FINAL DRAFT

OKACOM

THE PERMANENT OKAVANGO RIVER BASIN WATER COMMISSION

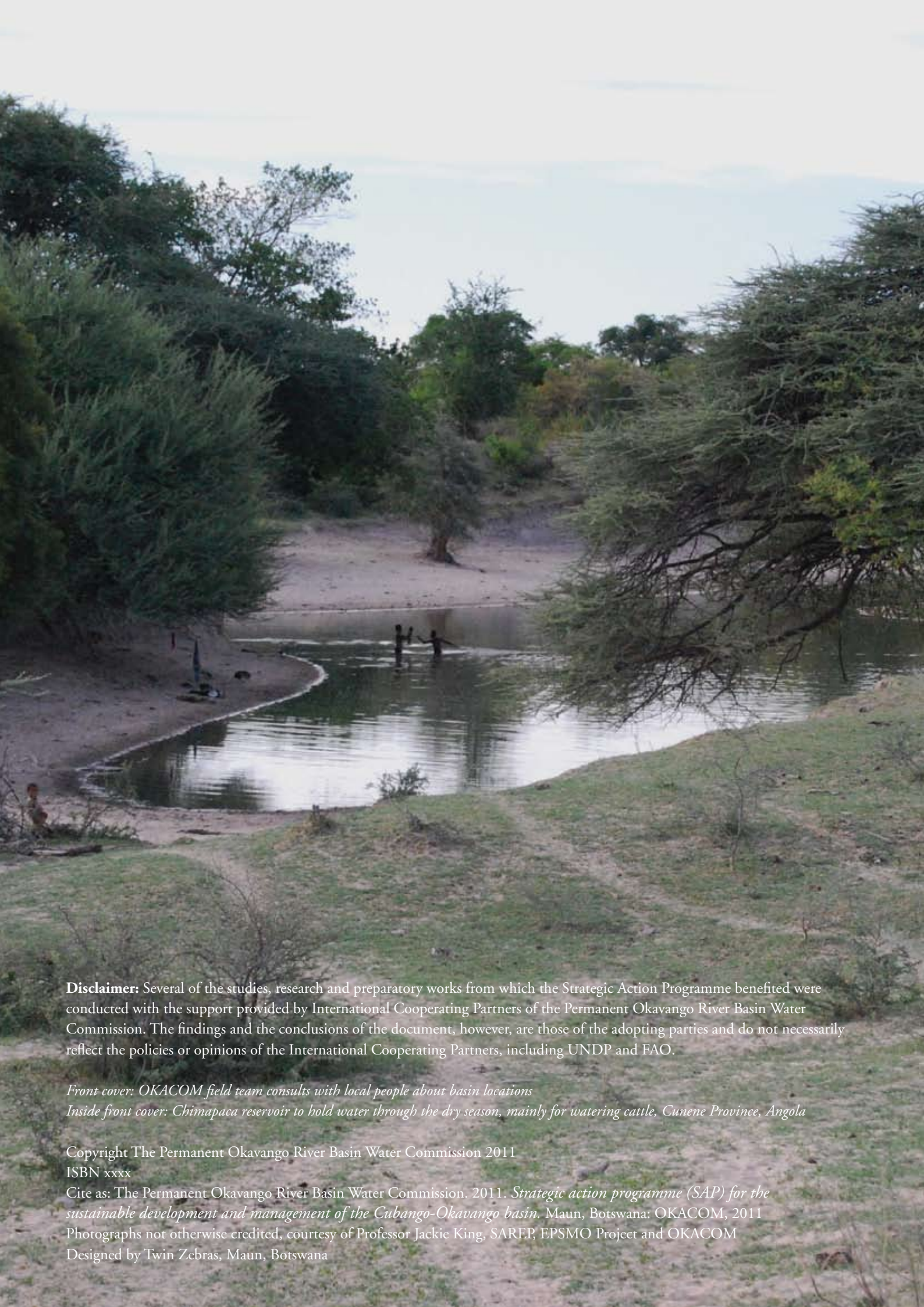
The Permanent Okavango River Basin Water

Commission

Strategic Action Programme (SAP) for the Sustainable Development and Management of the Cubango-Okavango Basin

ANGOLA BOTSWANA NAMIBIA

OKACOM



Front cover: OKACOM field team consults with local people about basin locations
Inside front cover: Chimapaca reservoir to hold water through the dry season, mainly for watering cattle, Cunene Province, Angola

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Strategic Action Programme (SAP) for the Sustainable Development and Management of the Cubango-Okavango Basin

2011

Approved

For: Republic of Angola

For: Republic of Botswana

For: Republic of Namibia

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Republic of Botswana

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ACRONYMS AND ABBREVIATIONS

BDMF	Basin Development and Management Framework
CBNRM	Community Based Natural Resources Management
CITES	Convention on International Trade in Endangered Species
DSS	Decision Support System
EA	Environmental Assessment
EPSMO	Environmental Protection and Sustainable Management of the Okavango River Basin
ESI:	Environment Status Indicator
FAO	Food and Agriculture Organisation (of the United Nations)
GATECI	Grupo de Apoio Técnico Inter-Ministerial (Angola)
GEF	Global Environment Facility
GWP	Global Water Partnership
ICP	International Cooperation Partner
IFA	Integrated Flow Assessment
IMO	Integrated Management Objective
IMO	Integrated Management Plan
IWRM	Integrated Water Resources Management
MAR	Mean Annual Run-off
MDG	Millennium Development Goals
NAP	National Action Plan
OBSC	Cubango-Okavango river basin Steering Committee
OKACOM	Permanent Cubango-Okavango river basin Water Commission
PDO	Pacific Decadal Oscillation
PI	Process Indicator
SADC	South Africa Development Community
SAP	Strategic Action Programme
SAREP	Southern African Regional Environmental Programme (of USAID)
SRI	Stress Reduction Indicator
TDA	Transboundary Diagnostic Analysis
TSS	Total Suspended Solids
USAID	Unites States Agency for International Development
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention on Combating Desertification
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

Catch of the day, Mucundi, Angola

EXECUTIVE SUMMARY

The Strategic Action Programme (SAP) is a basin-wide policy framework document for the Cubango-Okavango river system basin that lays down the principles for the development of the basin and improvements of the livelihoods of its people through the cooperative management of the basin and its shared natural resources. The overarching objective of the SAP is:

> To promote and strengthen the integrated, sustainable management, use and development of the Cubango-Okavango basin at national and transboundary levels according to internationally recognised best practices in order to protect biodiversity, improve the livelihoods of basin communities, and the development of basin states.

This objective balances the shared commitments of the basin states for environmental sustainability, alleviation of poverty and improvement of the welfare and living conditions of the population through increased economic growth, using the mechanism of IWRM.

The SAP is a mid-term planning document that is designed for voluntary adherence by the Cubango-Okavango basin states. Its contents are supported by and in accordance with their national development plans and the National Action Plans (NAPs) for their part of the basin that have been developed in parallel with the SAP. Implementation of the SAP is the responsibility of the basin states independently as component of their NAPs, and collectively as part of OKACOM.

The SAP has been developed over three years (2008-2010) through a consultative process with a wide range of stakeholders from government departments, academic and scientific institutions, civil society, the private sector and community representatives. The SAP is a coordinated management response to the problems posed by these Driving Factors and Priority Areas of Concerns as identified by the Transboundary Diagnostic Analysis (TDA) carried out for the basin (as part of the GEF funded EPSMO project). The TDA identified four emerging Areas of Concern in the basin and for underlying Driving Factors, which are described below.

AREAS OF CONCERN	DRIVING FACTORS
• Variation and reduction of hydrological flow • Changes in sediment dynamics • Changes in water quality • Changes in the abundance and distribution of biota	• Population dynamics • Land use change • Poverty • Climate change

DRIVING FACTORS

Population dynamics

Throughout the basin, there is a trend towards increasing urbanisation associated with population growth and a lack of alternative livelihood options. Although the population in the basin is predominantly rural, Angola has an urban population of about 40%, Namibia approximately 20% and Botswana 30%. Increased urbanisation leads to increased demand for services such as water supply and sanitation, which, if not regulated, could lead to increased water pollution.

Land use changes

Land-use change is a driving force for changes in sediment dynamics, water quality and abundance and distribution of biota, and has impacts on the hydrological regime through deforestation. Linked strongly to population growth, its impact is incremental and often very difficult to reverse. Despite the relatively low population densities in the Cubango-Okavango river basin the changes in land use and vegetation cover has been marked. There is increased demand for land for crops along the length of the river from the Angolan highlands to the Panhandle and with an increasing population this trend will only accelerate.

Poverty

Poverty is a feature of the human populations of the basin in all three countries. This is partially due to the remoteness of the basin, but also the highly unequal distribution of wealth in the three countries. Poverty alleviation in the basin is a major investment target for governments and the three countries have national poverty reduction strategies aimed at improving the welfare and living conditions of their populations through increased economic growth and linked to the Millennium Development Goals (MDGs).

Rural children in field, Angola

Climate change

An analysis of projected climate change effects predicts a rise in temperature and rainfall in the basin. Higher temperatures (2.3°C-3°C) will affect the south of the basin more strongly than the north, increasing evaporation. There is a projected increase in rainfall of 0-20% across the basin, with the greatest effect in the north because of the north-south rainfall gradient. In general, the projected increase in rainfall will more than compensate for higher evaporation rates. This could result in an increase in runoff (total and monthly) with proportionately stronger peak flows.

PRIORITY AREAS OF CONCERN

Variation and reduction of hydrological flow

Increasing water demands for irrigation, domestic water and sanitation as well as other uses are likely to impact the flow regime of the river. The Cubango-Okavango river system is a 'losing' system in that by far most its water originates from the upper catchment, the headwaters of the Cubango and Cuito, and then water is lost through evapo-transpiration and groundwater recharge with small quantities of water flowing out of the Delta. The water availability may be adequate during flood flows, but during low flows the lack of water may be critical. The fact that all the water in the basin is generated upstream of the confluences of the Cubango and Cuartir Rivers in the west, and the Cuito and Longa Rivers in the east has great significance. Downstream of these points, the catchments of the lower Cubango and Cuito Rivers contribute very little additional runoff. For these reasons some parts of the river can withstand hydrological change better than others.

The overall trend is for run-of-river abstractions to reduce flows throughout the year, with the effect being particularly noticeable in the dry season. Under the conditions modeled in the TDA, dry-season flows would tend to be lower, start earlier and last longer with flood volumes becoming progressively smaller; the flood season would become shorter and start a little later.

The river and its floodplains provide significant ecological services which support the livelihoods of a large proportion of the basin's population. With the TDA economic analysis showing that most water use scenarios provide negative economic returns compared to the current economic returns from ecosystem services, any decision on water resources developments in the basin needs to carefully balance the potential losses in livelihood value (due to reduction in ecosystem services) and direct economic contributions against gains from development of irrigation, hydro-power, public water supply and sanitation. In this context the TDA shows that the provision of safe drinking water for both urban and rural populations is one of the most urgent (and economically beneficial) economic developments and should be advanced as quickly as possible.

Flooding is a major flow related issue in the Cubango-Okavango basin. There is a need to identify the areas susceptible to flooding and develop strategies to mitigate potential damage. This includes flood-preparedness plans, including government response information, flow of information and lines of command and decision structures and a public information system.

Changes in sediment dynamics

Sediment transport is known to be as important to the health of the river and Delta as hydrological flows, but knowledge of the impacts caused by changes in these flows is limited. Increasing erosion in the Angolan highlands as a result of deforestation and cultivation of more land has for some time been increasing sediment load. As land is cleared and cultivated more soil is eroded and carried down from the catchment into the river. Thus not only will land areas be lost, but the quantities of sediment in the river increase which could increase turbidity, reduce light and dissolved oxygen, and threaten aquatic habitats.

The flood plains are also coming under stress from changing land use patterns as a result of the reduction of environmental services through degradation of the flood plains and alterations to the sediment regime, which affect the water quality and the productivity of the lower basin and the Delta.

Degraded river banks and loss of riverine forest are two of the most visible impacts of increasing land-use change. Campaigns to restore these features will directly improve the environmental status of the river and require community involvement and educational programmes to build an understanding of the importance of their protection.

Aerial view of sand and sediment on bend of Cuito River

Changes in water quality

At present the water quality of the Cubango-Okavango river system is considered to be very good. However, the data available on water quality is meagre and limited to a few parameters and even in the lower basin, does not give a clear picture of the current status.

Of the threats due to direct pollution, the development of irrigation with its potential increase in discharge of agro-chemicals, is probably of most concern. It is difficult to predict levels of pollutants from returned irrigation water, because these will depend upon the soils, crops, cultivation practices and efficiency of irrigation, but the threat is present. In general, the greater the efficiency of irrigated water use, the lower the pollutant content in the returned water. Changes in nutrient levels affect the overall productivity of the system, probably changing the river from a nutrient poor to a nutrient rich system, with the consequent risks of eutrophication. The discharge of persistent organic pollutants such as pesticides from irrigated agriculture, malaria control and tsetse fly spraying is not significant at present. However, if these are not limited, they could enter the water, sediments and food chain of the river, with unknown long-term consequences for the health of people exposed to them.

The provision of sanitation services in the basin is limited and, for public health and environmental reasons, there is an urgent need to improve treatment of municipal waste which is currently a major pollution source.

Changes in abundance and distribution of biota

In ecological terms the abundance and diversity of flora and fauna in the Cubango-Okavango river system and especially in the Delta is outstanding. Any human-induced change in flow regime will threaten the biodiversity make-up along riparian belts and across floodplains. Conversion of floodplains and destruction of the riparian belts will decrease the capacity of the system to buffer the hydrology and water quality of the river. The risk of losing these key natural aquatic management

options is likely to increase under conditions of higher water use.

The Cubango-Okavango biosphere is under pressure from expanding human settlements and infrastructure. As the population increases, so pressure from harvesting, fishing and hunting of the natural resources will increase, inevitably leading to overexploitation and reduction in the abundance and even loss of some species. Land cover changes from overgrazing, deforestation and land transformation for farming contribute to the pressures on the system, as do extensive and prolonged fires. Particular pressures can already be seen on the riparian vegetation as well as over-use and degradation of the floodplains. As the population grows and more land is used for agriculture and livestock so the conflicts between humans and wildlife will grow.

Invasive species are potentially one of the most damaging threats to the Cubango-Okavango and the countries need to be ever vigilant and ready to respond as quickly as possible in a coordinated manner.

GOVERNANCE

The analysis of the policy and legal landscape in the three basin countries shows a relatively strong framework of natural-resource management policies and legislation in the basin states. All countries have replaced (or are in the process of doing so) old water legislation with IWRM-based water legislation that emphasizes the need for integrated management and provides the legal mechanism for implementing integrated management in practice. Of particular relevance is the provision in law for the establishment of local-level basin management committees, the composition of which legally requires inter-sectoral representation.

Participants at 17th OKACOM Meeting, Namibia

The most significant constraints for the effective sustainable management of the basin lie in the institutional framework. These constraints are largely of a structural nature, namely the fragmentation of management responsibilities across different line-function ministries, the lack of inter-sectoral planning, underdeveloped coordination between different spheres of government, weak institutional structures at the local level, a lack of skills, management capacity and resources for integrated planning and effective monitoring, implementation and enforcement.

It is clear that OKACOM has a central role to play in the management of the basin, especially as there are established basin-wide cooperation mechanisms in other natural-resource management fields, such as land-use or biodiversity. Some regional initiatives such as the Kavango-Zambezi Transfrontier Conservation Area (KAZA TFCA) initiative are active in some parts of the basin but do not have OKACOM's basin-specific mandate. Without pre-empting any decisions taken by member states on the exact role of OKACOM in the management of the basin it is foreseeable that its role and scope of activities will significantly grow, particularly once a more detailed basin management plan is developed and implemented. This requires the further strengthening of its capacity, particularly at an operational management level. Closer direct linkages are also desirable between OKACOM and the broad range of stakeholders in the basin and it is assumed that the stakeholder-participation strategy currently under development will adequately address this matter. The institutional linkages between local basin management committees and OKACOM could also be incorporated as an integral part of the stakeholder participation strategy.

From a planning perspective, the most critical issue is that the countries need to set out a vision for the basin with objectives for the major directions and describing the 'acceptable development' space. As part of the vision setting exercise a decision framework with thresholds and trigger points should be developed to guide the decision making process and for

which a decision support system (DSS) should be developed.

SAP STRUCTURE AND INTEGRATED MANAGEMENT OBJECTIVES

In response to the challenges described above the Okavango basin states have agreed on a set of six Integrated Management Objectives that guide the implementation of the SAP, namely:

IMO 1: The sustainable management of the Cubango-Okavango basin is based on a shared basin-wide vision and jointly agreed decision framework.

IMO 2: Decisions are based on solid scientific analysis of available data and information and improved basin knowledge through research programmes designed to answer management questions.

Community meeting in the upper catchment, Angola

IMO 3: Focused environmental and socio-economic monitoring programmes to support management decisions and track long-term trends are established and strengthened, and the results are used in adaptive management strategies.

IMO 4: Integrated planning criteria and objectives for sustainable development of water resources of the Cubango-Okavango basin are agreed and established.

IMO 5: The livelihoods of the basin's peoples are improved.

IMO 6: Technical capacity in the basin and involvement of stakeholders in SAP and NAP implementation is improved.

Guided by the IMOs the SAP will establish a long-term planning framework, titled the Basin Development and Management Framework (BDMF), which will include the development of a long-term vision and agreement on the accepted development space for the Cubango-Okavango basin. The BDMF will provide flexible management approaches informed by scientific and economic analysis and will respond to changing socio-economic and environmental conditions in the basin over time. The BDMF is complemented by four Thematic Areas that have been identified through the national and basin-wide consultation processes.

