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Forest–Water Relations in the Southern Africa Development Community

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Acronyms and abbreviations

AGW-NET	African Groundwater Network
COFO	FAO's Committee on Forestry
DANIDA	Danish Agency for International Development
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
GWP	Global Water Partnership
INBO	International Network of Basin Organizations
IUCN	International Union for the Conservation of Nature
IUFRO	International Union of Forest Research Organizations
IWRM	Integrated water resources management
JPCC	Joint Permanent Commission of Cooperation
JPWC	Joint Permanent Water Commission
JTC	Joint Technical Committee
KOBWA	Komati Basin Water Authority
LHDA	Lesotho Highlands Development Authority
LIMCOM	Limpopo Watercourse Commission
MCPFE	Ministerial Conference on the Protection of Forests in Europe
MRC	Mekong River Commission
OKACOM	Okavango River Basin Water Commission
ORASECOM	Orange-Senqu Commission
PJTC	Permanent Joint Technical Commission

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PWC	Permanent Water Commission
RBO	River Basin Organisation
REDLACH	Latin American Network of Technical Cooperation in Watershed Management
RSAP-IWRMD	Regional Strategic Action Plan for Integrated Water Resources Management and Development
SADC	Southern African Development Community
SAWINET	Southern African Water Information Network
TFCA	Transfrontier conservation areas
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environmental Programme
WARFSA	Water Research Fund for Southern Africa
ZAMCOM	Zambezi Watercourse Commission
ZESCO	Zambia Electricity Supply Corporation
ZINWA	Zimbabwe National Water Authority
ZRA	Zambezi River Authority

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Foreword

Water is a critical resource in the Southern African Development Community (SADC) that is experiencing good socio-economic development and rising population, both of which require water. A significant amount of the water resources in SADC is shared by at least two countries, making their development, management and use key issues in transboundary activities between the countries. To facilitate this, the SADC region has developed a Protocol for Shared Water Systems. The protocol provides for, among other things, the formation of river basin organisations that will facilitate implementation of bilateral agreements on water access, use and management among member states. Already there are such river basin organisations in the region.

Water is gradually becoming scarce in individual countries and in the region as a whole. In fact, some countries are expected to consume more than available renewable water by 2015. This phenomenon is heavily attributed to climate change, and of course to the high levels of socio-economic growth, urbanisation and population growth. Additionally the region's economy relies heavily on agriculture. This has necessitated the construction of many dams to facilitate irrigated agriculture. This situation has caused considerable tensions and ecological disasters for the downstream users of such shared water resources.

The Protocol on Shared Water Systems and most national water legal frameworks appear to be weak on, or completely overlook important issues of biodiversity, and especially forests. Further, the relationship between forests and water has been remotely mentioned in some legislation, with commitment on how to enhance it either weak or completely lacking. Another important issue that is less visible in the regional programmes is the management of underground water. Although the SADC region developed a Regional Groundwater Management Programme in 2000, it would appear that most of water activities in the region relate to surface water.

Currently the region has embarked on a lot of capacity building and information and data sharing activities on water resources through various networks. While membership to these networks is mostly limited to engineers and hydrologists who were initially associated with these activities, it would appear that membership had better be significantly increased to include actors in land-based activities like foresters, agronomists, and the like, who are now conspicuously missing in the networks. Further, given the adverse effects of climate change and variability on the environment as well as on activities of the people in this region, this is an opportune time for the region to take conscious steps to address the important issue of managing the link between forests and quality water supplies for the sustainability of both forest and water resources. This report provides a modest initial step in this direction, by highlighting key aspects related to the link between these two resources, as well as some

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issues that could be addressed by various stakeholders including researchers, local communities and policy makers.

This report has been made possible through collaborative efforts of the African Forest Forum and the Southern Alliance for Indigenous Resources (SAFIRE) in Zimbabwe. Dr. Phosiso Sola was responsible for writing this report and credit should be attributed to her for this work.

Prof. Godwin Kowero
Executive Secretary, African Forest Forum

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Executive summary

The SADC region has continued to recognise that water resources are essential to development and poverty alleviation. It is estimated that 70% of the regional surface water is shared between two or more member states. However a number of States suffer devastating droughts and it is projected that in the next 20-30 years three or four of the member States will be facing major water shortages if preventative measures are not adopted. It was in recognition of the importance of a coordinated approach to utilisation and preservation of water that the SADC member States embarked on a process that led to the signing of the Protocol on Shared Watercourses at the 1995 Summit in South Africa.

The protocol has formed a foundation for enhancing, guiding and enforcing regional management of water by affirming commitment to equity and binational and multinational relations on shared watercourses. It provides for the establishment and functioning of river basin institutions. There are fifteen major river basins shared by two or more countries and combined drainage areas of these international rivers cover over 78% of land area. Partnerships that have emerged at regional level have created regional consensus and common understanding in terms of capacity building needs and framework for institutional arrangements and legislative processes. However, collection and storage of water data is still a major challenge in the region. Most countries do not directly measure or report internal water resources data and estimates are produced using indirect methods.

