP/UNIDO 2001).

The possible policy options are quite similar to those identified in the frame of pollution issues in the GCLME. The main obstacle to sound environmental management of the natural resources in the GCLME is the lack of data with its consequence i.e. the lack of understanding of the dynamics of living resources in this particularly wide and complex LME:

- Governance: Reinforcement of fishing agreements between the 16 coastal states, associating the respective governments of the industrial fishing vessels, the industrial fishing companies and the representatives of the non-industrial fishermen.
- Assessment and monitoring of the stocks of fish.
- Environmental evaluation of impacts of overfishing on stock depletion and the crosscutting effects on other economic or non-economic species.
- Linkages with the other issues and concerns (i.e. eutrophication, chemical pollution and climatic evolution).
- Creation of an institutional network specialised in the management of living resources in the GCLME (including ecosystems and biodiversity).
- Definition of a financing mechanism in collaboration with governments of countries with a fishing fleet operating in the GCLME, and with the fishing companies and artisanal fishermen.
- As in the case of monitoring of chemical pollution, the leverage of an externally financed project seems inevitable.

Immediate policy option: Assessment of ecosystem degradation

The paucity of reliable, detailed and historic scientific data on coastal, marine and freshwater environments in the GCLME region also applies to fisheries. There is an urgent need for a comprehensive assessment of the state of the fisheries resources and the extent of ecosystem degradation (including status and trends analysis) in the region.

Beyond this first stage of monitoring/understanding, there is an urgent need to rationalise and make the fishing practices sustainable by facilitating the optimal harvesting of living resources, for example:

- Co-management with fishing communities and industry: Co-financing from the fishing industry and other donors is a priority for effective management.
- Provision of information to facilitate regional assessments of shared resources: A structure should be established to conduct regional stock assessments, ecosystem assessments, evaluate resource-environmental linkages, and facilitate post-harvest technology. Joint stock assessments with the Benguela Current LME and Canary Current LME should be explored and implemented.
- Joint surveys and assessments carried out cooperatively will help produce enhanced management and optimal utilisation. These joint surveys will be offered as a 5-year demonstration of the benefits to the individual countries of joint transboundary assessments.
- Gathering and calibration of baseline information. This should be done for resources, potential resources before harvest, as well as for ecosystems.
- Cooperative analysis of socio-economic consequences: Analyses of socio-economic consequences of sub-optimal and improved use of resources should be carried out with a view to facilitate appropriate intervention within the framework of improving sustainable livelihoods.

Mitigation measures and cross-cutting policy options

Besides the main policy options addressing the root causes, other policy options have been identified by the GEF/UNIDO/GCLME project (2003) to address or compensate the impact/symptoms/effects of the overexploitation of fish resources within the GCLME:

- **Responsible development of mariculture**
 - Socio-economic assessment of potential: A full socio-economic assessment needs to be conducted on the ability of mariculture to contribute to the regional economy and the improvement in the living conditions of coastal communities.
 - Feasibility assessment: The feasibility of mariculture for particular species in certain areas of the region needs to be

assessed, and the best species for development need to be chosen on the basis of this assessment.

- Formulate harmonised policies for the region: A crucial component if the negative effects of one country's policy on the economic potential of another are to be precluded.
- Training will be needed, particularly in terms of promoting community-based mariculture, as well as the overall management of mariculture in the region.
- **Protection of vulnerable species and habitats**
 - Assessment of the status of vulnerable species and habitats; this work has started in some countries, but a holistic regional study is needed.
 - Appropriate mitigation solutions need development and implementation for combating beach erosion and reducing unnecessary loss and restoring lagoon productivity.
 - Assessment of non-harvested species and their role in the ecosystem.
 - Joint dedicated surveys and assessments. Such surveys need to be dedicated to the non-harvested species because of the special technology needed.