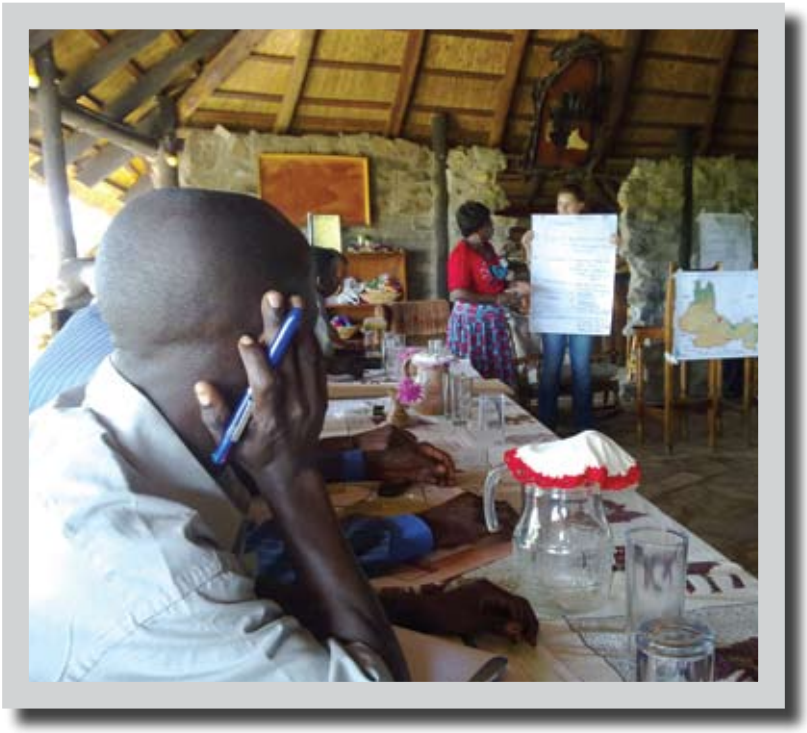
BASIN DEVELOPMENT AND MANAGEMENT FRAMEWORK
Thematic Area 1: Livelihoods and Socio-economic Development
Thematic Area 2: Water Resources Management
Thematic Area 3: Land Management
Thematic Area 4: Environment and Biodiversity

While the BDMF primarily addresses the governance challenges identified in the TDA, the proposed interventions in the four thematic areas respond to the challenges posed by the driving factors and priority areas identified by the TDA. The SAP structure and its envisaged outcomes and interventions are thus a direct management response to the key problems identified by the TDA and supported by the extensive consultation processes that were undertaken.

SAP IMPLEMENTATION

Once adopted and endorsed by OKACOM member States the implementation of the SAP will become the responsibility of OKACOM and the governments of the riparian States. At national level the SAP initiatives are to be integrated within the respective National Action Plan (NAP) of each basin state, making the NAP a critical tool for the implementation of SAP priority actions at national level and the integration of transboundary and basin concerns into national legislative, policy and budget decision making processes.

At the national level the institutional mechanisms for the coordination of NAP and SAP implementation have been identified during the NAP development process and are clearly spelled out in the respective NAPs. At the basin level SAP implementation will be coordinated by OKACOM through its organs, primarily OBSC assisted by the Secretariat. Based on the annual work plans of the Commission, the OBSC will also be responsible for coordination of the International Partner projects and work to attract further SAP implementation support from the both public and private sectors at the regional and national levels.



Basin Wide Forum members at RCCP workshop, Rundu, Namibia

1.1 PURPOSE AND OBJECTIVE OF THE SAP

The Strategic Action Programme (SAP) is a basin-wide policy framework document that lays down the principles for the development of the basin and improvements of the livelihoods of its people through the cooperative management of the basin and its shared natural resources. The overarching objective of the SAP is:

> To promote and strengthen the integrated, sustainable management, use and development of the Cubango-Okavango river basin at national and transboundary levels according to internationally recognised best practices in order to protect biodiversity, improve the livelihoods of basin communities, and the development of basin states.

This objective balances the shared commitments of the basin states for environmental sustainability, alleviation of poverty and improvement of the welfare and living conditions of the population through increased economic growth, using the mechanism of IWRM. It recognizes that increasing future water demands will need to be met but that the ecosystem integrity of the Cubango-Okavango must be maintained and the value of the ecosystem services it provides ensured.

Consultation with villagers by SAREP, Manyana, Namibia

The SAP is designed for voluntary adherence by the Cubango-Okavango basin states and its contents are supported by and in accordance with their national development plans and National Action Plans (NAPs) for their part of the basin, with appropriate support from International Cooperation Partners. Such voluntary adherence will promote cooperative and coherent action for the sustainable development of the basin, thereby safeguarding the environment of the Cubango-Okavango basin, and advance the sustainable and equitable use of its water resources.

Implementation of the SAP is the responsibility of the basin states independently as component of their NAPs, and collectively as part of OKACOM. The Permanent Okavango River Basin Water Commission (OKACOM), through its organs, is the primary body for overseeing the implementation of the SAP and coordinating the activities under the different SAP thematic areas as well as maintaining adequate linkages with relevant organizations at the national level. The pivotal role of the Okavango Basin Steering Committee (OBSC) and the OKACOM Secretariat in SAP coordination is recognized and these OKACOM organs will require considerable capacity strengthening, something which has been addressed in the SAP itself.

The SAP has been developed over three years (2008-2010) through a consultative process with a wide range of stakeholders from government departments, academic and scientific institutions, civil society, the private sector and community representatives. A series of national consultation workshops was held in each country, complemented by basin-wide consultation meetings under the umbrella of the Okavango Basin Steering Committee (OBSC).

The SAP is a mid-term planning document which is designed to be reviewed and recast every 5 years alongside the TDA and the NAPs. A critical component of the SAP is the development of a longer term over-arching vision for the Cubango-Okavango basin (which has not yet been agreed) that is a clear representation of the characteristics desired for the future environment linked to an agreed ' Development Space' for the basin. The long term vision is a political objective to be achieved within a twenty year time-frame and is designed to inspire the peoples of the Cubango-Okavango and their leaders.

1.2 THE CUBANGO-OKAVANGO BASIN AND ITS INSTITUTIONS

The Cubango-Okavango basin remains one of the watersheds least affected by human impacts on the African continent. In its present near-pristine status, the river provides significant ecosystem benefits and will continue to do so if managed appropriately. However, mounting socio-economic pressures on the basin in the riparian countries, Angola, Botswana and Namibia, could change its present character. Maintaining the river's benefits requires agreement over the sharing of both the benefits and associated liabilities through joint management of the basin's natural resources.

The river rises in the headwaters of the Cuito and Cubango Rivers in the highland plateau of Angola, where it derives its principal flow from the sub-humid and semi-arid rangeland in the Kuando-Kubango Province. It then flows as the boundary between Namibia and Angola and finally into the Okavango fan or Delta in Botswana. Geological features at the margins of the fan direct the Delta outflow into a series of non-perennial rivers, lakes and pans in the Kalahari Desert.

The water quality of the Cubango-Okavango river system is believed to be good; the waters are relatively clear with few dissolved chemicals, solutes or pollutants. The riparian landscapes along a fair proportion of the waterways are largely unchanged with natural plant and aquatic life. The river supports people, their livestock and a myriad of livelihoods ranging from artisanal fisheries to small scale agriculture, as well as diverse wildlife. The Okavango Delta, a unique ecosystem, is a significant source of tourism income and cultural value to its people.

The low level of economic development associated with the Cubango-Okavango is a by-product of history and geopolitics. The Cubango-Okavango river basin supports predominantly rural communities most of which are located either adjacent to the river or along roads. In each country, the basin populations are remote from the countries' capital cities and main centres of economic activity; this is reflected in the social development indicators in the basin, which are lower than the national figures. In general, the people of the basin are poorer, less healthy, and less well educated than other groups in their respective countries. This is particularly the case in Angola where the war curtailed social and economic development. The national social and economic development policies, including achievement of the Millennium Goals, target these communities, thereby putting added pressure on the water resources of the basin and the ecosystem services provided by the river system. These services are important not only for the myriad of livelihoods they support in riparian communities, ranging from artisanal fisheries to small-scale agriculture, but also because of the major eco-tourism industry in the Okavango Delta.

Aerial view of papyrus and reedbeds on Okavango Panhandle

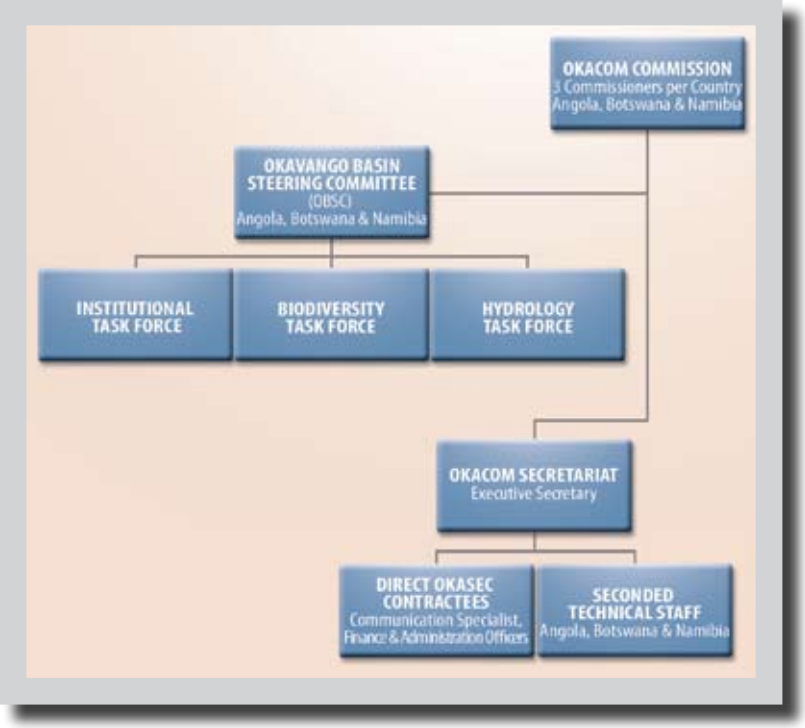
The current situation offers the riparian countries of the Cubango-Okavango a unique opportunity to choose a carefully planned and negotiated development pathway for the basin that will enhance the lives of people as well as protecting the river system. By doing so, the countries could become international leaders in transforming the notion of sustainable development into practical transboundary water management solutions.

Established in 1994 by the *Agreement between the Governments of the Republic of Angola, the Republic of Botswana and the Republic of Namibia on the Establishment of a Permanent Okavango River Basin Water Commission (OKACOM),* the Commission consists of representatives of the state parties and serves as technical advisor to the Parties on matters relating to the conservation, development and utilization of water resources of common interest. The OKACOM Agreement determines the issues for which OKACOM is mandated to advise the Parties on:

- Measures and arrangements to determine the long-term safe yield of the water available from all potential water resources in the Okavango river basin;
- Reasonable demand for water from the consumers in the Okavango river basin;
- Criteria to be adopted in the conservation, equitable allocation and sustainable utilization of water resources in the Okavango river basin;
- Investigations, separately or jointly by the Contracting Parties, related to the development of any water resources in the Okavango river basin , including the construction, operation and maintenance of any water works in connection therewith;
- Prevention of the pollution of water resources and the control over aquatic weeds in the Okavango river basin;
- Measures that can be implemented by any one or all the Contracting Parties to alleviate short term difficulties resulting from water shortages in the Okavango river basin during periods of drought, taking into consideration the availability of stored water and the water requirement within the territories of the respective Parties at that time;
- Such other matters as may be determined by the Commission.

In April 2007 the Parties concluded the *Agreement between the Governments of the Republic of Angola, the Republic of Botswana and the Republic of Namibia on the Organizational Structure of OKACOM* (hereafter OKACOM Structures Agreement) which establishes the organs of OKACOM as

- The Commission,
- The Okavango Basin Steering Committee (OBSC); and
- The Secretariat,
- (Provision for establishment of further permanent or temporary committees is made in Art. 4(2), on which basis specific task forces have been established.



OKACOM organizational structure diagram

The Commission is the principal organ responsible for defining and guiding policy and for the general supervision of the activities of OKACOM. The OBSC is the technical advisory body to the Commission whereas the Secretariat is responsible for providing administrative, financial and general secretarial services to OKACOM. In particular the OKACOM Secretariat has the mandate to ensure that:

1. OKACOM decisions are well informed, based on a well-prepared analysis of the alternatives and relative costs and benefits; and once taken, are implemented in a timely and effective manner.
2. All relevant actors are aware of the sources of information about the basin and that these sources of information match the present and future needs for information.
3. All relevant actors are aware of, respect and understand the operations of the other actors in the basin, thus minimizing communicational barriers to cooperation.

Thus, at present the Secretariat fulfils an administration, communication and information management role. This role of the Secretariat could potentially be expanded in the future to a broader monitoring, coordination and possibly even project management and execution role.

The OKACOM Structures Agreement defines the functions of the three organs in significant detail, together with regulating other procedural matters relevant for the functioning of OKACOM such as financing, working language and communication. Article 7(n) permits the Commission to establish ad hoc working groups or specific temporary or permanent committees. This has been made use of by the Commission and at present three Task Forces have been established, namely a Biodiversity Task Force, a Hydrology Task Force and an Institutional Task Force. The OKACOM Agreement, the Southern African Development

Community (SADC) Revised Protocol on Shared Watercourses and the 1997 UN Convention on the Law of the Non-navigational Uses of International Watercourses provide a framework for cooperation between the three basin states. The Revised SADC Protocol encourages Member States to conclude basin-specific management agreements tailored to the characteristics and uses of a particular watercourse, while adhering to the principles of the Revised SADC Protocol.

The OKACOM Agreement commits the three member states to promote coordinated and environmentally sustainable regional water resources development, while addressing the legitimate social and economic needs of each of the riparian states. Under the OKACOM Agreement, the riparian countries must work towards the implementation of an Integrated Management Plan (IMP) for the basin on the basis of an Environmental Assessment (EA); this requirement has been addressed through the development of a Transboundary Diagnostic Analysis (TDA) and the current Strategic Action Programme (SAP).

In addition to their commitments under the OKACOM Agreement the three states are committed to meeting the UN Millennium Development Goals and pursuing and implementing the concept of Integrated Water Resources Management. These commitments include the preparation of national Integrated Water Resources Management Plans.

1.3 THE GEOGRAPHIC SCOPE OF THE SAP

The geographical scope of the SAP is the whole Cubango-Okavango basin.

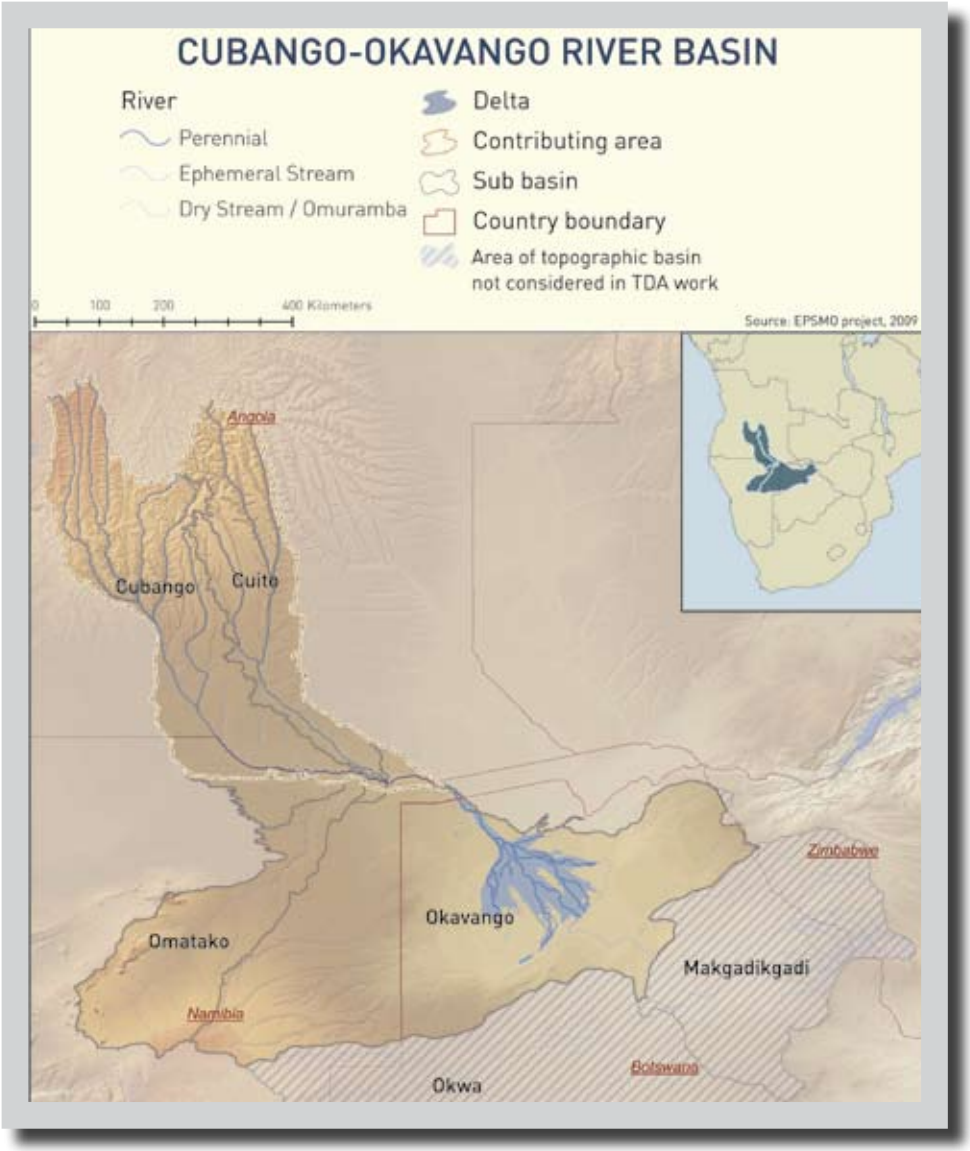


Figure 1: Map of the Cubango-Okavango river basin

1.4 THE EPSMO PROJECT AND THE OKAVANGO TDA

Funded by the Global Environment Facility (GEF) and co-funded by the three basin countries, the Environmental Protection and Sustainable Management of the Cubango-Okavango river basin project (EPSMO) was designed to help OKACOM fulfill its mandate.

The long-term objective of the EPSMO Project was to achieve global environmental benefits through concerted management of the naturally integrated land and water resources of the Cubango-Okavango river system. The specific objectives of the project were to:

- Enhance the depth, accuracy and accessibility of the existing knowledge base of basin characteristics and conditions, and identify the principal threats to the transboundary water resources of the Cubango-Okavango River Basin through a Transboundary Diagnostic Analysis (TDA).
- Develop and implement, through a structured process, a sustainable and cost-effective programme of policy, legal and institutional reforms and investments to mitigate the identified threats to the basin's linked land and water systems through the Strategic Action Programme (SAP).
- Assist the three riparian states in their efforts to improve their capacity to collectively manage the basin.

The TDA identified four emerging Areas of Concern in the basin as well as for underlying Driving Factors (see more detailed description in Section 2):

AREAS OF CONCERN	DRIVING FACTORS
• Variation and reduction of hydrological flow • Changes in sediment dynamics • Changes in water quality • Changes in the abundance and distribution of biota	• Population dynamics • Land use change • Poverty • Climate change

One of the principal challenges of the basin states will be to establish a management framework to address these Areas of Concern and their underlying Driving Factors as they emerge or aggravate over the next ten to twenty years and ensure that development of the Cubango-Okavango's natural resources is undertaken in a sustainable manner.