Water in the SADC is unevenly distributed in both space and time. Two major disparities evident in the SADC region are the decreasing trend in rainfall southward and the increasing trend in economic and political power southward. It is not surprising, therefore, that water demand follows the development trend and that the level of water infrastructure investment is along the same trends. These disparities have lead to some potential and/or simmering conflicts in the region. These conflicts have been mitigated by a number of agreements to make shared waters a basis for cooperation rather than conflict. However, most of the agreements are purely inter-governmental agreements, State centric and do not ogre well with non-State actors.

The Southern African Development Community countries have made a lot of progress in developing institutional and policy frameworks for managing limited and fragile water resources. However, there is a general weakness in legal framework for addressing environmental issues especially forests in watersheds and catchments. It is therefore recommended that an integrated approach is adopted in managing shared water resources in the SADC to include forests and wildlife. It was against this background that the African Forest Forum commissioned a study on forest–water relations with the aim of identifying best practices and developing a policy of integrating forest in water legislative framework.

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CHAPTER 1 Introduction

PROMOTING SYNERGY AND STRENGTHENING COOPERATION OF MEMBER STATES ON WATER

The Southern African Development Community (SADC), made up of Angola, Botswana, the Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe (Figure 1), came into effect by the signing of a Treaty in August 1992 (ADF, 2005). When SADC was created the responsibility to coordinate regional development was delegated to member states with the Water Sector Coordinating Unit based in Maseru, Lesotho. In March 2001, a restructuring process was engaged and the 21 sector-coordinating units and commissions located in member states were abolished and replaced with four Directorates based at the SADC Secretariat in Gaborone, Botswana (ADF, 2005). These Directorates are:

1) Trade, Industry, Finance and Investment;
2) Infrastructure and Services;
3) Food, Agriculture and Natural Resources, and
4) Social and Human Development and Special Programmes.

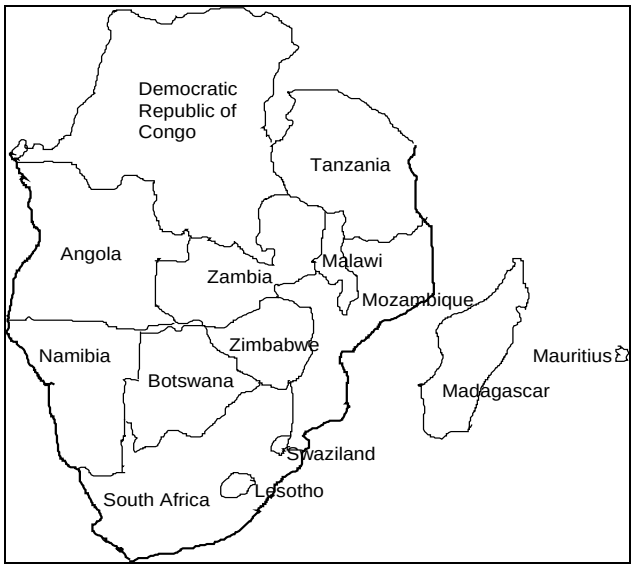

Figure 1 Countries of the Southern African Development Community

The Water Division is managed under the Directorate of Infrastructure and Services (ADF, 2005). Water resources are crucial to development and poverty alleviation in the SADC region (SARDC, unpublished). About 70% of the regional surface water is shared between two or more member states (Burchi and Mechlem, 2005; ADF, 2005). However, a number of States suffer devastating droughts and it is projected that in the next 20-30 years three or four of the member States will be facing major water shortages if preventative measures are not adopted (Burchi and Mechlem, 2005). It was in recognition of the importance of a coordinated approach to utilisation and preservation of water that the SADC member States embarked on a process that led to the signing of the Protocol on Shared Watercourses at the 1995 Summit in South Africa (Granit, 2000). The Protocol was subsequently revised to incorporate the Convention on the Non-navigational Uses of

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International Watercourses adopted by the United Nations General Assembly in 1997 (Conley, 1996) (Box 1). The revised protocol was then signed by the Heads of States on 7 August 2000 in Windhoek, Namibia, and implemented from the 22 September 2003 (Heyns, 2004). The SADC Protocol on Shared Watercourses aims at:

1) promoting and facilitating the establishment of shared watercourse agreements and shared watercourse institutions for the management of shared watercourses;
2) promoting a co-ordinated and integrated environmentally sound development and management of shared watercourses;
3) promoting the harmonisation and monitoring of legislation and policies for planning, development, conservation, protection of shared watercourses and allocation of the resources thereof;
4) promoting research and technology development, information exchange, capacity building, and the application of appropriate technologies in shared watercourses management.

The protocol has formed a foundation for enhancing, guiding and enforcing regional management of water by affirming commitment to equity and binational and multinational relations on shared watercourses (Conley, 1996). It provides for the establishment and functioning of river basin institutions. This has paved way for international development agencies to collaborate in research and management initiatives. In addition to the protocol, the SADC region embarked on a visioning process called regional vision for water in the 21st century. This was developed with a 25-year horizon and adopted by the regional water sector in 2000 as a contribution to the Africa and global water vision development process (Ramoeli, 2007). To realise this vision the region outlined a water policy and strategy and implemented a water programme (2005 – 2010) under the auspices of the Regional Strategic Action Plan for Integrated Water Resources Management and Development (RSAP-IWRMD). The specific content of the policy, strategy and objectives on the RSAP-IWRMD is presented in Box 1. Progress to date includes (Zhou, 2002; Granit, 2000; ADF, 2005; Ramoeli, 2007):

- the 1998 SADC Protocol on Shared Watercourse Systems that was revised in 2000;
- Regional Strategic Action Plan (RSAP I) for integrated water resources management (IWRM) and Development (1999 – 2004) with seven priority areas and more than 33 IWRM projects at regional and national level;
- SADC Vision for Water, Life and the Environment was developed and sets out the overall SADC 2000 Water Vision;
- the second Regional Strategy and Action Plan, RSAP II with priority IWRM projects was developed in 2005;
- the development of the 2005 Regional Water Policy;
- Regional Water Strategy developed in 2006 with financial support from UNEP.