1.5 PRINCIPLES OF ENVIRONMENTAL MANAGEMENT AND COOPERATION

The three riparian states share a common desire to enhance the livelihoods and ensure the wellbeing of the people in their countries as a whole, and particularly in the basin, through the sustainable management of the natural resources and biodiversity of the basin for the benefit of present and future generations. The riparian states recognize their roles and responsibilities for the well-being of their people and for conserving the global value of the Okavango River system's biodiversity resources. They have considered and taken into account, where appropriate, the following principles and values when developing this document.

1.5.1 The **well-being of the people** in the basin and in the basin states as a whole – in economic, health, social and cultural terms – and the improvements of their livelihoods is a primary objective, with the achievements of the UN Millennium Development Goals being an immediate priority.

1.5.2 Development and management of the basin through national as well as joint action shall take place in a spirit of **basin-wide cooperation,** within the frameworks set by existing national legislative and policy frameworks and guided by the still-to-be-developed Basin vision.

1.5.3 The principle of **sustainable development** shall be applied in accordance with the UN Millennium Development Goals, such that there is a prudent and rational utilization of living resources together with preservation of the rights of future generations to a viable environment.

1.5.4 **Integrated water resources management** and the underlying Dublin Principles shall be adopted. IWRM is a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

1.5.5 The **precautionary principle** shall be applied, such that measures shall be taken when there are reasonable grounds for concern that any activity may increase the potential harm to the river ecosystem or amenities, or interfere with other legitimate uses of the Cubango-Okavango basin.

1.5.6 The **polluter-pays principle** shall be applied, such that the cost of preventing and eliminating pollution, including clean-up costs, shall be paid by the polluter.

1.5.6 The **principle of anticipatory action** shall be applied, such that contingency planning, environmental impact assessment and strategic impact assessment (involving the assessment of the environmental and social consequences of governmental policies, programmes and plans) shall be undertaken in future development in the region.

1.5.7 The **principle of preventative action** shall be applied, such that timely action shall be taken to alert the responsible and relevant authorities of likely impacts and to address the actual or potential causes of adverse impacts on the environment, before they occur. Many adverse impacts are irreversible or, if they can be reversed, the cost of remedial action is higher than the costs associated with prevention.

1.5.8 The principle of **accessibility of information** shall be applied, such that information on the use and pollution of the water resources and ecosystems of the Cubango-Okavango basin held by a riparian state shall be provided by that state to all riparian states, where relevant and in the maximum possible amount.

1.5.9 The principle of **public participation and transparency** shall be applied, such that all stakeholders, including communities, individuals and concerned organizations shall be given the opportunity to participate, at the appropriate level, in decision-making and management processes that affect the Cubango-Okavango basin. This includes providing access to information concerning the environment and development plans that is held by public authorities, and effective access to judicial and administrative proceedings to enable all stakeholders to exercise their rights effectively.

Woman carrying water, Maun, Botswana

1.6 IWRM AND GOOD GOVERNANCE

The above principles are applied within the concept of Integrated Water Resources Management (IWRM). The three basin countries are committed to managing the basin on the basis of this concept and it is at the heart of the SAP. IWRM is a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (GWP 2000).

Emerging from the 1992 Dublin Principles, IWRM is the term given to what is now considered best practice in water management.

THE 'DUBLIN PRINCIPLES'	
Principle No. 1 -	Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment
Principle No. 2 -	Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels
Principle No. 3 -	Women play a central part in the provision, management and safeguarding of water
Principle No. 4 -	Water has an economic value in all its competing uses and should be recognized as an economic good

IWRM is not intended as a strict set of rules that would apply around the world, but rather a flexible approach based on the above principles which can be adapted to the needs of an individual country of basin.

Water governance is a broader concept than IWRM and is defined by Global Water Partnership (GWP) and later modified by the UN as being said to be:

> 'made up of a range of political, social, economic and administrative systems that are in place, which directly or indirectly affect the use, development and management of water resources and the delivery of water services at different levels of society. Governance systems determine who gets what water, when and how and decide who has the right to water and related services and benefits.' (UNESCO, 2006).

In this context of good water governance four dimensions may be identified in terms of usage:

- Equitable (social)
- Sustainable (environmental)
- Efficient (economic)
- Democratic (political)

From this definition of good governance one can see the natural progression to the three E's (economic efficiency, social equity and ecosystem sustainability) under-pinning IWRM. A major objective of the SAP will be to strengthen the governance framework and contribute to developing a governance system for the basin that ensures a balanced transboundary development programme.

The components of a governance system are described in the generic policy cycle below and can be divided into three distinct processes:

- an analytical process (data and information, and analysis and advice) which determines the availability of water to users;
- a political process (decision making) which determines the 'rights' and needs of the various users at different levels (local, national regional and international);
- and a regulation process (implementation and review), ensuring delivery of agreed resources.

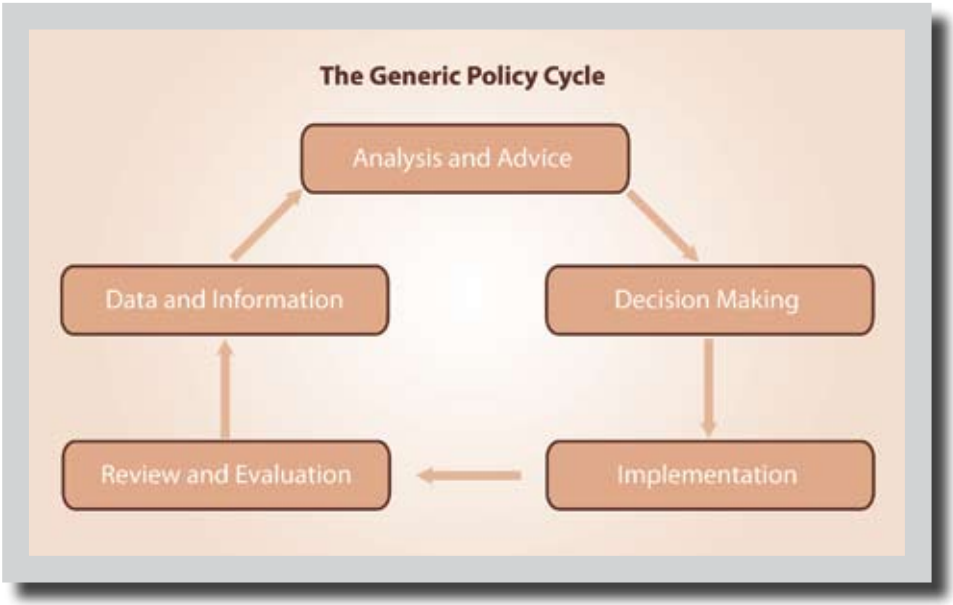


Figure 2: Generic policy cycle

1.7 MILLENNIUM DEVELOPMENT GOALS

The Millennium Development Goals (MDGs) agreed at the Millennium Summit in New York in the year 2000 are the most broadly supported, comprehensive and specific development goals ever agreed globally. There are eight time-bound goals that provide concrete, numerical benchmarks for tackling extreme poverty in its many dimensions. They include goals and targets on income, poverty, hunger, maternal and child mortality, disease, inadequate shelter, gender inequality, environmental degradation and the Global Partnership for Development.

Set to be achieved by 2015, the MDGs are both global and local, tailored by each country to suit specific development needs. The initiatives contained in the SAP have the potential to contribute to seven of the eight MDGs, namely: MDG 1 – Eradicate Extreme Poverty & Hunger, MDG 3 – Promote Gender Equality and Empower Women, MDG 4 – Reduce Child Mortality, MDG 5 Improve Maternal Health, MDG 6 – Combat HIV/AIDS, Malaria and Other Diseases, MDG 7 - Ensure Sustainable Environment and MDG 8 – Global Partnership for Development.

MDG 1:	ERADICATE EXTREME POVERTY & HUNGER
MDG 2:	ACHIEVING UNIVERSAL PRIMARY EDUCATION
MDG 3:	PROMOTE GENDER EQUALITY AND EMPOWER WOMEN
MDG 4:	REDUCE CHILD MORTALITY
MDG 5:	IMPROVE MATERNAL HEALTH
MDG 6:	COMBAT HIV/AIDS, MALARIA AND OTHER DISEASES
MDG 7:	ENSURE ENVIRONMENTAL SUSTAINABILITY
MDG 8:	DEVELOP A GLOBAL PARTNERSHIP FOR DEVELOPMENT

Overview of MDGs

The MDGs provide guidance for the integration of the SAP into the planning process of the basin states and for development of a framework to aid the international community's support efforts. Through its Thematic Area 1: Livelihoods (and particularly the outcome related to improving water and sanitation) the SAP contributes to achieving MDGs 1, 3, 4, 5 and 6. MDG 7 is addressed through Thematic Areas 2: Water Resources Management, Thematic Area 3: Land Management, and Thematic Area 4: Environment and Biodiversity.

Through the Basin Development and Management Framework (BDMF) the SAP provides the overall planning and coordination mechanism in which the activities under the Thematic Areas take place. Likewise, the establishment of a mechanism for the coordination of ICP support activities under the BDMF contributes to achieving MDG 8. (See further detail on the BDMF and Thematic Areas in Section 3 below).

OVERVIEW OF SAP AREAS AND MDGS THEY CONTRIBUTE TO ACHIEVING

SAP THEMATIC AREAS	MDG
Basin Development and Management Framework	MDG 8
Thematic Area 1: Livelihoods	MDG 1, MDG 3, MDG 4, MDG 5, MDG 6
Thematic Area 2: Water Resources Management	MDG 7
Thematic Area 3: Land Management	MDG 7
Thematic Area 4: Environment and Biodiversity	MDG 7

2.1 DRIVING FACTORS

At present the Cubango-Okavango basin, including its river ecosystem, is in exceptionally good condition, which, for a large international river is very unusual. However current trends in the basin are much the same as those facing most developing regions: growing population numbers and the need for food security, social upliftment, reliable supplies of good quality water, provision of sanitation and increasing energy generation to support social and industrial growth. However, the impact of the benefits enjoyed from water-resource developments are increasingly becoming apparent and are well documented globally and in the form of environmental degradation and the loss of river resources. The Cubango-Okavango basin countries are dependent in several different ways on a healthy river ecosystem: for food, for drinking and washing, flood attenuation, flood storage and reliable dry-season supplies, and for tourism. These tangible and intangible (e.g. spiritual value) attributes of the river, most with a considerable inherent monetary worth, are vulnerable and will decline with water-resource development.

The potential increase in water demand over the next 10-20 years is considerable and therefore so is the vulnerability of the river and its dependent social structures. Demand for water is forecast to rise to meet the needs of a growing basin population, increased irrigation development, hydro-power development and inter-basin transfers. The level of increased sustainable demand that could be made on the Cubango-Okavango river system, its tributaries and the Delta, is as yet unknown but initial studies show that the impact of any development proposal needs to be carefully considered and evaluated for the entire basin. The volume of water involved would need to be considered, as well as the effects on the flow, sediment, chemical and thermal regimes, the riverine biota and the people who use the river.

Channels in the Delta, Botswana

The extensive work carried out by OKACOM in formulation of the TDA has led to the identification of the above-mentioned (Section 1.4) four key factors that drive change in the basin, namely population dynamics, poverty, climate change and land use changes.

2.1.1 Population dynamics

The population of the Cubango-Okavango river basin in all three countries is increasing steadily and this, with the concurrent increase in demand for goods and services is a key driver of change in the basin. Even if the basin populations did not increase as predicted, the demand for goods and services would increase as a result of higher standard of living among all inhabitants of the basin.

Throughout the basin, there is a trend towards increasing urbanisation associated with population growth and a lack of alternative livelihood options. Although the population in the basin is predominantly rural, Angola has an urban population of about 40%, while in Namibia the figure is approximately 20% and in Botswana around 30%. The centres of Menongue and Cuito Cuanavale in Angola, Rundu in Namibia and Maun and, to a lesser extent, Gumare and Shakawe in Botswana, are all growing in size. In particular, Rundu is growing at a rate of 2.5% per annum compared to 1.5% in the rural areas of Kavango. Increased urbanization leads to increased demand for services such as water supply and sanitation, which, if not regulated, for example could lead to increase water pollution and over abstraction of water from the river.

2.1.2 Land use change

Land use change is a driving force for changes in sediment dynamics, water quality and abundance and distribution of biota and through de-forestation has impacts on the hydrological regime. Linked strongly to population growth its impact is incremental and often very difficult to reverse. Despite the relatively low population densities in the Cubango-Okavango river basin the changes in land use and vegetation cover has been marked. There is increased demand for land for crops along the length of the river from the Angolan highlands to the Panhandle and with an increasing population this trend will only accelerate. The impact of land use change may be more significant than direct increased water use and its control a more difficult challenge. A first step is to assess the problem and to recognise the barriers to reform, including national legislation and its implementation at the local level. Ideally there should be a set of land use guidelines which the local authorities can follow and implement throughout the basin aimed at preserving the ecosystem health and environmental services. The implementation of these guidelines will require extensive public education campaigns beginning with the basin communities and through to the local institutions.

2.1.3 Poverty

Poverty is a feature of the human populations in all three basin countries as described in Chapter 3, with the incidence of poverty in the Cubango-Okavango river basin being much higher than in other parts of each of the countries as a whole. This is partially due to the remoteness of the basin, but also to the highly unequal distribution of wealth in the three countries. It is clear that poverty alleviation in the basin should be a major investment target for governments and the ambitious water use development plans inherent in the future development scenarios suggest that this is the case, particularly in Angola and Namibia. As discussed in Chapter 5 all three countries have national poverty reduction strategies aimed at improving the welfare and living conditions of their populations through increased economic growth.

Children in Menongue market, Angola

The importance of the contribution that natural resources make to the livelihoods of the people that live in the Cubango-Okavango river basin has been stressed in the TDA. Most of the people living in the basin live in the rural areas, and are all the more dependent upon the natural resources for food, fibre and fuel. As the population increases, so the pressure upon these natural resources will increase. Assuming that the current patterns of use of natural resources remain the same, the pressure on natural resources will increase by nearly 50% in Angola and by about 25% in Namibia and Botswana. This will inevitably lead to further degradation and loss of critical habitats such as the floodplains and riparian woodland, as trees are cut for timber and firewood, reedbeds converted to grazing or agricultural land, and reeds and grasses cut for household use, baskets and matting. To some extent such natural resources are sustainable, re-growing each year, but if they are over-harvested the vegetation may be depleted or lost completely, so that the wider habitat is changed. There is evidence in some parts of the Namibian section that, for example, riparian vegetation has been so changed that it no longer provides the natural resources it used to. It is essential therefore for the river to remain in a good condition, since its natural resources are often important 'safety nets' for poor communities in adverse times.

It should be noted that while water use developments are aimed at increasing the amount of income coming from the river system, particularly in the upper basin, this may not necessarily reduce poverty. As determined by the economic analyses carried out for the TDA, poverty within the basin is worse than that in the broader societies of basin countries. Where developments form part of the formal sector, and particularly where most of the economic linkages fall outside the basin, the benefits will be skewed towards high income segments of society. In the basin the poorest elements of resident

societies have tended to rely on direct use of natural resources, as discussed above, and tended to depend on the fact that access to these resources provides them with a safety net in times of adversity. The expected losses in livelihoods for these communities, resulting from water use developments, could significantly increase their vulnerability.

2.1.4 Climate Change

The Okavango River basin is subject to long-term hydrological variability and climate change impacts. Desegregating these two effects and interpreting how they impact upon the available water resources and consequently on water resource management is extremely complex and the current understanding is limited.

Floodwaters at Maun, Botswana

There is long-term variability in the flow of the Okavango River driven by variable rainfall and a clear relationship between the long-term rainfall in the Cubango-Okavango river basin and a long-term variability in sea surface temperatures known as the Pacific Decadal Oscillation (PDO). Recent research suggests that the PDO is preserved under conditions of green-house gas-driven climate change. The alternative to this hypothesis is randomness. The reality is probably a combination of both - the effect of PDO modified by unpredictable randomness. Because the PDO is considered to result from natural processes, a better understanding of these can lead to projections of the long-term variability of rainfall and thus of river runoff.

An analysis of projected climate-change effects predicts a rise in temperature and rainfall in the basin. Higher temperatures (2.3°C-3°C) will affect the south of the basin more strongly than the north, increasing evaporation. There is a projected increase in rainfall of 0-20% across the basin, with the greatest effect in the north because of the north-south rainfall gradient. In general, the projected increase in rainfall will more than compensate for higher evaporation rates. This could result in an increase in runoff (total and monthly) with proportionately stronger peak flows.

Three climate-change scenarios are considered possible for the Okavango Delta –'dry', 'moderate' and 'wetter' than present day. In the Okavango Delta, in the 'dry' scenario, the increase in evaporation and transpiration may exceed the increase in local rainfall and inflow from the catchment, resulting in drier conditions. This would result in a decrease in frequency and duration of flooding throughout the Delta, a reduction of low flows in the rivers draining the system and shrinking of swamp areas or terrestrialisation around the edges of the Delta. However, if the rainfall increases substantially (in the 'wetter' scenario) there will be an increase in duration and frequency of inundation throughout the Delta, and an increase of high and low flows in the rivers draining the system. Under the 'moderate' and 'wetter' scenarios, expansion of the permanently inundated areas and areas subject to long inundation could be observed, which could have implications for urban and agricultural areas and tourist facilities. There would also be a relative reduction in areas subject to short inundation.

2.2 PRIORITY AREAS OF CONCERN

The impacts of the above described key drivers are primarily seen in four priority areas of concerns as identified by the TDA, namely:

- Variation and reduction of hydrological flow
- Changes in sediment dynamics
- Changes in water quality
- Changes in the abundance and distribution of biota

These are emerging transboundary problems and issues that are as yet not significantly realised. Their scale will be determined by the countries' decisions on water resource and other developments, and thus are as yet not quantified. To help determine the possible nature and scale of the impacts OKACOM undertook as part of the TDA an Integrated Flow Assessment (IFA) using a suite of hydrological and other models and drawing upon a comprehensive series of specially prepared expert reports. The IFA investigated High, Medium and Low Scenarios for water use over a planning horizon of twenty or more years and compared them to present day levels. From these studies OKACOM will be able to establish an early estimate of the scale of water resource development that would be possible without compromising the sustainability of vital ecosystems of the basin. The potential for development in the context of the Cubango-Okavango basin will be termed the ' accepted development space'. The challenge is to further define and refine the extent of, and agree on the accepted development space for the future. The agreed development space needs to be translated into a management framework that will ensure that development of the Cubango-Okavango's natural resources is undertaken in a sustainable manner in accordance with the agreed vision for the basin. A brief description of each issue is given below.

2.2.1 Variation and reduction of hydrological flow

The flow regime of the river can be affected in two ways:

- the average quantity of the flow or the Mean Annual Runoff (MAR) can be changed through water abstractions and changes in land-cover and
- abstractions, impoundments and land-cover changes can affect the timing or the seasonality of the flow regime such as the onset, peak, volume and duration of the dry season or flood events.

Aerial view of islands at Popa Falls, Namibia

The Okavango River is a 'losing' system in that by far most of its water comes from the upper catchment, the headwaters of the Cubango and Cuito, and then water is lost through evapo-transpiration and groundwater recharge with small quantities of water flowing out of the Delta. The available water for people may be adequate during most years, but during drier years the non-perennial parts of the system tend to dry out, with implications also for groundwater, and even the perennial parts may have extremely shallow flows, causing problems for drinking water, irrigation, navigation, water quality and the biota. The fact that nearly all the water in the basin is generated upstream of the confluences of the Cubango and Cuartir Rivers in the west, and the Cuito and Longa Rivers in the east has great significance. Downstream of these points, the catchments of the lower Cubango and Cuito River contribute very little additional runoff. There is thus no chance of the lower part of the system ameliorating upstream abstractions through the inflow of tributaries, making the lower part of the system potentially vulnerable to water resource developments in the upper and middle sections.

The floodplains of the Cuito are one of its characteristic features and are threatened by reduction in river flows. They extend from quite high up in the Cuito sub-basin all the way down to the confluence with the Cubango River. There are smaller floodplain areas on the Cubango and on the shared Angola/Namibia section of the river. The floodplains are critical for maintaining the flows in the river throughout the year; they act as storage areas of floodwater delaying release of waters back into the main channel. If the floodplains shrink, the hydrograph of the river will become more subject to flash floods, like the Cubango, with less water available during the dry season. The floodplains are also reservoirs of natural resources. There are extensive productive areas of reeds and grasses in the floodplains, and it is the seasonal variation between flood and dry seasons that contributes to the productivity of the floodplains. The diversity of habitats, reedbeds, backswamps, meanders and oxbow lakes are used by a wide range of species for breeding and nursery grounds for fish, moving between the main channel and seasonally flooded areas to take advantage of the rich and secure conditions to be found there.

As with fish, so birds and other wildlife also move in to the floodplains to take advantage of food and good breeding conditions. People and local communities use the floodplains extensively, for the collection of reeds and grasses, for fishing and for grazing their livestock. In some places, floodplain cultivation for crops is also practiced, taking advantage of the rich soils and good supply of water. The key ecosystem services that will be affected by these changes are in provisioning

- food, such as fish, vegetable and fruit products and medicinal plants from the river and its floodplains,
- fodder for livestock may be affected by shrinking floodplain areas
- fibre from reeds and grasses for thatching and basket making, and
- fuel from the woody plants.

Without the floodplains, the overall productivity and diversity of the river would be significantly lower.

The additional water abstracted from the river to meet the demands from the various planned developments if executed in full over the next 15 years (as described in the high water use scenario of the Integrated Flow Assessment carried out for the TDA) would be 3,768Mm^3/a, of which 3.715Mm^3/a would be for new irrigation development. This figure compares with a mean average flow of the lower river of 9,600Mm^3/a and a 1 in 20 year drought flow of 3,120Mm^3/a. High level abstractions cannot therefore be supported without development of substantial upstream storage.

Growth in demand over the next 15 years of 3768 Mm^3/a would be dominated by an increase in irrigation demand. In comparison, the rise in domestic demand (urban and rural) of 6 Mm^3/a over the same period would be insignificant and its impact on the river if abstraction and waste water disposal was handled carefully, would be negligible. On the other hand, the provision of safe drinking water for both urban and rural populations would be one of the most important economic developments that could be advanced quickly and would have a significant positive impact on the quality of life for people along the river.

The estimated impacts of changes in the flow regime need to be adequately considered in basin-planning and decision-making on development options for the basin. In order to enable decision-makers to make informed decisions that optimise the sustainable use of the river's water resources and adequately balance developmental needs with flow regime considerations, the following major responses to variation and reduction in river flows have been identified by the TDA:

- Review of meteorological and hydrological monitoring programmes and recommendations for their strengthening
- Development of strategic, phased investment programme for the improvement of meteorological and hydrological networks, including institutional components

There is a clear need to strengthen the meteorological and hydrological monitoring programmes in the basin. There are few hydrological stations operable in the upper basin and this lack of baseline data is a weakness in hydrological modeling studies that have been undertaken. The data will be valuable for both operational and planning purposes. The investment could be phased over a long period with key locations at transboundary points and downstream of major abstractions being given priority. This investment could be part of a wider national strengthening of the monitoring system and should include technical capacity building at the basin and national level.

- Design and implementation of a groundwater monitoring programme for the major aquifers and at key locations
- Quantification of the groundwater resources of the basin

A basin groundwater monitoring programme should be developed to provide improved operational and planning knowledge, including information on water quality. The inter-connectivity of the groundwater and surface water systems should be evaluated and the contribution of groundwater from periphery areas of the basin should be assessed. At the moment the information on the groundwater contribution to the available and potential water resources is weak. The problem of saline aquifers and their interfaces with non-saline groundwater as well as the understanding of recharge mechanisms in the basin has still to be investigated thoroughly. The groundwater resources of the basin and their recharge are not quantified and their interaction with surface water so far remains unclear. Qualitative and quantitative research will be carried out to determine the hydrogeological characteristics of the basin, how these affect river flows and to quantify the usable groundwater resources potential. Saline aquifers need to be localized and their extension verified.

- Review of water resource demands.

A detailed listing of current abstractions (both licensed and actual amounts) should be assembled and compound demand forecasts to beyond 2035 should be prepared. The forecasts should look in detail at the potential irrigation demand, transfers and hydro-power schemes as well as municipal demand based on a range of economic scenarios. It is important that these forecasts be undertaken using a consistent methodology.

- Review of implementation of water abstraction licensing procedures and their implementation and enforcement and proposals for their improvement.

It is unclear from the TDA investigations what the status of regulation on water resources is on the ground and how the performance may be improved. The strengthening and capacity building of local regulatory bodies will be an important element to any proposals but so will the development of pragmatic, community level approaches to enforcement which are cost effective and not burdensome are crucial. The flow of information is important and simple systems should be in place to deliver knowledge from the communities' right up to the national centres. This bottom-up approach should be developed not only for management of water but all other natural resources.

- Upgrading and expansion of hydrological models for the Cubango-Cubango-Okavango river basin.

The current hydrological models have limitations both technically and in geographical scope. The models should be up-graded to improve their capabilities.

- Development of a decision support system and information management system for the Okavango basin and provision of advice on acceptable development space.

The decision support tool developed under the TDA should be expanded to a full decision support system which would support a basin-wide decision framework agreed by the countries. The DSS would consider impacts not only of variation and reduction in hydrological flow but also changes to the sediment regime, land use and water quality. An integral part of the DSS would be an information management system which would operate on a number of levels and contain amongst others water resource, land-use, fisheries, socio-economic and biological databases. The DSS would be used to assist the basin to define the development space and therefore the vision for the basin.

- Review of water resource options of Cubango-Okavango and development of water resource plan harmonised with IWRM plans at national level

There should be developed in line with the basin 'vision' a water resource development plan. This would look at all the potential water resource options needed to meet the various water demand scenarios. The water resource development plan should be linked with the existing national IWRM plans and basin specific plans such as the ODMP and the Cubango IWRM plan (that is currently under development)

- A review of impact of climate change on water resources and water demands

The current climate change study should be revised and a more detailed set of scenarios developed to investigate the impact upon not only water resources but also water demand throughout the basin. As the countries look ahead 15 to 25 years this will become an ever more increasing important issue and it should be addressed at basin-wide and national levels.

- Development of drought management plans
- Development of flood forecasting model and flood preparedness plans

Drought management plans should be developed linked to the overall water resource development plans and with thresholds at which decisions are to be made clearly defined. The issue of flooding and flood protection has not as yet been investigated thoroughly in the context of an integrated water resource strategy. Flooding is a natural annual event central to the well-being of the river ecosystem but it also can cause tremendous damage and hardship to the basin population. There is a need to identify the areas susceptible to flooding and develop strategies to mitigate potential damage. This includes flood preparedness plans, including government response information, flow of information and lines of command and decision structures and a public information system. Similar plans should be developed for droughts and pollution incidents.

2.2.2 Changes in sediment dynamics

There are several issues associated with sediment transport in future predictions for the Cubango-Okavango river system. The first is the increasing erosion in the Angolan highlands as a result of deforestation and cultivation of more land. As land is cleared and cultivated more soil is eroded and carried down from the catchment into the river. The risk is that with

increasing cultivation, such natural erosion processes will be enhanced. Not only will land areas be lost, but the quantities of sediment in the river will increase. With accelerated erosion and consequent increase in sediment loads to the channels of the Cubango and Cuito, turbidity could increase, reduce light and dissolved oxygen, and threaten aquatic habitats.

The presence of significant numbers of livestock can degrade riparian vegetation. The river provides a focus for medium and high density livestock numbers, especially in Namibia and along the western side of the Okavango Delta putting stress on the banks. In Angola and Namibia livestock numbers are expected to increase substantially by 2025 – in Angola by up to 175%, and in Namibia, where numbers are already high, they may increase by up to 125%. In Botswana, the present high numbers of cattle (625,000) are expected to decrease somewhat to about 560,000 by 2025.

In Botswana, overgrazing coupled with climatic variations such as periods of drought, can lead to bush encroachment resulting in changes of species composition of grasses - from more palatable perennial species to less palatable annuals. Wind erosion in the rangelands could also be increased by overgrazing. While this is more of an issue for the rangelands away from the Cubango-Okavango river, the increasing numbers of livestock kept within the 10 km corridor of the river will have a significant localized impact upon the riverine and floodplain vegetation.

Grazing land in Botswana

Bank erosion is a concern of riparian land owners in Namibia and in the Panhandle area of Botswana. The process of channel formation, involves deposition of sediments in some parts of the channel, which forces the currents to change and erode banks on the inside of bends in the river. The banks may be several metres high and usually consist of unconsolidated sand that can erode easily. The loss of riverine vegetation, such as can be seen along the Kavango River in Namibia, reduces the protection that these trees and shrubs provide. River bank erosion can be expected to get worse as riverine vegetation is lost. Changes in flow regime as a result of abstractions or downstream of hydropower schemes can aggravate the situation.

The sediment dynamics in the Cubango-Okavango river system are both complex and critical to the continued maintenance of the river, its floodplains and delta ecosystems. The Cubango-Okavango river system's patterns of sediment transport are highly characteristic. There are very few clays or silt carried by the river and the concentration of dissolved solids is low. Three categories of sediment are transported down the river to the Delta - Fine sand, Suspended load, Solutes.

Changes in the flow regime will alter the balance of all three components of sediment reducing the bed load. However higher erosion processes in the upper catchment will tend to increase the suspended load and the return of irrigation waters to the river will bring an increased concentration of both fine sand, and solutes from the agricultural fields. Conversely changes in sediment dynamics will alter the hydraulics and river morphology and in the Delta and floodplains the depositing sediments are responsible for channel blockage and formation, meanders and oxbow lakes.

Hydropower schemes cause decreases in sediment. The bed load sediments will be trapped behind them and the designs must incorporate methods for clearing the sediment and passing it downstream. If flushes of high concentrations of sediment are passed in a short space of time, this will influence the water quality and the ability of the river downstream to cope with raised sediment levels. Sediment passing mechanisms are never completely effective, so inevitably there would be a loss of fine sand in the river.

After passing through a dam, the waters tend to carry less sediment, creating the symptom of "sediment hungry" rivers.

Water which has lost its natural load of sediment tries to pick it up again through eroding banks and river bed downstream of dams. Infrastructure lying near the eroding river banks may be washed out, including roads, water abstraction points and flow monitoring equipment. Another factor contributing to the removal of fine sands from the river is sand mining, which, although no estimates of the degree of sand mining are available, has been raised as a concern in Namibia.

An increase in Total Suspended Solids (TSS) in the water due to increased land erosion decreases the penetration of light. TSS in the Cubango-Okavango is currently very low and water clarity is high. In the Cubango-Okavango, nutrients are limited, so there is relatively little algal production. Increases in TSS might lead to loss of higher aquatic plants and an increase in filamentous algae. High TSS can block gills and breathing pores of macroinvertebrates and fish, leading to mortality or reduced productivity. If visibility in the water is decreased, fish and insects that depend upon their vision for hunting will be disadvantaged. Increased sediments smother sensitive aquatic habitats, e.g. gravel and rocky river bottoms that may be important for fish spawning.

It is not clear to see what the cumulative impact of all these changes would be and further data and information is required about the sediment transport system of the river, with the establishment of a sediment monitoring programme. There is a great deal of knowledge about the sediment regime of the Delta, but it is unclear what would be the impact of changes to the sediment components, either positive or negative, caused by upstream development and change in land use on the basin ecosystem and services in quantitative terms. These are complex questions which need to be addressed as part of the development of any decision support system. The following major responses to and knowledge gaps in changes in sediment dynamics have been identified:

- Mapping of land use potential (sensitivity map) of the basin and detailed assessment of land use policies, legislation and regulations.
- Erosion hazard mapping
- Harmonisation of land use planning guidelines

The TDA has focused on the impact of increasing water use on the health and functioning of the river ecosystem and its delivery of environmental services. The question of changing land use has been studied in less detail and its impact may be more significant and its control a more difficult challenge. The first step is to assess the problem and to recognise the barriers to reform, including national legislation and its implementation at the local level. As pointed in chapter 5, land-tenure is a key issue in land use reform in a number of the countries. Ideally there should be a set of land use guidelines which the local authorities can follow and implement throughout the basin aimed at preserving the ecosystem health and environmental services. The implementation of these guidelines will require extensive public education campaigns beginning with the basin communities and through to the local institutions.

- Establishment of sediment monitoring programme and determination of sediment flux in the basin
- Investigation of the rates of change of river morphology and physiology

The information collected by the TDA on the sediment transport in the river and changes in topography has been scant and academically based. The sediment transport is known to be as import to the health of the River and Delta as hydrological flows but knowledge of the impacts cause by changes in sediment transport, certainly at the level of the regulators, seems to be limited. The establishment of a proper monitoring programme based at key points within the system would be a first step. It is understood a monitoring programme exists in the Delta but this should be extended to the rest of the River system. Where changes are known to be occurring, the sediment fluxes should be monitored and the local changes in topography observed.

- Determination of the relationship between composition of the various flood plain vegetation communities and depth, frequency and timing of inundation.

The floodplains are an important component of the river ecosystem and provide a range of environmental services, including flood storage. Knowledge of how these biological systems function is important in order how best to manage use and preserve their intrinsic value.

- Degraded river banks and riverine forests restored and vegetative buffers established based on best practice guidelines.

Degraded river banks and loss of riverine forest are two of the most visible impacts of increasing land use change. Campaigns to restore these features will directly improve the environmental status of the River but also through community involvement and educational programmes build an understanding of the importance of their protection.

- Demonstration of sustainable rangeland management practices at priority sites

As part of a larger campaign to improve basin livelihoods, the rangeland best practice should be demonstrated in all three countries.

2.2.3 Changes in water quality

At present the water quality of the Cubango-Okavango river system is considered to be very good, characterized by very low suspended solids and turbidity, with very clear waters, low nutrients and low organic content. It is an oligotrophic river, with dissolved oxygen content adequate for maintaining the biological diversity. It is more sensitive than a eutrophic river and any pollution will be more evident and damaging. There are existing local areas of reduced water quality as a result of:

- Geological conditions such as increased levels of iron and manganese
- Urban areas where untreated waste water and solid waste leachate may be discharged untreated, raising the organic content and nutrients.
- Areas where livestock are watered, increasing solids in suspension and organic matter from excrement
- Agricultural areas, especially where irrigation water is returned to the river, carrying nutrients, such as nitrates and phosphates and agricultural chemicals such as pesticides.

There may also be seasonal shifts in water quality as run-off carries sediment, organic matter and nutrients into the waters during the rainy season, or during the dry periods, the conductivity and nutrients become more concentrated because of evaporation.

Hydrological monitoring equipment in Angola

The concern is that with the basin developments, the irrigation schemes in particular, and the change in land use there could be a serious decline in the water quality. With the reduction in flow the carrying capacity of the river would be much reduced and changes in riparian vegetation could limit the systems natural buffering capacity. The impacts of reduced water quality in the Cubango-Okavango would be wide ranging and as mentioned previously could severely impact on the ecosystem services. There are currently no permanent monitoring systems on the river and no record of pollution sources and their discharges and it is therefore impossible to establish a meaningful pollution regulatory system. At present pollution loadings in the basin are in general at a low level but are higher in the urban areas. A review of the municipal waste water treatment facilities or lack of them shows the scale of the problem.

In Angola access to sanitation services is limited. There are no waste water treatment facilities in the urban areas and solid waste is not properly disposed of and is sometimes dumped in the river by uninformed citizen. In Namibia approximately 82% of the rural population has no access to sanitation services and the majority uses the bush, although some have access to pit latrines and septic tanks. Only fifteen per cent of the inhabitants of Rundu are connected to a central sewer system. In Botswana there is a relatively new sewage treatment plant in Maun designed in 1993 but this experiences regular breakdowns and may be reaching its capacity by now. Other waste water treatment systems in Botswana include a 100 m3 per day plant at Boro Farm, a constructed wetland facility at Thuso Rehabilitation Centre, and a new sewer network and treatment plant at Gumare. Within the Delta each camp or lodge requires its own waste water disposal system. There is concern that there may be localised water pollution and eutrophication of the wetlands around tourist facilities. With

forecast increase in population and a trend towards urbanisation, local sanitation might deteriorate further, threatening potable supplies and public health.

The water quality in the river will change with decreasing flows, as more water is abstracted. With higher levels of water use, water quality may be expected to decline, especially in the lower sections when there is no additional run-off to dilute contaminants. Increased water use developments may also cause additional decline in water-quality because of increased effluents from urban areas, agricultural return flows with their loads of pesticides and fertilisers, and changed oxygen and temperature levels caused by storage dams.

Of the threats due to direct pollution the development of irrigation is probably of most concern, with its increase in fertilizers, fungicides and pesticides. The impact of the latter can be insidious and long-lasting. Only about 15% of the water abstracted for irrigation will be returned to the river, and this will carry remaining nutrients that have not been absorbed by the plants and any residues of agricultural chemicals. It is difficult to predict levels of nutrients coming from returned irrigation waters, because these will depend upon the soils, crops, cultivation practices and efficiency of irrigation. In general, the greater the efficiency of irrigated water use, the lower the nutrient content in the returned waters. Changes in nutrient levels affect the overall productivity of the system, probably changing the river from a nutrient poor to a nutrient rich system, with the consequent risks of eutrophication. The discharge of persistent organic pollutants, such as pesticides, from irrigated agriculture, malaria control and tsetse fly spraying, which although not significant at the moment, could if not controlled increase, entering the water, sediments and food chain - the consequences for the long-term health of the people exposed to these chemicals is unknown.