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In southern Africa political commitment by Water Sector Ministries to address management of water resources on a national level through policy and legislative reforms and on the sub-regional level through the implementation of the SADC Water protocol is evident (Granit, 2000). On the regional level the SADC framework creates a good foundation for collaboration, awareness raising and trust. The sub-region has facilitated and adopted water reforms which were led by the SADC Water Division at regional level whilst national level activities were driven by member States. Progress on shared waters management has been marked by the move from mostly bilateral agreements toward a river basin approach (Ramoeli, 2007). A number of agreements for transboundary water management have been entered into including several bilateral and multilateral commissions, river commissions being established (ADF, 2005; Ramoeli, 2007). These included among others:

- Zambezi Watercourse Commission (ZAMCOM),
- Orange-Senqu Commission (ORASECOM)
- Okavango River Basin Water Commission OKACOM),
- Limpopo Watercourse Commission (LIMCOM),
- Zambezi River Authority (ZRA)
- Lesotho Highlands Development Authority (LHDA)

Although a number of instruments and programmes have been adopted and implemented issues of underground water are less visible (Christelis et al., 2007). In their research, Christelis and others concluded that the extent to which principles for surface water resources can be applied or adjusted to suit transboundary groundwater resource management have not received adequate attention and the existence of transboundary aquifers in the SADC region has not been investigated comprehensively. In addition lack of comprehensive information on the extent of aquifers, has made it even more difficult to institute management systems (Christelis, et al., 2007).

Box 1: Southern African Development Community regional water management policy and strategic objectives

Regional water policy and strategy	Strategic objectives of the RSAP-IWRMD
▸ Recognise water as an instrument for peace, cooperation and regional integration; ▸ Promote effective public consultation and involvement of users at all levels; ▸ Promote integrated people-centred development; ▸ Promote joint planning and the development of strategic regional	▸ Maintain and sustain an enabling environment for regional water resources development and management; ▸ Provide a framework for sustainable, effective and efficient planning and management of shared river basins at regional and related national levels; ▸ Promote and support strategic infrastructure development for regional

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infrastructure; ▸ Apply best practices (e.g. demand management and the polluter pays principle) for efficient use of available water resources.	integration, socio-economic development and poverty alleviation; ▸ Develop, promote and facilitate best practices regarding effective participation by various individual and institutional stakeholders in water resource development and management, including women, youth and other disadvantaged groups; ▸ Build and strengthen human and institutional capacity for sustainable management of water resources at basin, national and regional level.
UN Convention on the Non-navigational Uses of International River Systems ▸ Respect and apply the existing rules of international law and abide by the principles of equitable utilisation. ▸ Maintain a proper balance between resource development and conservation and enhancement of the environment to promote sustainable development. ▸ Pursue and establish close cooperation in the study and execution of all projects. ▸ Exchange available information on such watercourse systems. ▸ Use shared watercourse systems in an equitable manner and protect them adequately. ▸ Require any person intending to use the water for purposes other than domestic use, or intending to discharge all types of wastes into such waters, first to obtain a permit from the authority within the state concerned. ▸ Notify without delay other potentially affected states of any emergency originating within their respective territories. ▸ Take all measures necessary to prevent the introduction of alien aquatic species. ▸ Maintain and protect shared watercourse systems to prevent pollution or environmental degradation. ▸ Establish appropriate institutions for effective implementation of the protocol, for which a monitoring unit will be established under SADC, and the formation of river basin management institutions will be encouraged.	

Consequently, although a number of SADC countries had entered into agreements to establish water commissions, in most cases no specific reference was made to groundwater because most of the agreements had focused only on the development and management of surface water resources (Turton et al., 2003; Christelis et al., 2007). Recognising this weakness the region developed a Regional Groundwater Management Programme (SADC,

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2000) with the objective of promoting the sustainable development of groundwater resources at a regional level and incorporating research, assessment, exploitation and protection. In March 2008, SADC Ministers of Water called on River Basins in the region to include groundwater management strategies in their integrated water resources management activities to maximize the role of groundwater towards economic integration and poverty alleviation (SADC, 2008).

EXTENT OF SHARED WATER RESOURCES IN SADC

The SADC region (excluding the Democratic Republic of Congo) has a total land area of nearly 6.8 million km^2. Renewable freshwater resources are estimated at an annual average of 650 billion m^3, distributed amongst rivers, lakes and ground water bodies. There are fifteen major river basins shared by two or more countries and combined drainage areas of these international rivers cover over 78% of land area. They range from the Congo River Basin (3,800,000 km^2) to Umbeluzi River Basin (5,500 km^2). The Zambezi River Basin (1,400,000 km^2), transverses the highest number of countries, covering eight SADC member States. Even the small Umbeluzi River is shared by Mozambique and Swaziland. One of the major characteristic features in the region is the complex water rights and potential conflicts over utilisation of the shared resources (SARDC, unpublished; Boroto, 1998). The Congo, Zambezi and the Orange River basin are the largest in the region. Figure 2 shows the extent of river basins in the mainland SADC countries.