The balance of salinity in the Delta is finely tuned and highly dependent upon the flow regimes. Local salinity changes are a recognized function in the development of islands and vegetation patterns in the delta. Overall reductions and changes in the seasonal and geographic distribution of flood waters in the Delta could increase local salinities and alter the ecosystem balance in different parts of the Delta. In addition the salinity in return waters from the irrigation schemes will be elevated and it is not clear how this impacts the river basin and the Delta, much again depends upon the efficiency and management of the schemes.

Salty islands in the Delta

The Cubango-Okavango ecosystem provides extensive services in terms of water purification through its floodplains and riparian vegetation, which degrade organic matter and reoxygenate the waters and which bind nutrients in the growing vegetation. Changes in the extent of floodplains, as a result of changes in the flow and land-use will reduce the capacity of the river to provide these ecosystem services. The buffers that these areas provide against pollution and eutrophication may therefore be compromised.

There is also increased loading from urban and rural waste waters, the majority of which, as discussed above, are discharged untreated. As well as the increase in nutrient loading there is the danger of bacterial contamination from sewage and faecal matter increasing the risks to public health, especially for those depending upon the river as their main source of drinking water. Water borne gastro-intestinal diseases may increase. Vector-borne diseases such as bilharzia may also increase as a result of lowered water quality and changes in flow. The costs of treating these diseases and the loss of productive capacity of people are likely to increase.

There could be a serious impact on the fish and fisheries in the basin; polluted and poor quality water will tend to drive fish away to other areas that are less polluted, if it does not immediately kill the fish. Ultimately there could be a loss of the

more sensitive species in certain parts of the river and a decline in fishery productivity overall. This will have economic and nutritional consequences.

Poor quality stretches of the river will have an impact on recreational and cultural uses of the river. They will be less attractive for visitors engaged in boating and fishing. There will be social and economic implications if stretches of the river with poor water quality become extensive. Usually poor water quality is local, and the river's self-purification function helps to improve water quality downstream. With heavy pollution loads and loss of reedbeds and floodplains, the purification ability may be impaired.

If the water in the river becomes more polluted or more turbid as a result of changes in flow and sediment dynamics, the costs of water treatment for urban water supply are likely to increase. The trend towards greater urbanization will anyway lead to changes in the structure of provision from surface and groundwater sources. It is expected, for example that direct access to river water will diminish as groundwater sources are exploited under rural water supply programmes in Angola. However, the links between surface and groundwater throughout the basin are close, and contamination of surface waters may lead to contamination of the groundwater sources in some areas.

In larger storage dams thermoclines can develop and lower temperature and oxygen deficient water can be released from the lower stratas of the reservoir. These waters may also have higher sediments loads, all of which may have adverse impacts on the downstream river water quality.

The following major responses to and knowledge gaps in changes in water quality have been identified by the TDA:

A survey of contamination levels in sediments throughout the basin to provide a baseline.

- Review of water quality monitoring network, including laboratories and make recommendations for strengthening.
- Implementation of strategic, phased investment programme for the improvement of the water quality monitoring network, including capacity building components.
- Development and introduction of a biological based water quality monitoring programme
- Review of implementation and execution of regulatory function and recommendations for their improvement.

The data available to the TDA on water quality was meagre and limited to a few parameters. It did not give, even in the lower basin, a clear picture of the current status. The statements regarding the water quality that it is generally good are considered reasonable but cannot be supported. There is commentary on pollution sources but this is of generic nature and their location and impact on ambient water quality is not defined. This is one of the most important knowledge gaps within the TDA. A survey of contamination levels of sediments at strategic locations in the river basin including cores will provide the necessary baseline for key contaminants such as heavy metals and organics. A survey of the water and suspended solids phased over a year would also help to develop a clearer picture of the existing water quality problems and issues and provide foresight in addressing the up-coming problems

The scale and frequency of water quality monitoring in the three countries varies from is very limited to non-existent depending on the country. The design of the monitoring network must take into account the remoteness and extent of the region, the technical capacity available and the existing threats and decisions the monitoring system is to support. The inclusion of biological monitoring is seen as idea screening methodology for the Cubango-Okavango since it is very cost effective for large coverage areas and can be implemented by semi-skilled personnel and linked to community programmes. This would be backed up by more detailed investigations where problems or changes were observed.

- Harmonisation of water quality standards and monitoring protocols. Establishment of water classification system and agreement on water objectives
- Development of action plan for improvement of water quality including an inventory of existing discharges and listing of potential threats
- Emergency response plans

The harmonisation of water quality standards and monitoring protocols should be seen as a long term aim since it will need to be agreed at the national basis not just at the basin-wide level. In this regard, perhaps the countries should look to see how the South African systems could be adapted for their use.

An itinerary of existing discharges (locations, volumes, discharge standards, compliance etc) needs to be assembled and analysed against water quality objectives. An action plan should be drawn up and an investment programme determined for water quality improvement measures. This work will also help in setting discharge standards for new developments and in the design of overall monitoring programme. Where there are major discharges, which if failed could have serious implications for the basin, emergency response plans should be developed.

2.2.4 Changes in the abundance and distribution of biota

Rough estimates of the amount of natural habitat remaining within the Cubango-Okavango basin in each country show that a very high value of 90% – 95% of the natural habitat is still intact. The generally intact ecosystem integrity is not surprising as the basin has low population densities and is remote within all three countries. The 'changes in the abundance and distribution of biota' is a cross cutting area of concern, being linked strongly to all the proceeding areas of concern and a number of other key causes.

In ecological terms the abundance and diversity of flora and fauna in the Cubango-Okavango river system and especially in the Delta is outstanding. Any human induced change in flow regime will threaten the biodiversity make-up along riparian belts and across floodplains. Conversion of floodplains and destruction of the riparian belts will decrease the capacity of the system to buffer the hydrology and water quality of the river. The risk of losing these key natural aquatic management options is likely to increase under conditions of higher water use. The productive value of riparian zones in terms of economic and ecological services are already apparent to communities linked to floodplains, but these benefits extend beyond the basin, securing national, regional and even global benefits as well, for example the flyways for migrating bird species that use the Cubango-Okavango as a destination.

The importance of the contribution that natural resources make to the livelihoods of the people that live in the Cubango-Okavango river basin has been stressed. Most of the people living in the Basin live in the rural areas, and are all the more dependent upon the natural resources for food, fibre and fuel. As the population increases, so the pressure upon these natural resources increases. This will inevitably lead to further degradation and loss of critical habitats such as the floodplains and riparian woodland, as trees are cut for construction timber and firewood, and reeds and grasses cut for household use, baskets and matting. To some extent such natural resources are sustainable, re-growing each year, but if they are over-harvested the vegetation stock may be damaged or lost completely, so that the wider habitat is changed.

There is also evidence that fish populations have changed under fishing pressure, for example by the use of gill nets in the stretch of river between Kapako and the confluence with the Cuito, so that the larger, commercially attractive species are less available. In comparison the protection afforded by the Mahango Game Reserve has preserved a more diverse population of fish species. This does not yet seem to have happened in the Panhandle, arguably the most productive fishery of the basin, but increased fishing pressure with new and improved fishing methods will surely bring about such changes in the future.

There is a great imbalance in the large wildlife populations between the three countries, with the most living in Botswana, some high concentrations focused in pockets in Namibia, and relatively scarce large mammals in Angola. Historically, the populations of wildlife in Angola would have been much higher than at present, especially in the more southern parts of the basin, where dry woodland savannas are similar to conditions in Namibia and Botswana (outside the Delta). The wildlife populations have been severely disturbed by civil war and depleted by subsistence hunting for food. There are reports that the number of elephants and other wild animals are coming back to Angola. For example, in the Coutada Publica do Mucusso there is already a conflict between humans and animals in search for water from the Cubango-Okavango river system with the resulting crop damage the main cause for concern. In Namibia and Botswana where there has been a history of wildlife management and protected areas, the wildlife numbers and diversity can be spectacular. The income generated by tourism, both nationally and at the community level, has ensured that the value of wildlife resources in the Delta has been protected.

A river ecosystem is much more than a wetted channel. Swamps, deltas, floodplains, marshes, river banks, complex secondary-channel networks and the associated groundwater play their roles in adding to the river's biodiversity and its ability to support the abundance of plants and animals so valued by humans. This dynamic, ever-changing environment creates the physical environment upon which the river's plants and animals live their lives. Species respond to day-to-day changes in flow conditions, with each river's mix of plant and animal species having evolved over millennia to live in synchrony with its unique short and long term cyclical flow patterns. Some species thrive in drier years and others in wetter years, and so the balance of species is maintained with none dominating but rather the mix of species changing from year to year. Reductions in the natural variability of flows and changes in the timing of different flows disrupt these life cycles and reduce diversity, abundance and resilience of the ecosystem.

Biodiversity changes may be observed in the changes in habitats in the river ecosystem, in the occurrence and abundance

of different species, as they adapt to the ecological changes. Some high value species may be lost, e.g. the near endemic Slaty Egret and near threatened bird species like the African Skimmer and Rock Pratincole, as well as charismatic bird species, such as Wattled Cranes, may be at risk. The global existence of species is unlikely to be threatened, because no truly endemic species have been found in the Basin. The lack of information on the biodiversity in the upper reaches of the Cubango and Cuito may mean that if change occurs quickly, any undescribed and little known species living in the headwaters may be lost before they can be studied.

Although there might be an initial increase in the larger grassland mammals, with the increase in seasonal wetlands, the decreased flows into the Delta will cause longer term biodiversity changes. The area may become less attractive to tourists leading to lower incomes from tourism. This will have consequences for both local employment and contributions to national income. The risk is highest for Botswana which has made considerable investment in developing tourism, but the effects will also be felt in Namibia. The opportunities for the incipient tourism industry in Angola, which may develop as part of wider Cubango-Okavango tourism initiatives, will be lost before they can be fully realized. The opportunity to develop a low-impact, low water use, biodiversity based development for the region as a whole would be lost with increased water abstraction.

If dry seasons become more prolonged, there may be increased human-animal conflict as elephants use the river for watering, and feed on crops grown nearby. This will apply especially in Botswana and parts of Namibia, and is already increasing as elephants move back into Angola.

Decline in water quality due to organic pollution will cause lowering of the dissolved oxygen, and could lead to reduction in macroinvertebrate and fish species living in that locality, e.g. around urban areas. Increases in nutrients could lead to eutrophication of the waters, with high algal productivity. This in turn would lead to changes in the species diversity of macroinvertebrates and fish. Pesticides and toxins, coming principally from the return waters of irrigated fields, can cause fish kills, or accumulation of toxins in fish flesh. This might be passed on to humans who eat them (as well as to fish-eating birds and mammals).

The changes in sediment dynamics may affect the river morphology so dramatically that the biological features of the river may change too, adapting to the new conditions, e.g. as permanent swamps in the Delta dry out, and seasonal swamps turn to grasslands, the grazing wildlife populations may rise.

The Cubango-Okavango biosphere is under pressure from expanding human settlements and infrastructure. As the population increases, so pressure from harvesting, fishing and hunting of the natural resources will increase, inevitably leading to overexploitation and reductions in the abundance and even loss of some species. Land cover change from overgrazing, deforestation and land transformation for farming contribute to the pressures on the system, as do extensive and prolonged fires. Particular pressures can already be seen on the riparian vegetation, especially in Namibia, and overuse and degradation of the floodplains.

The risk of introducing new invasive alien species, although at present not considered high, may become a serious area of concern with changes in flow and mobility of populations.

The following major responses to and knowledge gaps in the changes and abundance in biota have been identified by the TDA:

- Establishment of minimum environmental flows in key locations in the catchment

As part of the water resource assessment, minimum environment flows should be set based on international best practice. The minimum flows restrictions would provide the bounds for any water development and help define the acceptable development space.

- Design and implementation of a biodiversity monitoring programme linked to the existing Okavango Delta Management Plan programme, including a review of indicator species
- Vegetative mapping of basin wetlands and classification based on conservation status

The biodiversity monitoring programme associated with the ODMP and knowledge of the Delta ecosystem is extensive, but we have less knowledge of the biodiversity of the upper catchment and its associated wetlands.

- Establishment of game corridors in critical areas
- Strategies for mitigation of human/wildlife conflicts developed at selected sites

As the population grows and more land is used for agriculture and livestock so the conflicts between humans and wildlife will grow. The large wildlife populations in Namibia and Botswana are high but in Angola are relatively scarce. Some organised relocation of wildlife to Angola is already taking place. Maintaining (and re-opening) traditional wildlife migration routes will ease the movement of wildlife and contribute to reducing human-wildlife conflicts, particularly as human developments grow in scale

- Develop best practice guidelines for community based use of natural resources
- Development of guidelines for management of different categories of wetlands
- Creation of transboundary fishing reserves

The above proposals are part of a wider livelihood development programme recommended in chapter 8 of the TDA.

- Mapping and assessment of impact of invasive species in the basin and identification of future threats
- Development of transboundary programmes for control and spread of alien plant species

Invasive species are potentially one of the most damaging threats to the Cubango-Okavango and the countries need to be ever vigilant and be ready to respond as quickly as possible in a coordinated manner. Knowledge of existing species and potential species needs to be expanded and counteractive measures put in place.

- Status of the environment report produced every two years

The status report will provide a record of the improvement or decline of the environment as development increases. It will draw upon data and information from the information management system and will inform the DSS and the up-dating of the TDA, SAP and NAPs.

2.3 GOVERNANCE CHALLENGES

The TDA has recognized the crucial need to strengthen the governance framework, nationally and regionally, in order to set the bounds and standards for water resource development, to police and monitor their implementation and to construct a mechanism for feed-back and review of the balance of development in terms of IWRM. The gaps in the components of the governance cycle have been analysed and are summarized below.

2.3.1 Policy and Legislation

The three countries share the overarching policy objective of alleviating poverty and improving the welfare and living conditions of their populations through increased economic growth. The incidence of poverty in the Cubango-Okavango basin is much higher than in other parts of each of the countries as a whole, partially due to the remoteness of the basin, and partially due to the unequal distribution of wealth in the three countries. Ambitious water resource development plans are aimed at alleviating this poverty, particularly in Angola and Namibia. In Angola the drive for economic growth is made more difficult by the need for post-conflict reconstruction and the gradual return and resettlement of previously displaced people.

While emphasising the need for economic growth and associated increasing water demands, all three countries recognise the importance of the environmentally sustainable use of natural resources. At international level the Okavango basin states are Parties to the major Multilateral Environmental Agreements at global as well as regional (SADC) level with the only exception being Angola presently not being a Party to the Ramsar Convention and CITES.

MULTILATERAL AGREEMENT	ANGOLA	BOTSWANA	NAMIBIA
OKACOM Agreement	15.09.1994	1994	1994
OKACOM Structures Agreement	19.04.2007 (signed)	19.04.2007 (signed)	19.04.2007 (signed)
SADC Protocol on Shared Watercourses	2000-08-07 (signed)	2000-08-07 (signed)	2000-08-07 (signed)
UNCBD	1998-04-01	1995-10-12	1997-05-16
UNCCD	1997-06-30	1996-09-11	1997-05-16

UNFCCC	2000-05-17	1994-01-27	1995-05-16
RAMSAR		1997-04-09	1995-12-23
SADC Tourism Protocol	1998 (signed)	1998 (signed)	1998 (signed)
Bonn Convention on Migratory Birds	2006-12-01		
CITES		1978-02-12	1991-03-18
SADC Protocol on Wildlife Management and Law Enforcement	1999-08-18 (signed)	1999-08-18 (signed)	1999-08-18 (signed)
SADC Protocol on Forestry	2002-10-03 (signed)	2002-10-03 (signed)	2002-10-03 (signed)

Date of ratification/ signature of international agreements by Okavango basin states

Likewise, the three countries have made environmentally sustainable natural resource use an integral part of their national policy and legislative frameworks. Botswana in particular has identified the economic opportunities from ecosystem preservation and sustainable natural resource use (e.g. through tourism) as one of the main focus areas for the country's future economic development. Among the most important social development objectives in the three countries is the extension of domestic water supply services with the ultimate goal of full coverage in line with the MDGs. This has particularly high priority in Angola where coverage rates are on average the lowest of the three countries in the basin. An increase in service coverage will require the construction of abstraction infrastructure and an increase in water abstraction volumes.

The analysis of the policy and legal landscape in the three basin countries shows a relatively strong framework of natural-resource management policies and legislation, although there is some variation between countries. The policy and legal framework is currently less developed in Angola due to the country's relatively recent emergence from armed conflict. However, Angola is fast addressing policy and legislative gaps, with a Water Act and other environmental legislation already passed some time ago and a number of environmental policies and strategies being completed or under development.

The strength of the current policy landscape is the recognition of the economic and social development opportunities of sustainable natural resource management. Particularly in Botswana and Namibia, emphasis is placed on sustainable resource use as an economic driver, primarily through tourism and Community Based Natural Resource Management (CBNRM) activities, and, as such, is reflected in policy and legislation. In Angola there is growing recognition of the need for sustainable management and it is expected that this aspect will be increasingly mainstreamed into sector policies under development. Yet there remains a number of existing or potential conflicts between sector policies that require resolution in order to determine the development pathway for the basin.

Of great importance for integrated basin management is that all countries have replaced old water legislation with IWRM-based water legislation that emphasises the need for integrated management and provides the legal mechanism for implementing integrated management in practice. Of particular relevance is the provision in law for the establishment of local-level basin management committees, the composition of which legally requires inter-sectoral representation.

On the other hand, there are some policy and legislative gaps at national level that currently hamper the optimal economic use of natural resources in a sustainable way – for example the inadequacies in the land tenure systems, e.g. insecurity of titles, making it difficult to obtain bank loans for tourism or CBNRM developments on communal land. Other examples include the exemption by law of communal land from meeting certain environmental protection requirements or the lack of strategic environmental assessment legislation/standards at national and basin level. Whereas the type, scope and area of legislative gaps vary between the three countries, there are several common challenges that the countries face. Arguably the most important one in this respect is the shortcomings in the land-allocation and tenure system, which are of concern in all of the countries. Likewise, inadequate EIA and SEA regimes are common to the countries. The common gaps in the policy, legislative and planning framework are mirrored at transboundary level. One of the most relevant issues is the absence of a harmonised land-use planning framework between the three countries that allows integrated basin-wide planning. Similarly, harmonised basin-wide water quality standards, harmonised water resources development plans and basin-wide

climate change adaptation strategies are missing at present.