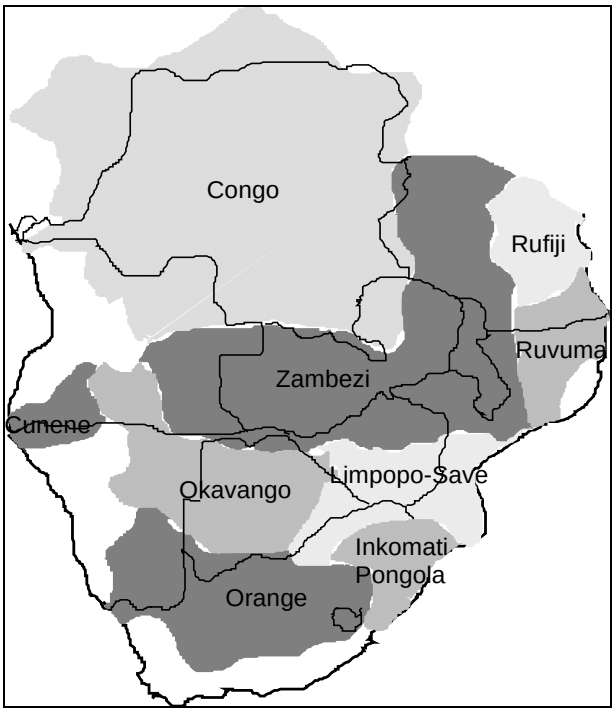

Figure 2: Location of major river basins in the SADC sub-region. Based on Gleick (1998)

Groundwater, through shallow wells, deep wells and bore holes, is one of the main sources of domestic water to many people in southern Africa. The recharge capacity of the aquifers, which is often the limiting factor for development, depends on the rainfall and infiltration rates over the contributing catchment (Conley, 1996). As groundwater is unseen and difficult to quantify in comparison to surface water, general focus and interest has been towards surface water. The limited awareness and understanding of groundwater availability, vulnerability and distribution pose major planning and management challenges (Beetlestone, 2009). To address the challenges in groundwater management, SADC has been facilitating

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a number of activities geared towards putting in place a framework and specific tools and activities for the management of shared aquifers. This is being done under the Groundwater Management Programme (SADC, 2008). There are 20 researched and documented transboundary aquifers in the sub-region (Figure 3).

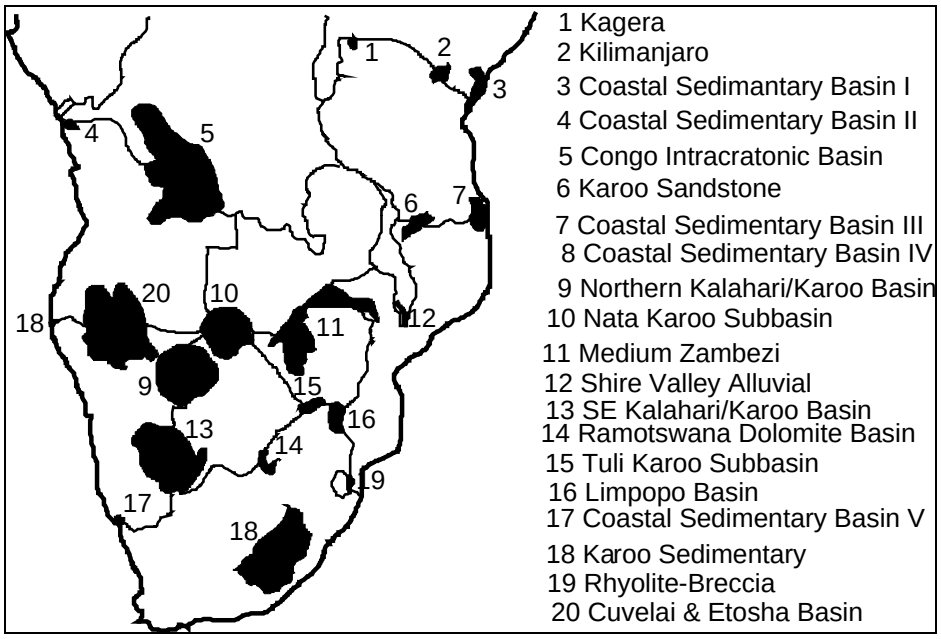

Figure 3: Transboundary aquifers in the SADC sub-region (Based on Vasak, 2008).

LEARNING AND SHARING EXPERIENCES AND BEST PRACTICES

Development of regional protocol

The SADC framework is a good vehicle and platform for collaboration and dialogue in the sub-region. This is evidenced by the regional cooperation that has resulted in the Protocol on shared Water Systems signed in 1995 and amended in 2000. Regional Strategic Action (RSAP) plan which was approved in 1998 with 31 project concepts provided guidance towards better management of water resources and civil society involvement, especially NGOs, that has continued to support and implement innovative IWRM projects in partnership with the private sector and academic research institutions. Partnerships that have emerged at regional level have created regional consensus and common understanding in terms of capacity building needs and framework for institutional arrangements and legislative processes (Granit, 2000).

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Formation of river basin organisations and their mandate

Best practices from integrated water resources management (IWRM) suggest that river basins should be regarded as management units at local, national and regional level. In addition, it has been recommended that an ecosystem approach should be used in land use management so as to integrate water resources. Furthermore, demand driven management practices should be adopted including recognition of the economic value of water (Granit, 2000). Although river basins are said to be the best unit for managing transboundary water resources, challenges still exist in these arrangements. For example, authority and responsibility are diffuse and in most cases decision making remains with local and central governments while activities have to be facilitated by the local organisations. In addition, in order to facilitate development the river basin organisation needs reliable sources of funds. This has proved to be difficult as international organisations have a competitive edge in raising funds; consequently, fundraising has been facilitated at higher levels and further distorted power relations (Christelis et al., 2007).

Integration of ground water management

To ensure ground water management, any initiative in the SADC to improve transboundary aquifer management should not be seen in isolation and limited to individually shared aquifer systems. Instead there should be an integrated initiative that is harmonised with existing regional instruments, existing transboundary water management institutions and coordinated with other programmes already initiated in the SADC (Christelis et al., 2007). Crucial in the management of transboundary aquifers is the information on the behaviour of groundwater systems on both sides of the border. As such proper hydrogeological characterization of a specific aquifer system combined with an understanding of the legal, socioeconomic, institutional and environmental issues of the countries sharing the groundwater resource is crucial for management (Christelis et al., 2007).

Sectorial approach

Another challenge is that key sector Ministries, such as Foreign Affairs and Finance, are only involved to a limited extent. It is believed that more aggressive engagement of other Ministries would be instrumental in facilitating planning and implementation of projects with regional dimensions (Granit, 2000). Countries in southern Africa have disparities in terms of economic and political development and capacity which resulted in unbalanced planning and management. Therefore, it is crucial to include capacity building components at national level in shared river basin initiatives hinging on effective stakeholder participation (Granit, 2000).

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Stakeholder participation

Effective stakeholder participation has proved to be crucial for successful shared water resources management and the case of the Okavango demonstrated this. The basin extends across three countries (Angola, Namibia and Botswana) covering an area of some 700 000 km^2 and is home to over 600,000 people most of which are in Angola (35%) (Lotfy, 2008). Even though Botswana has only 15% of the population and 18% of the catchment area, it is the main user of the basin for tourism. Namibia uses less than 0.2% of the river water for irrigation schemes alongside the river (Lotfy, 2008). After an inter-State project agreement in 1994, the Permanent Okavango River Basin Water Commission (OKACOM) was formed. The OKACOM is the highest-level regional institutional body for the Okavango River Basin advising the respective Governments on the conservation, development and utilisation of the water resources of the Okavango River Basin (Bethune, 2006; Lotfy, 2008).

OKACOM has been very active and provides fora for discussion and negotiation between member States and various interest groups. At its annual meeting held in Maun in 1999, OKACOM approved and endorsed the “Every River has its People” project, requesting regional partners to assist OKACOM by developing the capacity of local communities within the basin to enable them to participate more fully in future decision making. The OKACOM has promoted this concept to facilitate exchange of information between water managers, government departments, local communities and traditional leaders (Lotfy, 2008). One of the most successful platforms of public discourse is the Basin-wide Forum (BWF) which is a regional committee of local authority and community members with 30 members from each country.

Accurate data collection and reporting

Collection and storage of water data is still a major challenge in the region. Most countries do not directly measure or report internal water resources data and estimates are produced using indirect methods (SARDC, unpublished).

Value of water

In the SADC region, water is not yet widely considered as an economic good with an economic value. Current pricing strategies do not encourage water conservation and its sustainable management. It has been suggested that a “user pays principle” which encourages consumers to appreciate that water is an economic good that must be paid for and not something free to be wasted, be adopted and implemented (Mutembwa, 1998). South Africa and Zimbabwe have adopted and made some strides in implementing this approach.

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Capacity building

Technical capacity is pivotal in sustainable water use, as timely accurate and adequate information is required in decision making. This makes human resource development urgent in all aspects of water planning and management (Mutembwa, 1998). The region has benefited from two initiatives.

1) The WaterNet, a capacity building initiative, that has been active over the last 15 years focusing on building the regional institutional and human capacity in Integrated Water Resources Management (IWRM) through training, education, research and outreach through the harnessing of the complementary strengths of member institutions in the region and elsewhere.
2) The Water Research Fund for Southern Africa (WARFSA) has been active over the last years in the implementation of multi-disciplinary research projects in IWRM in the region aimed at ensuring sustainable development of water resources.

POTENTIAL FOR COLLABORATION IN MANAGING AND USING WATER RESOURCES

The Southern African Development Community countries have made a lot of progress in developing institutional and policy frameworks for managing limited and fragile resources. In some countries, the post-independence tendency has been an over-reliance on inherited colonial laws and regulation (command and control instruments) which have proved ineffective under weak legal and institutional environments (SARDC, unpublished). Additionally, there is a general weakness in legal framework for addressing environmental issues related to the management of international waters. National water policies generally have weak environmental provisions but the provisions for international waters dimensions are even weaker or non-existent, as they do not adequately cover assessment and management of the downstream environmental flow requirements. For instance, Mozambique one of the downstream riparian States, in nine river basins, bears the greatest impacts of upstream development (SARDC, unpublished).