2.3.2 Institutional strengthening

Having noted the existence of gaps in the policy and legal framework at national and basin level, these problems are comparatively easy to address (at policy and legislation level) in practice. More complex to solve, largely because of their structural nature, are the constraints resulting from a lack of institutional coordination and lack of effective implementation and enforcement of existing policies and legislation. The most significant constraints for the effective sustainable management of the basin lie in the institutional framework. These constraints are largely of a structural nature, namely the fragmentation of management responsibilities across different line function ministries, the lack of inter-sectoral planning, limited coordination between different spheres of government, weak institutional structures at the local level, a lack of skills, management capacity and resources for integrated planning and effective monitoring, implementation and enforcement.

The need for strong institutions at local level is at present the biggest governance challenge in the Cubango-Okavango basin. All three countries have made provision in law or policy to strengthen and give greater autonomy to local government in local level development decision-making. Practical implementation is, however, lagging behind and local government continues to be under-resourced and with limited decision-making power resulting in central government remaining the dominant development decision-making power. Likewise, local basin-management committees established under the respective national water acts are either not yet established or have low levels of skills and financial capacity. They would require significant strengthening in order to fulfill their role in an effective manner.

Established as a cooperation, coordination and information-sharing platform for the three basin states with respect to water resources management, it is clear that OKACOM has a central role to play in the management of the basin, especially as there are no established basin-wide cooperation mechanisms in other natural-resource management fields, such as land-use or biodiversity. However, integrated water resources management cannot be undertaken effectively without considering issues of land management and other natural-resource use aspects. OKACOM itself has already recognised the integrated nature of water resources management institutionally by establishing Task Forces for crucial management areas such as the Biodiversity Task Force, Hydrology Task Force and Institutional Task Force.

Hydrology Task Force members at ADCP training, Menongue, Angola

The member states must decide on the exact scope of activities of OKACOM in the overall management of the basin, choosing, for example, between a narrower focus on water resources management only and a broader economic development focus. Any choice cannot ignore the integrated nature of basin management and the need for inter-sectoral cooperation and coordination. At national level, inter-sectoral coordination is increasingly recognised and to some extent reflected in policy and legislation such as the proposed Water Resources Council of the Botswana draft Water Bill and the Comissão Inter-Ministerial para os Acordos sobre Águas Internacionais (Inter-ministerial Commission for International Water Agreements) in Angola, which deals with matters related to international agreements on river basins. However, this need is not yet reflected in the composition of the national delegations of all the countries to the Commission and/or to OBSC. Given the importance of agriculture and energy issues, increasing the diversity of sectors represented in the different organs of OKACOM would allow greater consideration of and coordination between different sectors. The linkages

between OKACOM and the member states could also be strengthened at local level, meaning closer ties between the respective local basin-management committees and OKACOM. This would not replace or undermine the decision-making power of the Commission made up of the national delegations, but could take the form of direct information exchange between OKACOM and the national basin-management committees. This would allow OKACOM to become more informed about local level planning, implementation and enforcement. Such direct information exchange mechanisms would improve the cooperation between the local committees in the three countries and bring implementation and enforcement challenges that require basin wide cooperation to the attention of OKACOM. Closer direct linkages are also desirable between OKACOM and the broad range of stakeholders in the basin and it is assumed that the stakeholder-participation strategy currently under development will adequately address this matter. The institutional linkages between local basin management committees and OKACOM could also be incorporated as an integral part of the stakeholder participation strategy.

Governor of Cuando Cubango Province with OKACOM representatives

Without pre-empting any decisions taken by member states on the exact role of OKACOM in the management of the basin it is foreseeable that its role and scope of activities will significantly grow, particularly once the Strategic Action Programme is endorsed and more detailed basin management plan is developed and implemented. This requires the further strengthening of its capacity, particularly at an operational management level. The OKACOM Structures Agreement gives OKACOM the necessary flexibility to structure its organs in a way that will accommodate its growing managerial role, with the establishment of Task Forces being one such option.

At operational level it is foreseeable that the Secretariat would have to play a stronger role, possibly over time taking on a key role in day-to-day monitoring and oversight of joint activities and also the implementation of joint projects and programmes between the three countries. A number of proposals for the further institutional evolution of OKACOM, and the Secretariat in particular, are already under consideration. It is critical for the effective, integrated management of the basin that OKACOM plays a central role and its institutional capacity is progressively strengthened in line with its evolving role and increased scope of activities.

2.3.3 Planning process

An overview of the responsibilities of different line function ministries in the respective natural resource management fields shows that numerous ministries and departments regularly need to be involved in most planning and decision-making processes and subsequent implementation. While the required coordination between national ministries does happen to some extent, it is still underdeveloped with sectoral rather than integrated planning being the norm. In some cases this is aggravated by conflicting sector policies that hinder integrated planning since line-function ministries have to pursue contradictory policy objectives.

Planning and decision-making across sectors and line function ministries or departments are arguably easier to achieve at local level where common local interests provide stronger incentives for cooperation and integrated planning. In Botswana, the Okavango Delta Management Plan (ODMP), a fully integrated management plan for the Okavango Delta developed with strong involvement of a vast diversity of stakeholders at all levels, might serve as a good example in this regard. However, even where integrated planning occurs and leads to the development of a fully integrated management plan, the challenge remains that implementation responsibilities reside in a diversity of agencies, again raising the issues of lack of

coordination and cooperation at implementation level. This often leads to inefficient use of government resources if not failure to implement altogether.

It is in this context that the provision in the three countries' water laws for the establishment of a basin-management committee is of great importance. Using the Okavango Basin Management Committee in Namibia as an example, the committee is comprised of representatives from a wide range of national ministries, local government and other relevant stakeholders, ensuring that a diversity of management responsibilities and sector interests can be considered in basin planning. The effectiveness of these basin management committees for integrated basin management requires strong institutions with adequate skills and capacity level, as well as effective coordination and cooperation between the local committees in the three countries, directly and/or through OKACOM.

2.3.4 Proposed responses

The countries need to strengthen the governance cycles and to integrate them vertically, from basin-wide to local levels, and horizontally, across the sectors. This is an immense challenge and cannot be achieved in the short-term. It should be seen as a work in progress but it must keep up with the planning process in the three countries. Looking at the generic governance cycle presented in Section 1.6, strengthening needs to occur at each step and can be split into the following areas:

- **Decision-making**
  a. Establishment of shared basin-wide vision
  b. Development of decision frameworks at national and basin-wide levels
  c. Strengthening of local and basin-wide institutions
- **Implementation**
  a. Strengthening of natural resource management and regulation at local, national and basin wide levels
- **Review and evaluation**
  a. Establishment and strengthening of regulatory monitoring programmes
- **Data and Information**
  a. Development of basin wide information management system and filling of knowledge gaps
- **Analysis and advice**
  a. Development of decision support system and common planning framework

3.1 PROGRAMME STRUCTURE AND INTEGRATED MANAGEMENT OBJECTIVES

All three basin states are pursuing ambitious economic and social development policies, in various sectors, including agriculture, hydropower and tourism which in the long term could have significant impact on the water resource availability and management. Some of these development policies bear the potential of being in conflict with each other if not harmonized and implemented in a coherent manner. In order to manage the future development of the basin in an integrated and sustainable manner in line with the mutually agreed development principles (see 1.5 and 1.6 above), the Okavango basin states have agreed on a set of six Integrated Management Objectives (IMOs), which address the main components of the governance cycle and guide the implementation of the SAP.

INTEGRATED MANAGEMENT OBJECTIVES
IMO 1: The sustainable management of the Cubango-Okavango basin is based on a shared basin-wide vision and jointly agreed decision framework.
IMO 2: Decisions are based on solid scientific analysis of available data and information and improved basin knowledge through research programmes designed to answer management questions.
IMO 3: Focused environmental and socio-economic monitoring programmes to support management decisions and track long-term trends are established and strengthened, and the results are used in adaptive management strategies.
IMO 4: Integrated planning criteria and objectives for sustainable development of water resources of the Cubango-Okavango basin are agreed and established.
IMO 5: The livelihoods of the basin's peoples are improved.
IMO 6: Technical capacity in the basin and involvement of stakeholders in SAP and NAP implementation is improved.

Guided by the IMOs the SAP will establish a long-term planning framework, titled the Basin Development and Management Framework (BDMF), which will include the development of a long-term vision and agreement on the accepted development space for the Cubango-Okavango basin. The BDMF will provide flexible management approaches informed by scientific and economic analysis and will respond to changing socio-economic and environmental conditions in the basin over time. The BDMF is complemented by four Thematic Areas that have been identified through the national and basin-wide consultation processes.

BASIN DEVELOPMENT AND MANAGEMENT FRAMEWORK
Thematic Area 1: Livelihoods and Socio-economic Development
Thematic Area 2: Water Resources Management
Thematic Area 3: Land Management
Thematic Area 4: Environment and Biodiversity

While the BDMF primarily addresses the governance challenges identified in the TDA and described in Section 2.3 of this document, the proposed interventions in the four thematic areas respond to the challenges posed by the driving factors and priority areas identified by the TDA. The SAP structure and its envisaged outcomes and interventions are thus a direct management response to the key problems identified by the TDA and supported by the extensive consultation processes that were undertaken.

For the BDMF as well as for each thematic area a number of envisaged outcomes have been specified based on the recommendations from the consultation process. Outcome indicators are specified for each outcome as are proposed interventions and an envisaged time frame for their implementation. The table below shows through which Thematic Areas the "Drivers" and "Priority Areas of Concern" are addressed, indicating the primary corresponding thematic area as well as other thematic areas contributing to addressing the challenges posed by the respective drivers and priority areas of concern.

DRIVING FACTORS	PRIMARY THEMATIC AREA	OTHER THEMATIC AREAS
Population Dynamics	1: Livelihoods and Socio-economic development	2: Water Resources Management 3: Land Management
Land Use Change	3: Land Management	1: Livelihoods and Socio-economic development
Poverty	1: Livelihoods and Socio-economic development	2: Water Resources Management 3: Land Management
Climate Change	4: Environment and Biodiversity	1: Livelihoods and Socio-economic development 2: Water Resources Management 3: Land Management
PRIORITY AREA OF CONCERN		
Variation and reduction of hydrological flow	2: Water Resources Management	1: Livelihoods and Socio-economic development 3: Land Management
Changes in sediment dynamics	2: Water Resources Management	3: Land Management 4: Environment and Biodiversity
Changes in water quality	2: Water Resources Management	1: Livelihoods and Socio-economic development 3: Land Management 4: Environment and Biodiversity
Changes in the abundance and distribution of biota	4: Environment and Biodiversity	1: Livelihoods and Socio-economic development 2: Water Resources Management 3: Land Management

A brief description of the BDMF and Thematic Area Outcomes is provided below and the full logical framework tables are provided in Annex 1.

3.2 THE BASIN DEVELOPMENT AND MANAGEMENT FRAMEWORK

The Basin Development and Management Framework (BDMF) will be the overarching, basin-wide information exchange, decision-making, development and management framework for the basin. The BDMF will provide the basin states with the basin-wide picture needed for long-term planning and joint decision-making on the management of the basin.

The focus of the BDMF will be the generation of shared information, the development of a jointly agreed mechanism for the analysis of the information, and the making of decisions based on the analysis. This will be done within an agreed development framework (development space) for the basin. A key Outcome under the BDMF is therefore the development of a joint basin Vision that will guide all future management and development of the basin and agreement on the development potential encompassed within this Vision.

In order to enable countries to make informed decisions the BDMF will require the development of basin-wide information sharing tools and a jointly agreed Decision Support Framework and Decision Support System (DSS). The harmonisation of national information and data and integration into the DSS and basin-wide information sharing mechanism are key Outcomes under the BDMF. This is complemented by the development of joint management tools in order to ensure that decisions taken at transboundary level are adequately implemented and enforced.

Maintaining the BDMF as a framework and implementing the decisions taken through this framework requires significant institutional capacity at both national and transboundary levels and the BDMF contains Outcomes focused on the required institutional strengthening. In this context the importance of stakeholder involvement in decision-making and management at different levels is recognised and reflected in the BDMF Outcomes.

It is important to bear in mind that the four Thematic Areas and the BDMF are closely inter-related and a reciprocal relationship exists between the BDMF and information generation, decision-making and implementation in the four Thematic Areas. While the BDMF will provide overall guidance for interventions in the four Thematic Areas, the latter will guide implementation of the jointly agreed, basin-wide development and management framework . The Integrated Management Objectives (IMOs) guide and inform the BDMF and the four Thematic Areas, thus ensuring integrated planning and management of the basin at transboundary and national levels.

BDMF OUTCOMES
1. Basin Vision agreed and Joint Decision-making and management framework established
2. SAP integrated with national decision-making frameworks and adequate national level implementation and enforcement capacity established
3. Basin wide information sharing and management tools developed and operational
4. Decision Support System developed which presents to the decision makers, at the basin-wide and national levels, the options in a clear and understandable fashion
5. National databases upgraded and harmonised in support of Cubango-Okavango river basin DSS
6. Stakeholder knowledge of the basin improved and involvement in SAP/NAP implementation ensured
7. Implementation plan for OKACOM Stakeholder Integration Strategy developed and roll-out initiated
8. Stakeholder knowledge and awareness of Cubango-Okavango river basin enhanced
9. Production of regular State of the Basin Report ensured

3.3 THEMATIC AREA 1: LIVELIHOODS AND SOCIO-ECONOMIC DEVELOPMENT

The TDA identifies Poverty and Population Growth as two key drivers of change in the basin and the basin countries share the common objective of improving the living conditions in the basin and the livelihoods of the basin population. Thematic Area 1 aims at sustaining key livelihood activities in the basin such as agriculture, livestock and fisheries and ensuring productivity improvements while at the same time reducing/mitigating the environmental impacts of such activities.

The economic analysis in the TDA identifies areas such as tourism and CBNRM as potential growth areas that can produce significant economic returns while having minimal impact on the environment. Thus, the further development of tourism, particularly in the upstream areas of the basin, as well as the expansion of CBNRM in the basin are critical outcomes on this Thematic Area. Likewise, the provision of improved water and sanitation supply to the basin population has the potential to produce large economic returns and also contributes significantly to the achieving of a number of MDGs. The improvement of water and sanitation supplies is therefore a key outcome in this Thematic Area. The evolving international climate change mitigation framework might hold potential economic opportunities that could be materialized in the basin and an assessment of such potential opportunity forms part of this thematic area. In order to facilitate investments and

economic development in the basin in a coordinated, sustainable fashion, the carrying out of a Multi-sectoral Investment Opportunity Analysis (MSIOA) to guide economic and investment planning forms a key output of this Thematic Area.

THEMATIC AREA 1 OUTCOMES	
1.	Basin-wide tourism strategy developed and tourism development increased
2.	Transboundary CBNRM established and livelihoods from CBNRM improved
3.	Conservation agriculture established in the basin and livelihoods from agriculture improved
4.	Livestock management and productivity in the basin improved
5.	Sustainability of River Fisheries ensured and aquaculture production expanded
6.	Water and sanitation supply to basin communities improved
7.	Sustainable economic and investment opportunities (including those from the global climate change mitigation framework) identified and utilised

3.4 THEMATIC AREA 2: WATER RESOURCES MANAGEMENT

There is inadequate knowledge about the contribution of the various parts of the Okavango River basin to the available water resources due to inadequate or inconsistent monitoring in some parts of the basin. Groundwater resources have never been quantified at the basin level. Changes in the quality of water arising from the planned developments will affect water users and ecosystems. The development of surface water, groundwater, and water quality monitoring systems will enable collection of data necessary for effective water resources management. Improvement of the various tools for overcoming challenges faced in water resources management is a key issue in the Cubango-Okavango river basin. The tools required are for managing water allocation, floods and water quality.

Water works at Menongue, Angola

Under the umbrella of the BDMF the outcomes in this Thematic Area are focused on the development of specific planning and monitoring instruments for water resources assessment and management ultimately leading to the development of a basin-wide IWRM plan. Taking into account the interconnectedness of surface and groundwater resources, emphasis is placed on the latter as the understanding of groundwater availability and quality in the basin is underdeveloped. Likewise, flood management is identified as a key outcome in this Thematic Area given the severe impacts of large floods in the recent past.

This Thematic Area respond (primarily) to the TDA Priority Areas of Concern 1 (Variation and Reduction of Hydrological Flow) and 3 (Changes in Water Quality) and to a lesser extend to Priority Area of Concern 2 (Changes in Sediment Dynamics). Like the interventions in the other Thematic Areas the interventions in this area are closely integrated with the BDMF and linked with interventions in other Thematic Areas.

THEMATIC AREA 2 OUTCOMES
1. Common demand forecast and water resource yield planning methodologies with consideration of climate change impacts approved and implemented
2. Basin-wide hydrological and meteorological monitoring system to determine surface water resource yields, groundwater recharge and predict drought and flood events strengthened
3. The potential of groundwater as an alternative source of water supply in the basin is known
4. Common guidelines and regulations for WDM (water demand management) and licensing of water abstraction approved and implemented
5. Environmental Water Requirements agreed and observed in the basin
6. Basin-wide water quality monitoring programme established
7. Common guidelines and regulations for water quality management approved and implemented
8. Basin-wide sediment monitoring system established
9. Reduced flood damage in the basin due to improved flood forecasting and early warning systems
10. Basin planning and management at national and transboundary level based on basin-wide IWRM plan

3.5 THEMATIC AREA 3: LAND MANAGEMENT

Changes in land cover affect the water quality, quantity and sediment load through changes in run-off, erosion, groundwater recharge and by introducing pollutants into the river. Furthermore land management objectives in one country can negate land management practices in another. Development in certain parts of the Cubango-Okavango river basin is guided by established land use plans but large parts of the basin either lack such plans or they are not enforced when available. National land and sectoral natural resource use policy and legislation provide a fragmented framework for land use planning and land management, including forestry and forest management. The development of harmonised land use guidelines throughout the basin will promote the sustainability of resource use in the basin and has been identified in the consultation process as a critical outcome for the SAP. Although environmental degradation in the basin is limited at present, it does exist in some areas and interventions will be carried out to reverse existing and halt further degradation.

Thematic Area 3 contributes to addressing all four Priority Areas of Concern identified in the TDA.

THEMATIC AREA 3 OUTCOME
1. Harmonised, basin-wide land use planning guidelines developed
2. Existing environmental degradation halted or reversed

3.6 THEMATIC AREA 4: ENVIRONMENT AND BIODIVERSITY

The Cubango-Okavango river basin supports an extraordinary level of biodiversity and sustains globally important wetlands. The ecosystem services provided are an important component of the livelihoods of the people in the basin. A better understanding and management of the basin's natural resources will contribute to maintain the value of the ecosystem services provided by the Okavango and increase the economic returns from sustainable resources use. As the TDA economic analysis has shown the economic potential of sustainable use of the basin ecosystem, and tourism in particular, outperforms the economic potential from more water-use intensive economic development options. At the same time, the basin's wetlands are critical for ensuring the flow regime of the river and the maintenance of dry season flows in

particular on which the other basin ecosystems and the ecosystem services they provide depend.