However, a lot of policy and legal framework reviews have been undertaken in many countries such that some of the instruments, such as the Water Acts of Angola, South Africa and Zimbabwe, are fairly new. While most countries have legislative instruments in place to deal with pollution, the implementation is often ineffective. Most stakeholders including individuals and governments, and especially the private sector, have lacked the capacity, but also the political will that is necessary for effective pollution control.

The general broad framework for managing water resources is provided for by the SADC protocol on shared water resources. However, regional success and conflict management is dependent on national progress and commitment. A few challenges still exist and are being

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exhibited by time taken to agree on bilateral arrangements. The constraint is that most national legislation has not been fully developed and that which exists is not exactly in tandem with regional protocol. Some national legislations are still very State-centric, with water resource management left to the State. Others have embarked on aggressive decentralisation of water resources management to local level making river basin organisation key in this regard. There are also some countries that have moved towards privatisation. These differences in themselves make harmonisation of regulations a mammoth task. Table 1 is a summary of national water management policies and regulations in the SADC member states. Literature has it that the most successful management systems of transboundary resources are based on the institutional bricolage approach (Bogoe, 2008). In this approach local stakeholders are key players. However this has its challenges, such as:

- local institutions lack adequate information thus fall victim to external actors;
- legal knowledge at local level is mostly scant, statutory laws not known or understood;
- most RBOs have representation which might not be adequate;
- participation is expensive and most actors do not use it fully;
- most transboundary initiatives are inclined towards external interests driven by outsiders;
- gaps between policy and practice exist and operation is more inter governmental;
- most RBOs do not provide conflict resolution mechanisms and little attention is paid to conflict prevention.

Table 1: Policies and legislation and institutions for water management in SADC

Country	Management unit	Role of the State	Stakeholder participation
Angola	Ministry of Energy and Water	Water Act-1996	
Botswana	Department of Water Affairs (DWA) and the Water Utilities Corporation (WUC) • Water Act of 1968	Department of Water Affairs (DWA) and the Water Utilities Corporation (WUC) • manage water supply, responsible for managing the country's water supply systems.	
Malawi	Ministry of Water • Water Resources	The Department of National Parks and Wildlife and the Department of Forestry	Water Resources Areas (WRAs), subdivided into 78 Water Resources Units

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Country	Management unit	Role of the State	Stakeholder participation
	Board • responsible for the granting of water rights for abstractions, discharge of effluents. • Water Resources Act 1978	• responsible for the protection of catchment areas that fall within their jurisdiction	(WRUs) • all water abstractions must be licensed and industrial effluent discharged into public water bodies • permits are required for abstractions used
Lesotho	Department of Water Affairs • Water Resources Act No. 22 of 1978	Several orders and acts administered by different departments without any consistency or overall guidelines.	
Mozambique	National Water Directorate (DNA) • National Water Policy 2000 • Water Law Act No. 16 of 1991	The National Water Directorate (DNA) within the Ministry of Public Works and Housing (MOPH) • in charge of policy making and implementation, overall planning • control the irrigation systems and collect water fees	The Regional Water Administrations (ARAs) are basin authorities • responsible for water development and management
Namibia	Department of Water Affairs NamWater, a parastatal institution • responsible for bulk water supply; • Water Act 54 of 1956	Department of Water Affairs (DWA) within the Ministry of Agriculture, Water and Rural Development, • water resource development projects	Regional level Water Point Committees (WPCs) Water Users' Associations (WUAs) at the river-basin level, • for local water control and pricing (community pay for operation and maintenance costs but by 2007 full cost recovery was to be achieved.
South Africa	Department of Water	Ministry of Water Affairs and Forestry, through the	All water abstractions above

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Country	Management unit	Role of the State	Stakeholder participation
	Affairs and Forestry Water User Associations (WUA) and Catchment Management Agency (CMA). • Water Services Act of 1997 and the National Water Act of 1998	Department of Water Affairs and Forestry (DWAF) • monitors surface water and groundwater resources, formulates the national water strategy, and is responsible for the implementation of the Water Act.	1000 l/day must be licensed
Swaziland	Swaziland Environment Authority Water Apportionment Board has determined apportionments based on normal flow Water Act of 1967, Water Bill of 2002	A Government Water Control Area may be declared if it is deemed necessary in the public interest to control the abstraction, utilisation, supply, or distribution of the water	Water Apportionment Boards. It is envisaged that they would be transformed into River Basin Authorities
Tanzania	Ministry of Water	Water Utilisation (Control and Regulation) Amendment Act No.10 – 1981	Temporary Standards – 1978
Zambia	Water Board operates under the Water Act, Cap 198 (1948). • Environmental Council of Zambia	Department of Water Affairs, Water Board and National Water Supply and Sanitation Council, • charges abstraction fees	• Residents Development Committees • Water Management Committee.
Zimbabwe	ZINWA, a parastatal agency under WATER Act of 1998		• Seven river catchment councils • Water permits of limited duration which will be allocated by Catchment Councils. • Polluter pays