Thematic Area 4 focuses on developing a better understanding of the basin ecosystems, particularly wetlands, and the inter-relation between different ecosystem functions. Biodiversity, wetland and sediment monitoring systems will be developed in order to monitor ecosystem functionality. A particular emphasis is placed on developing sustainable wetland management systems given the critical importance of wetlands for the Okavango ecology and livelihoods.

The impacts of climate change on ecosystem have been identified by the TDA as a driver of change in the basin. The increase of climate change awareness among basin communities and the development of climate change adaptation measures suited to the conditions in the basin have therefore been identified as critical and are reflected in Outcome 5 of this Thematic Area.

THEMATIC AREA 4 OUTCOMES	
1.	Biodiversity monitoring programme developed
2.	Wetland monitoring and management system developed and operational
3.	Climate change awareness of basin communities increased and adaptation measures adopted by basin communities

Tailed Net-winged beetle (Lycus trabeatus) on grass at Lake Ngami, Botswana

4.1 SAP IMPLEMENTATION

Once adopted and endorsed by OKACOM member states the implementation of the SAP will become the responsibility of OKACOM and the governments of the riparian States. At the national level the institutional mechanisms for the coordination of NAP and SAP implementation have been identified during the NAP development process and are clearly spelled out in the respective NAPs.

At the basin level SAP implementation will be coordinated by OKACOM through its organs, primarily OBSC assisted by the Secretariat. Based on the annual work plans of the Commission, the OBSC will also be responsible for coordination of the International Partner projects and work to attract further SAP implementation support from the both public and private sectors at the regional and national levels.

The exact organizational structures and roles within OKACOM for SAP implementation are yet to be determined. While essential for the successful implementation of the SAP, the necessary implementation structures need to be established gradually and the required capacity build over time as SAP implementation progresses and increases in scope. The determination and of appropriate implementation mechanisms and building of necessary organizational capacity has been identified as a critical output under the BDMF and is prioritized for the first period of SAP implementation.

Participants at Botswana NAP meeting, December 2010

4.2 NATIONAL ACTION PLANS (NAPS)

At national level the SAP initiatives are to be integrated within the respective National Action Plan (NAP) of each basin state, making the NAP a critical tool for the implementation of SAP priority actions at national level and the integration of transboundary and basin concerns into national legislative, policy and budget decision making processes. The National Action Plans (NAPs) represent an awareness of and commitment to enhanced sustainable management of water resources by the basin states. It is critical that all states continue to make further steps towards improved stewardship of all natural resources at the national level, with the confidence that even the smallest action can lead to large improvements when taken collectively. Without this commitment to implement the national supporting interventions the SAP's basin-wide interventions have no foundation and their implementation is undermined. Whilst the NAPs feed into the SAP, they are also cohesive, independent documents which detail national objectives, targets and interventions to be achieved. They have common guidelines and like the SAP will be implemented in two separate 5-year periods and will be reviewed every five years. Implementation of the NAPs moves forward independently of the SAP process but their updating shall be undertaken concurrently with the SAP.

The basin states have ensured and will continue to ensure that the NAP and SAP content, policy and measures, are coordinated and consistent with those developed across the sectoral ministries. The NAP consultation process leading to endorsement is designed to ensure all key government stakeholders are consulted fully and timely to ensure integration. In preparing the NAPs the basin states have referred to existing development and environment plans and it has been stressed that each riparian state should ensure that its body of laws and regulations is fully coordinated and supportive of environmental policies developed through the SAP.

4.3 RESOURCE MOBILIZATION

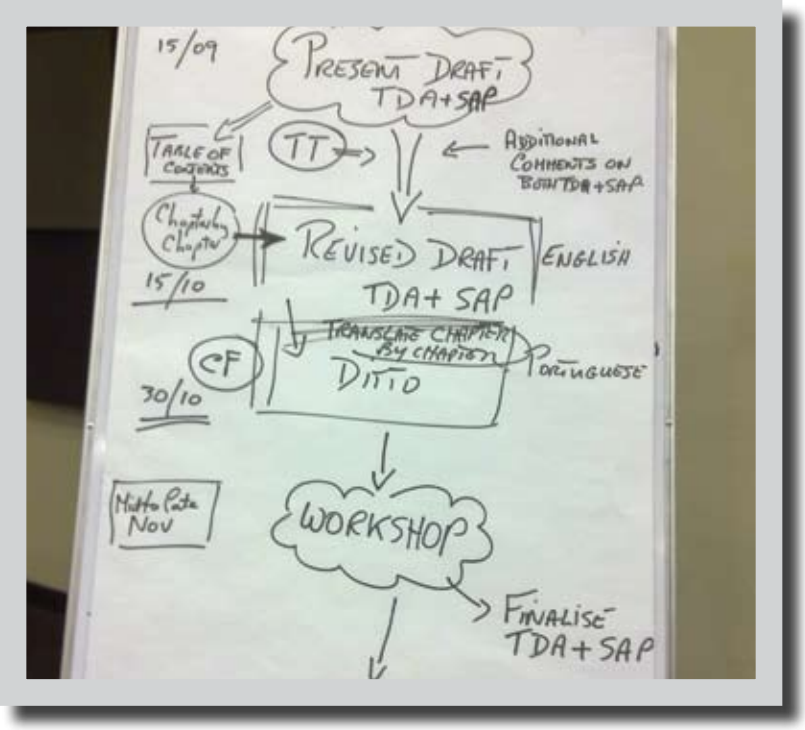
It has been estimated that implementation of the SAP in the first five year period (approximately 2011 – 2015) will require some $30 million, to be provided from national budget with potential assistance from International Cooperation Partners (ICPs) and the private sector estimated at $25 million. Implementation of the SAP in the second five year period is estimated at $27 million.

It is essential that the ICPs work together with common objectives and targets and minimize overlap and maximize synergy between projects. There has been collaboration between the GEF international waters EPSMO project and the GEF BiOkavango project supporting the Okavango Delta Management Plan in Botswana in the development of the TDA and the NAP in Botswana.

At present there is ongoing ICP cooperation between UNDP/GEF and USAID. The USAID Southern Africa Regional Environmental Programme (SAREP), worth $23.3 million, was launched in 2010 and many of its targets correspond to the TDA priority areas of concern. The SAREP has been consulted closely during the development of the SAP and has provided financial and technical assistance to the NAP development process. The programme's key result areas include:

- Cooperative management of shared resources
- Biodiversity and ecosystem services monitored and protected
- Increased access to safe water supply and sanitation
- Management of basin resources in the context of climate change by River Basin Organisations
- Regional, national and local development planning capacities in the river basin substantially improved.

It is envisaged that the SAP provides a platform for future coordination of development and management activities in the basin, both for ICP supported as well as for national projects. There any many regional and national projects funded by both international partners and state governments, which need to be identified and overlaps and synergies mapped. It is proposed that OKACOM establish an ICP coordination mechanism to improve collaboration and cooperation.



Flip chart process diagram at NAP planning meeting

International grant sources could be further raised; however, any success will undoubtedly be tied to the Cubango-Okavango states demonstrating their continued commitment to OKACOM towards implementation of the SAP and establishing strong governance frameworks. International financial institutions should be approached for loans with the full involvement of both technical institutions and financial, economic and planning authorities to ensure that the requests meet the relevant financial and guarantee criteria. The SAP as a basin-wide management framework endorsed at the highest political level in the three basin states is evidence of a high degree of political commitment of Angola, Botswana and Namibia to the Sustainable Management Objectives contained therein. It provides a solid basis for soliciting future funds, in the forms of grants or loans, for investments supporting the sustainable development and management of the basin. Holding an ICP conference in order to solicit support for the implementation of SAP initiatives is envisaged as a first step in this regard.

Even given the above initiatives there may remain however a significant funding gap, which will principally need to be filled by the riparian states. This may be done through further integration of development and environment planning

processes; assigning higher value to environmental considerations in the region, and allocation of substantially enhanced national financial resources to water resource and environmental management issues in general and to the Cubango-Okavango in particular. Consideration of environmental costs and benefits should be fully taken into account in economic measures and budget making, as well as with the private sector partnerships for environment protection should be promoted throughout the region.

4.4 SAP MONITORING AND EVALUATION

The SAP is firmly anchored within the work programme of OKACOM and the Commission (through its organs) will be responsible for the overall coordination, monitoring and evaluation of the SAP. The monitoring and evaluation of progress in the implementation of the SAP will be guided by the specific results-based indicators of the SAP as presented in Annex 1.

Monitoring and evaluation of the SAP will take on a bi-annual basis as part of the overall implementation work programme of OKACOM. In this regard the Commission will establish mechanisms for ensuring that the evaluation is carried out in the most transparent and objective manner. Official reporting will be in the form of bi-annual progress reports of the Secretariat tabled to the Commission, the main decision-making organ of OKACOM.

Sunset over Kavango River at Rundu, Namibia

4.5 THE FUTURE OF THE SAP

The SAP is officially launched with its adoption by OKACOM and endorsement by the states of the Cubango-Okavango basin. Active promotion of the SAP by the riparian states and OKACOM at national, regional and international fora is critical in gaining the broad support it needs for successful implementation. Key stakeholders are to be targeted through public meetings, media campaigns and briefings and consultations. Ultimately, the riparian states responsibility is to create and maintain the necessary momentum for SAP implementation. The riparian states and OKACOM will maintain their close dialogue on how best to support implementation of the SAP and strenuous efforts will be made to attract new international donors and donors from the private sector. The OBSC and secretariat will maintain close communication with the national bodies to ensure concordance between the SAP and the three NAPs and shall report annually to OKACOM on the implementation status of the SAP and the NAPs in accordance with the M&E framework. Every five years OKACOM and Member States governments shall review and recast the SAP and NAPs for the next 5+5 year period and, if necessary, reset the regional priorities. This review shall take place concurrently with an updating of the TDA, which will identify new areas of concern and new potential interventions.

STRATEGIC ACTION PROGRAMME (SAP) FOR THE SUSTAINABLE DEVELOPMENT AND MANAGEMENT OF THE CUBANGO-OKAVANGO BASIN

SAP LOGICAL FRAMEWORK

Boteti River road crossing, Botswana

ANNEX 1: SAP LOGICAL FRAMEWORK

BASIN DEVELOPMENT AND MANAGEMENT FRAMEWORK (BDMF) – *Towards basin-wide information exchange*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
1. Basin Vision agreed and Joint Decision-making and management framework established	1.1 Basin Vision agreed by riparian states	PI	1.1.1 Development of a shared vision for the development and protection of the Cubango-Okavango basin through a consultative process	1-5 years
			1.1.2 Promotion of the Vision throughout the basin and production of information materials.	1-5 years
	1.2 Draft Framework Convention for the Development and Management of the Cubango-Okavango basin developed	PI	1.2.1 Guidelines for determining equitable utilisation in the context of the OKAVANGO agreed based on criteria in OKACOM Agreement and Revised SADC Protocol and other international Conventions	1-5 years
			1.1.2 Support for initial negotiations for a Framework Convention for the Development and Management of the Cubango-Okavango basin environment and its peoples.	1-5 years
	1.3 OKACOM mandate for basin development, basin monitoring and SAP coordination agreed and required institutional capacity established	PI	1.3.1 Development of options for role of OKACOM in basin development, basin monitoring and SAP implementation	1-5 years
			1.3.2 Development of Terms of Reference for OKACOM organs based on selected option (from 1.4)	1-5 years
			1.3.3 Assessment of capacity needs of OKACOM based on selected option (from 1.4)	1-5 years
			1.3.4 Capacity building for strengthen OKACOM organs in line with developed ToR and based on capacity assessment	1-5 years
			1.3.5 Development of long-term financial strategy for OKACOM	1-5 years
			1.3.6 Development of reporting and M&E Framework for SAP projects in line with agreed ToR	1-5 years

BASIN DEVELOPMENT AND MANAGEMENT FRAMEWORK (BDMF) – *Towards basin-wide information exchange*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
2. SAP integrated with national decision-making frameworks and adequate national level implementation and enforcement capacity established	2.1 Reference to SAP and NAP in national IWRM and natural resource plans	PI	2.1.1 Review of national governance/ regulatory frameworks and make recommendations for strengthening through national IWRM plans and linkage with the BDMF.	1-5 years
	2.2 NCUs and Inter-Ministerial Committees operating	PI	2.2.1 Review of coordination and implementation of NAPs in the basin states as an integral part of the national planning process	1-5 years
	2.3 Fully funded catchment level management authorities operating in the three states as management and planning bodies	PI	2.3.1 Support to the establishment (where necessary) and strengthening of national catchment level management bodies	1-5 years
			2.3.2 Strengthening of OKACOM NCUs and Inter-Ministerial Committees in each basin country	1-5 years

OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
3. Basin wide information sharing and management tools developed and operational	3.1 Revised OKACOM Hydrological Data-sharing Protocol signed and operational agreements signed by data-providers	PI	3.1.1 Strengthening of existing OKACOM hydrologic data sharing protocol, signed by the key data providers and water resource regulatory and management organizations in each state.	1-5 years
			3.1.2 Development of compatible data formats and reporting procedures	1-5 years
	3.2 Basin-wide SEA and EIA procedures signed by Member States	PI	3.2.1 Development of agreed transboundary SEA procedures	1-5 years
	3.3 Reference to agreed transboundary SEA and EIA procedures in national legislation and guidelines	PI	3.3.1 Development of agreed EIA procedures in a transboundary context	1-5 years
	3.4 Meeting minutes of donor coordination group chaired by OKACOM	PI	3.4.1 Establishment of donor coordination mechanism for SAP implementation	1-5 years
	3.5 Donor projects clearly programmed under SAP and NAPs	PI	3.5.1 Development of map/registry of donor projects and linkage with SAP and NAPs	1-5 years

BASIN DEVELOPMENT AND MANAGEMENT FRAMEWORK (BDMF) – *Towards basin-wide information exchange*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
4. Decision Support System developed which presents to the decision makers, at the basin-wide and national levels, the options in a clear and understandable fashion	4.1 Fully developed DSS (responding to BDMF needs) operational	PI	4.1.1 Review of existing decision support system and needs assessment in light of the BDMF and national decision frameworks.	1-5 years
			4.1.2 Re-design of new system components (inputs, outputs and interfaces)	1-5 years
			4.1.3 Installation of full DSS in OKACOM secretariat and in OKACOM national coordinating units	1-5 years
	4.2 Designated OKASEC staff and 10 persons per country trained on DSS use	PI	4.2.1 Training on DSS operation for decision makers at different levels	1-5 years
	4.3 Model covering the whole of basin developed and operating	PI	4.3.1 Development of water resource/ hydrological models for the basin with an adequate concept	1-5 years
	4.4 Cadastre of groundwater resource yields and abstractions in Cubango-Okavango basin	PI	4.4.1 Assessment of utilizable groundwater resources yields of major aquifers.	1-5 years
	4.5 Different water resource use options fully integrated into DSS	PI	4.5.1 Review of water resource use options in the basin, including conjunctive use, in-basin storage and demand management.	1-5 years
	4.6 Economic models integrated into DSS	PI	4.6.1 Refinement of economic model, including more detailed assessment of indirect benefits and the existence value of the Cubango-Okavango system and comparative study of the value of water for different economic uses.	1-5 years
	4.7 IFA findings fully integrated into DSS	PI	4.7.1 Assessment of impacts of increased water abstraction and climate change on water quality and basin ecosystems	1-5 years
			4.7.2 Refinement of IFA methodology and geographical expansion of IFA	1-5 years

BASIN DEVELOPMENT AND MANAGEMENT FRAMEWORK (BDMF) – *Towards basin-wide information exchange*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
5. National databases upgraded and harmonised in support of Cubango-Okavango river basin DSS	5.1 Land use, biodiversity and socio-economic databases created	PI	5.1.1 Development of common structure and format for national databases (water resources, water quality etc.) compatible with basin DSS	1-5 years
	5.2 All relevant existing and new databases operational on common structure and linked to DSS	PI	5.2.1 Up-grading of GIS database and expansion of layers for land-use, water resource, conservation and other planners	1-5 years
			5.2.2 Development/ upgrading of remote sensing monitoring database to determine land use and vegetation change for land-use and conservation managers	1-5 years
			5.2.3 Development of basin-wide biodiversity databases and listing of indicator species	1-5 years
			5.2.4 Creation of basin-wide socio-economic database, to include all major areas of economic activity (tourism, agriculture, fishing, mining, etc.)	1-5 years
			5.2.5 Development of web-based information management system linked to DSS and accessible at different levels by a range of stakeholders	1-5 years

BASIN DEVELOPMENT AND MANAGEMENT FRAMEWORK (BDMF) – *Towards basin-wide information exchange*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
6. Stakeholder knowledge of the basin improved and involvement in SAP/NAP implementation ensured	6.1 Number of staff secondments and training activities increased	PI	6.1.1 Assessment of training needs of key basin stakeholders with regard to basin management and NAP/SAP implementation	1-5 years
	6.2 Okavango related curriculum components included in primary, secondary and tertiary schools in the region	PI	6.2.1 Review of training programmes being undertaken by governments and international partners	1-5 years
	6.3 Academic exchange program and conferences focusing on Cubango-Okavango ecology held throughout the basin.	PI	6.3.1 Development of training and knowledge exchange programmes between basin states developed based on needs assessment	1-5 years
	6.4 Number of academic partnerships recorded by OKACOM increased	PI	6.4.1 Coordination of basin-wide training programme between OKACOM and relevant national authorities	1-5 years

OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
7. Implementation plan for OKACOM Stakeholder Integration Strategy developed and roll-out initiated	7.1 Implementation plan for OKACOM Stakeholder Integration Strategy exists	PI	7.1.1 Identification of priority issues for engagement based on OKACOM Stakeholder Integration Strategy and NAP/SAP priorities	1-5 years
	7.2 Sustainable funding plan for OKACOM Stakeholder Participation Strategy in place	PI	7.2.1 Development of institutional mechanism for implementation of OKACOM Stakeholder Integration Strategy at national and transboundary levels (e.g. reactivation of Okavango NGO forum)	1-5 years
	7.3 Key stakeholder identified and actively engaged in OKACOM Stakeholder Participation Strategy priority issues	PI	7.3.1 Development of implementation plan and funding plan for 1st phase of OKACOM Stakeholder Integration Strategy	1-5 years
		PI	7.3.2 Implementation of selected priority activities on issues identified under 2.1 above	1-5 years

BASIN DEVELOPMENT AND MANAGEMENT FRAMEWORK (BDMF) – *Towards basin-wide information exchange*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
8. Stakeholder knowledge and awareness of Cubango-Okavango river basin enhanced	8.1 Awareness raising material readily available in all major local languages	PI	8.1.1 Establishment of Environmental Education Centres in each riparian state	1-5 years
			8.1.2 Production of reading material and documentaries in local languages	1-5 years
			8.1.3 Development and implementation of marketing/ promotion strategy produced for the Cubango-Okavango basin	1-5 years

OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
9. Production of regular "State of the Basin Report" ensured	9.1 First report prepared in 2013 and reports subsequently every two years	PI	9.1.1 Production of "State of the Basin Report"	1-5 years

THEMATIC AREA 1: LIVELIHOODS AND SOCIO-ECONOMIC DEVELOPMENT – *Towards sustainable livelihoods and reduced environmental impacts*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
1. Basin-wide tourism strategy developed and tourism development increased	1.1 Investment in tourism (outside the Delta) increased by 15 % by 2015	PI	1.1.1 Development of basin-wide tourism marketing/ promotion strategy	1-5 years
	1.2 New tourism products, particularly for upper basin, developed	PI	1.2.1 Development and establishment of basin-wide tourism management knowledge exchange programme established (e.g. wildlife management, lodge management, marketing, eco-cultural tourism)	5-10 years
	1.3 Joint ventures between existing (Delta)tourism operators and upstream tourism developers concluded	PI	1.3.1 Development of investment programme to promote investments from downstream to upstream	5-10 years
			1.3.2 Establishment of pilot joint transboundary tourism operations in cooperation with private sector and basin communities	5-10 years

OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
2. Transboundary CBNRM established and livelihoods from CBNRM improved	2.1: Basin-wide natural resources use guidelines developed	PI	2.1.1 Harmonisation of guidelines for community-based use of natural resources including indigenous plants, forests, and hunting harmonised	1-5 years
	2.2 15 projects qualified for small grants and grants disbursed by 2015	PI	2.2.1 Development and implementation of CBNRM knowledge exchange (between basin communities) programme established and delivery of training to selected pilot CBNRM projects	1-5 years
	2.3 Five new CBNRM projects initiated by 2013	PI	2.3.1 Establishment of small-grants programme for improvement of and CBNRM and local tourism.	1-5 years
	2.4 CBNRM projects profitable and disburse income to communities	SRI	2.4.1 Pilot joint transboundary CBNRM operations established in cooperation with private sector and basin communities	5-10 years

THEMATIC AREA 1: LIVELIHOODS AND SOCIO-ECONOMIC DEVELOPMENT – *Towards sustainable livelihoods and reduced environmental impacts*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
3. Conservation agriculture established in the basin and livelihoods from agriculture improved	3.1 Basin-wide guidelines for conservation agriculture agreed	PI	3.1.1 Detailed economic and financial analysis of all agricultural systems, including irrigation projects, in the basin	1-5 years
	3.2 Conservation Agriculture implemented in three pilot sites (communities) per basin state	PI	3.2.1 Development of toolkit (guidelines) for conservation agriculture tailored to the specific conditions of the Okavango basin incl. methodology for irrigation efficiency on Kalahari sands, riverbank protection etc.)	1-5 years
			3.2.2 Implementation of pilot projects in conservation agriculture	
	3.3 Community income from agriculture (in pilot sites) improved by 25%	SRI	3.3.1 Development of guidelines for Molapo farming and implementation in selected pilot sites	1-5 years
	3.4 Incidence of human/wildlife conflicts in pilot sites reduced by 30%	SRI	3.4.1 Development and implementation of training programme in conservation agriculture techniques for relevant stakeholders	1-5 years
			3.4.2 Development of strategies for the mitigation of human/wildlife conflicts in agriculture and implementation in selected pilot sites	1-5 years

OUTCOME	OUTCOME INDICATORS	INDICATOR TYPE	PROPOSED INTERVENTIONS	TIME FRAME
4. Livestock management and productivity in the basin improved	4.1: Basin-wide rangeland management strategy established	PI	4.1.1 Development basin-wide rangeland management programme with common property management to increase productivity and implementation in pilot sites	5-10 years
	4.2 Outbreak of livestock diseases reduced by 30% (in number of outbreaks and affected livestock numbers) by 2020	SRI	4.2.1 Development of basin-wide livestock health and disease-control management strategies	1-5 years
	4.3 Outbreak of wild animal diseases and zoonotic diseases reduced by 30% by 2020	ESI	4.3.1 Development of disease control strategies for wild animals and zoonotic diseases	5-10 years
	4.4 Livestock productivity improved by 15% by 2020	ESI	4.4.1 Establishment of programme to increase productivity of small-scale livestock	5-10 years

THEMATIC AREA 1: LIVELIHOODS AND SOCIO-ECONOMIC DEVELOPMENT – *Towards sustainable livelihoods and reduced environmental impacts*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
5. Sustainability of river fisheries ensured and aquaculture production expanded	5.1 Harmonised fishing regulations gazetted in all basin states	PI	5.1.1 Identification, demarcation and establishment of fishing reserves	1-5 years
	5.2 Fishing reserves clearly demarcate and local communities informed	PI	5.2.1 Harmonisation of fishing regulations in basin states	1-5 years
	5.3 Five new fish hatcheries established by 2015	SRI	5.3.1 Establishment of new fish hatcheries for restocking and seed stock	1-5 years
	5.4 Five new community run aquaculture projects established by 2015	SRI	5.4.1 Development of basin-wide biodiversity integrity guidelines for aquaculture (based on existing initiatives, i.e. BIOKAVANGO)	1-5 years
	5.5 Food and income security of communities from (five new) aquaculture projects improved by 20%	ESI	5.5.1 Establishment of appropriate aquaculture programme, including new community aquaculture projects, developed with emphasis on capital and low input systems	1-5 years

OUTCOME	OUTCOME INDICATORS	INDICATOR TYPE	PROPOSED INTERVENTIONS	TIME FRAME
6. Water and sanitation supply to basin communities improved	6.1 Number of people in the basin using water directly from the river reduced by 50% (from 2010 levels) by 2020	SRI	6.1.1 Identification of innovative, tailor-made local water and sanitation solutions	5-10 years
	6.2 Number of basin households without sanitation system reduced by 25% (from 2010 levels) by 2020	SRI	6.2.1 Provision of sustainable water supply to basin communities	5-10 years
			6.2.2 Provision of sewerage/ sanitation systems to basin communities	5-10 years

THEMATIC AREA 1: LIVELIHOODS AND SOCIO-ECONOMIC DEVELOPMENT – *Towards sustainable livelihoods and reduced environmental impacts*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
7. Sustainable economic and investment opportunities (including those from the global climate change mitigation framework) identified and utilised	7.1 Investment opportunities identified on a basin-scale	PI	7.1.1 Multi-sectoral Investment Opportunity Analysis (MSIOA) carried out	1-5 years
	7.2 Investment opportunities and projects under GDM and REDD+ identified	PI	7.2.1 Analysis of economic opportunities from Green Development Mechanism (GDM) carried out	1-5 years
			7.2.2 Analysis of economic opportunities from REDD+ carried out	1-5 years

THEMATIC AREA 2: WATER RESOURCES MANAGEMENT – *Towards planning and monitoring instruments for basin-wide Integrated Water Resources Management*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
1. Common demand forecast and water resource yield planning methodologies with consideration of climate change impacts in use	1.1 Common demand forecast methodologies agreed	PI	1.1.1 Analyze IWRM approaches and WRM methodologies in the three basin states	1-5 years
	1.2 Climate change scenarios mainstreamed into water resources yield and demand fore cast	PI	1.2.1 Development of common methodologies for component demand forecasts over a twenty year planning horizon	1-5 years
			1.2.2 Determination of water resource surpluses and deficits in the basin based on interventions 1.1 and 1.2	1-5 years
			1.2.3 Review climate change scenarios for the Cubango-Okavango basin and determination of impact on water resource yield and demand of most the likely scenarios.	1-5 years

OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
2. Basin-wide hydrological and meteorological monitoring system to determine surface water resource yields, groundwater recharge and predict drought and flood events strengthened	2.1 Harmonised basin-wide meteorological and hydrological monitoring programme agreed between basin states	PI	2.1.1 Review of national meteorological and hydrological monitoring networks and development of harmonised basin-wide monitoring programme	1-5 years
	2.2 Automated monitoring stations established at critical locations providing with adequate recording formats (e.g. real time data, automatic recorders, observer operated)	PI	2.2.1 Development of strategic phased investment programme for the improvement of the meteorological and hydrological monitoring network (e.g. monitoring stations, gauging equipment, boats etc.)	1-5 years
	2.3 Ten people per country trained in the application of harmonised meteorological and hydrological monitoring programme	PI	2.3.1 Implementation of basin-wide meteorological and hydrological monitoring programme , including establishment of new monitoring stations in appropriate sites throughout the basin	5-10 years
			2.3.2 Development and implementation of targeted training courses on meteorological and hydrological monitoring	5-10 years

THEMATIC AREA 2: WATER RESOURCES MANAGEMENT – *Towards planning and monitoring instruments for basin-wide Integrated Water Resources Management*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
3. The potential of groundwater as an alternative source of water supply in the basin is known	3.1 Thematic maps showing the availability, potential and quality of groundwater resources produced	PI	3.1.1 Assessment of existing groundwater information and identification of knowledge gaps	1-5 years
		PI	3.1.2 Addressing of knowledge gaps (e.g. additional monitoring boreholes) and carrying out of hydrocensus including groundwater quality assessment	1-5 years
		SRI	3.1.3 Delineation of aquifers, groundwater recharge areas and groundwater control and protection zones	5-10 years
			3.1.4 Development and implementation of weather and hydrological monitoring courses	5-10 years
	3.2 Basin-wide groundwater monitoring strategy agreed by basin states in line with OKACOM Data sharing Protocol	PI	3.2.1 Assessment of present monitoring network and development of common groundwater monitoring strategy for level and quality monitoring	1-5 years
	3.3 Quarterly submitted groundwater monitoring data are used for groundwater management	PI	3.3.1 Drilling and instalment of additional monitoring boreholes where needed	5-10 years
			3.3.2 Development of monitoring capacity at local level	1-5 years

OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
4. Common guidelines and regulations for WDM (water demand management) and licensing of water abstraction approved and implemented.	4.1 Common WDM guidelines and approved	PI	4.1.1 Review of national permitting and licensing procedures and regulations in the basin for water abstractions and discharges and recommendations for their harmonization and improvement.	1-5 years
	4.2 Water abstraction licensing regulations harmonized	PI	4.2.1 Review of national policies regarding law enforcement of regulations on water abstractions and discharges and recommendations for their harmonization and improvement.	1-5 years

THEMATIC AREA 2: WATER RESOURCES MANAGEMENT – *Towards planning and monitoring instruments for basin-wide Integrated Water Resources Management*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
5. Environmental Water Requirements agreed and observed in the basin	5.1 Environmental Water Requirements integrated in national legislation and regulations	PI	5.1.1 Agreement of key locations and undertaking of base-line surveys	1-5 years
	5.2 Ecosystem integrity and health monitored and shown to be maintained or improved	ESI	5.2.1 Environmental Water Requirements determined for key locations in the basin using DSS and implemented	5-10 years

OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
6. Basin-wide water quality monitoring programme established	6.1 Water quality baseline information available	PI	6.1.1 Review of national water quality monitoring programmes and development of harmonised (biological based) basin-wide water quality monitoring system	1-5 years
	6.2 Harmonised basin-wide water quality monitoring programme agreed between basin states	PI	6.2.1 Carrying out of baseline survey of contamination levels/ pollution loadings in the river and identification of hot spots	1-5 years
	6.3 Basin laboratories equipped and mobile laboratories deployed.	PI	6.3.1 Development of strategic phased investment programme for the improvement of the water quality monitoring network, including institutional strengthening and capacity building components.	1-5 years
	6.4 Ten people per country trained in the application of harmonised water quality monitoring system	PI	6.4.1 Implementation of basin-wide water quality monitoring programme, including establishment of new monitoring stations in appropriate sites throughout the basin	5-10 years
	6.5 Water quality data available quarterly and bi-annual water quality report produced	PI	6.5.1 Development and implementation of targeted training courses on water quality monitoring (including, where appropriate, with community involvement)	5-10 years
	6.6 Data available quarterly and annual report produced on the basin surface water quality.	PI	6.6.1 Production of bi-annual water quality report for inclusion in "State of the Basin Report"	5-10 years

THEMATIC AREA 2: WATER RESOURCES MANAGEMENT – *Towards planning and monitoring instruments for basin-wide Integrated Water Resources Management*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
7. Common guidelines and regulations for water quality management approved and implemented	7.1 Harmonised water quality standards gazetted in all basin states and applied in practice	PI	7.1.1 Development of basin-wide standards for water quality and monitoring protocols	1-5 years
			7.1.2 Development of monitoring capacity at local level	1-5 years
	7.2 Pollution loadings reduced by 30% (from 2010 levels) by 2020	ESI	7.2.1 Establishment of a common water classification system including priority parameters to be measured.	1-5 years
			7.2.2 Development of a basin-wide water quality improvement plan to be established over a 10 year planning horizon.	5-10 years

OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
8. Basin-wide sediment monitoring system established	8.1 Sediment transport baseline information available	PI	8.1.1 Production of historical baseline report of sediment transport and determination of sediment contributions of all tributaries to the lower basin (incl. ascertain composition of sediments by grain size)	1-5 years
			8.1.2 Investigation of the rates of change of river topography and physiology	1-5 years
	8.2 Sediment monitoring systems installed in appropriate sites throughout the basin and	PI	8.2.1 Development and establishment of basin-wide sediment monitoring programme (i.e. monitoring systems, equipment etc.)	1-5 years
	8.3 Ten people per basin country trained in the application of the sediment monitoring system	PI	8.3.1 Development and implementation of targeted training courses on sediment monitoring	1-5 years

THEMATIC AREA 2: WATER RESOURCES MANAGEMENT – *Towards planning and monitoring instruments for basin-wide Integrated Water Resources Management*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
9. Reduced flood damage in the basin due to improved flood forecasting and early warning systems	9.1 Basin-wide flood early warning system operational	PI	9.1.1 Production of basin-wide flood risk maps	1-5 years
	9.2 Decrease in flood damage	SRI	9.2.1 Development of basin wide flood forecasting model	5-10 years
			9.2.2 Development of basin-wide flood early warning system	5-10 years

OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
10. Basin planning and management at national and transboundary level based on basin-wide IWRM plan	10.1 Basin-wide IWRM plan approved	PI	10.1.1 Analysis of Okavango components of national IWRM plans and recommendations for integration into basin-wide plan	1-5 years
	10.2 Basin-wide IWRM plan integrated into national planning, monitoring and decision-making frameworks	PI	10.2.1 Development of OKACOM IWRM Master Plan based on harmonized WRM methodologies, guidelines and regulations and consistent with the SAP and NAP and applicable watercourse agreements	5-10 years

THEMATIC AREA 3: LAND MANAGEMENT – *Towards harmonising land use*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
1. Harmonised, basin-wide land use planning guidelines developed	1.1 Sensitivity map of the Cubango-Okavango basin on new GIS template	PI	1.1.1 Mapping of the basin's vegetation cover, economical-ecological aptitude and land use potential (sensitivity map) of the basin	1-5 years
			1.1.2 Mapping of erosion areas (main erosion gullies, high risk areas) in sub-basins and municipalities	1-5 years
	1.2 Harmonised land use planning guidelines agreed	ESI	1.2.1 Detailed assessment of land use policies, legislation, regulations and plans in the basin countries.	5-10 years
	1.3 Land degradation from unsustainable land use in pilot sites reduced by 30% (from 2010 levels) by 2020	ESI	1.3.1 Development of harmonised, basin wide land use planning guidelines and technical criteria and implementation in pilot sites	5-10 years

OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
2. Existing environmental degradation halted or reversed	2.1 River banks restored in selected pilot sites in each basin state	SRI	2.1.1 Restoration of degraded river banks and riverine forests and establishment of vegetation buffers	5-10 years
	2.2 5000 Hectares of riverine forest protected and restored	SRI		5-10 years
	2.3 Five vegetation buffer schemes established in each basin state	SRI		5-10 years
	2.4 Eradication measures agreed and control teams established and equipped	PI	2.4.1 Mapping and assessment of impact of invasive species in the river basin	1-5 years
	2.5 Spread of target species halted or reduced	ESI	2.5.1 Establishment of transboundary programmes for control of spread of alien plant species	5-10 years
	2.6 Number and scale of fires in the basin reduced by 30% by 2020	ESI	2.6.1 Establishment of basin-wide bush and forest fire control programme coordinating existing national programmes	5-10 years

THEMATIC AREA 4: ENVIRONMENT AND BIODIVERSITY – *Towards a better understanding of basic ecosystems and climate change through effective monitoring*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
1. Biodiversity monitoring programme developed	1.1 Biodiversity monitoring programme agreed by basin states	PI	1.1.1 Design and implementation of basin-wide biodiversity monitoring programme, including agreement on indicator species, monitoring locations, monitoring intervals, data formatting and analysis	1-5 years
	1.2 30 community members in each basin state trained in biodiversity monitoring and actively involved in monitoring programme	PI	1.2.1 Development and implementation of training programmes in biodiversity monitoring with emphasis on involvement of local communities	1-5 years
	1.3 Regional specimen collection established and electronic identification keys developed	PI	1.3.1 Production of bi-annual biodiversity reports for inclusion in "State of the Basin" report	1-5 years
	1.4 First biodiversity report produced in 2012 and bi-annually thereafter	PI		1-5 years

OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
2. Wetland monitoring and management system developed and operational	2.1 Vegetative maps prepared using remote sensing data.	PI	2.1.1 Vegetative mapping of basin wetlands and classification based on conservation status	1-5 years
	2.2 Wetlands monitoring system agreed by basin states	PI	2.2.1 Wetland monitoring system developed and established	1-5 years
	2.3 Biodiversity monitoring programme proves maintenance of biodiversity in the selected priority wetlands	ESI	2.3.1 Development of wetland management strategies for selected priority wetlands	1-5 years
			2.2.2 Development and implementation of community awareness raising activities on sustainable wetland management	

THEMATIC AREA 4: ENVIRONMENT AND BIODIVERSITY – *Towards a better understanding of basic ecosystems and climate change through effective monitoring*				
OUTCOME	**OUTCOME INDICATORS**	**INDICATOR TYPE**	**PROPOSED INTERVENTIONS**	**TIME FRAME**
3. Climate change awareness of basin communities increased and adaptation measures adopted by basin communities	3.1 Three climate change adaptation projects identified and implemented in each basin state	PI	3.1.1 Identification of suitable climate change adaptation measures tailored to the main livelihood options (agriculture, livestock, fishing) in the basin	1-5 years
	3.2 Food security and community in pilot sites improved by 20% by2020	SRI	3.2.1 Demonstration of climate change adaptation measures in selected pilot sites	5-10 years

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