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CHAPTER 2 Management of Water Resources in SADC

WATER DISTRIBUTION AND AVAILABILITY

Fresh water is a basic need and right for all human populations but is increasingly becoming scarce, mismanaged and polluted the world over. It has been documented that the earth's water is 1.5 billion km3 of which only 2.7% is fresh and the rest is marine. Additionally, only 0.36 % of fresh water is readily available to humans in rivers and lakes as 77.3% is frozen in ice, 22.4% is in underground aquifers (Mutembwa, 1998; Burchi and Mechlem, 2005; Bogoe, 2008). The SADC region is predominantly arid or semi-arid with approximately 65% of the land area classified as almost arid or semi-arid. In the sub-region only 43% receives rainfall of more than 1,200 mm per year and substantial proportion of 22% receive less than 400 mm per year (Table 2).

Table 2: Precipitation in Southern Africa Development Community countries.

State	Annual rainfall (mm)	Total dam capacity (10^6 m^3)	Rainfall range (mm)	Average rainfall (mm)	Potential evaporation range (mm)	Total surface runoff (mm)
Angola	No data		25–1600	800	1300–2600	104
Botswana	416	380 (1995)	250–650	400	2600–3700	0.6
Lesotho	768	2820 (2005)	No data	No data	No data	No data
Malawi	1181	43 (2002)	700–2800	1000	1800–2000	60
Mauritius	2041	93 (2003)	No data	No data	No data	No data
Mozambique	1032	64474 (2000)	350–2000	1100	1100–2000	275
Namibia	265	708.5 (2001)	10–700	250	2600–3700	1.5
South Africa	495	28500 (2002)	50–3000	500	1100–3000	39
Swaziland	788	582 (2002)	500–1500	800	2000–2200	11
Tanzania	1,071	4196 (2002)	300–1600	750	1100–2000	78
Zambia	1020	106000 (2002)	700–1200	800	2000–2500	133
Zimbabwe	657	103000 (2003)	350–1000	700	2000–2600	34

Sources: Pallett (1997), Earth Trends (2003). Figures in brackets indicate the reference year of the data.

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Precipitation over southern Africa is almost entirely in the form of rain, with short periods of snow over limited mountainous areas in South Africa in winter. Total annual precipitation over southern Africa amounts to approximately 5,105 km^3. Year-to-year rainfall variability can be as high as 30–35%; e.g. the rainfall in the 1990s was 20% lower than in the 1970s (Chenje and Johnson, 1996). Of this amount, 50% falls on the five major catchments of the region, namely, the Zambezi (1,328 km^3), Okavango (367.5 km^3), Orange (366.5 km^3) and Limpopo (256.1 km^3) (Cumming, 1999). In summary, according to Hamilton (2008), the SADC region is characterised by:

- multiple shared water courses (15) and aquifers;
- high spatial and temporal variability in water resources availability;
- prevalence of droughts (91/92, 94/95) and floods (87/88, 99/2000, 2001);
- high levels of poverty and lack of access to safe drinking water and sanitation;
- widespread food insecurity due to low agricultural production.

Rainfall in southern Africa is concentrated in the north close to the equator and decreases southwards. Mean annual rainfall is less than 750 mm and range from 100 mm in the western parts to 1500 mm in the eastern parts. An average of 65% of rain water evaporates immediately after rain fall. Evaporation is much lower in relatively cooler and more humid areas but can be as high as 83% in Namibia (Mutembwa, 1998; Beekman et al., 2003; ADF, 2005). Of the remaining 17%, 14% is lost through evapotranspiration, 1% recharges groundwater and only 2% remain to be harvested by dams. Consequently northern basins have more water than those in the south although they have much higher runoff per unit area than those in the south. For example, unit runoffs for the Orange, Zambezi and Congo basins are about 12 mm, 90 mm and 300 mm, respectively (Conley, 1996; ADF 2005). In fact, southern Africa as a whole has inherently low runoff, which affects both surface water river flows and groundwater recharge. With predictions of a drier future due to climate change increasingly low ground water recharge cannot be avoided (SARDC, unpublished; Conley, 1996; Turton et al., 2003).

Thus, water in the SADC is unevenly distributed in both space and time, for instance South Africa, Namibia, Botswana and Zimbabwe have the least water available (SARDC unpublished; Conley, 1996). All countries in southern Africa, beside Angola and Zambia, have scarce fresh water; however, symptoms of scarcity are being experienced everywhere. The main challenges to fresh water management in southern Africa include (Lotfy, 2008):

- poor technical and financial capacity institutions;
- lack of adequate political and financial support from member countries; thereby affecting the performance of a number of regional and basin level institutions;
- low investments in water resources management, including pollution control and inadequate legislative reforms and enforcement;

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- decline of the quality of data collected is making it difficult to provide adequate and accurate information needed for water resources assessment and development activities at national and basin levels.

Angola, Mozambique and Zambia have relatively higher per capita renewable water resources of close to 10,000 km^3 whilst, Lesotho, Malawi, South Africa and Zimbabwe have volumes of about 1,000 km^3. In terms of water usage, Mauritius, South Africa, Swaziland and Zimbabwe are using more than 20% of the renewable water resources. Additionally, nearly the whole of Mozambique, South Africa, Swaziland, and Zambia have less than 55% of their populations having access to clean water (Table 3) (Earth Trends, 2003). A brief summary of water profiles in the individual SADC countries is given below. Currently, yearly variation in rainfall is between 25-30%. However, with climate change, it has been predicted that annual rainfall will decrease by up to 5% and this will be experienced in Namibia, Mozambique, and parts of Zimbabwe and South Africa (SARDC, unpublished).

Table 3: Fresh water availability and use in the SADC member states

State	Percentage population with clean water	Renewable water resources		Annual usage			
		Total $10^9m^3/yr$	Per capita m^3/yr	Year of data	Total $10^6m^3/yr$	Per capita m^3/yr in 2000	% of Total actual renewable
Angola	No data	158	13,203	1987	500	54	0.4
Botswana	95	12.2	6,819	2000	194	112	1.6
Lesotho	76	3	1,679	2000	43.6	24	1.4
Malawi	67	17.28	1,401	2000	1,005	88	5.8
Mauritius	100	2.75	2,231	2003	725	594	26
Mozambique	42	217.1	11,318	2000	635	36	0.3
Namibia	80	17.7	8,809	2000	300	158	1.7
South Africa	55	50	1,106	2000	12,496	284	25
Swaziland	52	4.5	4,164	2000	1,042	998	23

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State	Percentage population with clean water	Renewable water resources		Annual usage			
		Total $10^9 m^3/yr$	Per capita m^3/yr	Year of data	Total $10^6 m^3/yr$	Per capita m^3/yr in 2000	% of Total actual renewable
Tanzania	87	93	2,469	2002	5,184	143	5.6
Zambia	55	105.2	9,630	2000	1,737	167	1.7
Zimbabwe	83	20	1547	2002	4205	328	21

Source: Earth Trends (2003).

CONFLICTS AND CHALLENGES

Two major disparities evident in the SADC region are the decreasing trend in rainfall southward and increasing trend in economic and political power southward. It is not surprising, therefore, that water demand follows the development trend and that the level of water infrastructure investment is along the same trends. Botswana, Namibia, South Africa and Zimbabwe have invested a lot in ensuring renewable water resources keep up with the demand from population and economic pressure. Zimbabwe and South Africa have the highest number of dams which in some cases even disadvantaged the countries downstream. For instance, the Save basin has been so intensively regulated by dams that it is virtually dry in Mozambique; so is the case with the Orange River which ends up being seasonal at the mouth with the Atlantic Ocean. Additionally, South Africa consumes 80% of the water in the region but contributes only 10% to the total renewable water resources (Bogoe, 2008). Relations between Namibia and Botswana are also strained by Namibia's Eastern National Water Carrier proposal to draw water from the Okavango to supply towns in Central and Eastern Namibia, as well as Windhoek.

The Lesotho highland water project which aims at selling water to South Africa in order for Lesotho to earn foreign currency. The noble arguments were that South Africa needed water for industrialisation in Gauteng region whilst Lesotho needed water for mining and industrial sector. However, it turned out that the needs of Lesotho were underestimated and the country might not afford to off load such huge volumes of water to South Africa (Bogoe, 2008).

In the Kunene river basin, Angola wants to construct a dam at Baynes whilst Namibia indicated the site is too small instead they prefer the Epupa site as it will make the third largest dam in the world. However, there is strong resistance from semi-nomadic Himba

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clan that live on both sides of the river, regardless of political boundaries. Construction of a dam at Epupa will destroy the indigenous Himba people's lifestyle, livelihood sources and anchor of their spiritual and culture values e.g. graves of their ancestors will be drowned (Bogoe, 2008).

Zimbabwe has proposed a dam at Batoka Gorge but Zambia claims this would compromise the countries hydro power generation at Victoria Falls. There is also a conflict over the Kariba dam about preferred use between fishing in Zambia and tourism in Zimbabwe (Bogoe, 2008).

As far back as the 1930, Zimbabwe has had a proposal to draw water from the Zambezi River to supply the drought prone southern region of Bulawayo. This was further complicated by Botswana requesting to extend the pipe line to Gaborone and of course South Africa added their own petition for the extension of the pipeline, even if they are not a Zambezi riparian State. No agreement has been reached yet (Bogoe, 2008).

These disparities have lead to some potential and/or simmering conflicts in the region. These conflicts pose huge dangers as they have been mitigated by a plethora of agreements that forced SADC to embark on a campaign to make shared waters sources a basis for cooperation rather than conflict. This cooperation has been packaged and marketed such that 'agreements on integrated and cooperative management of transboundary river basins are of mutual benefit in economic development for member States. However, most of the agreements are purely inter-governmental agreements, State centric and do not ogre well with non-State actors (Bogoe, 2008).

MANAGEMENT OF WATER RESOURCES IN INDIVIDUAL SADC COUNTRIES

Botswana

Botswana has five major river basins four of which are internationally shared. The South Interior basin, an endorheic basin, is the largest covering 63% of the country and is inclusive of the Kalahari Desert and Mkgadikgadi pans. Limpopo basin is the second largest covering 24% of the country in the east whilst the Zambezi only covers 2% in the north. The others are Orange (12%) and the Okavango (9%) in the North West. The Okavango, together with south Interior, the Chobe and Linyati Rivers, account for 95% of all the surface water in this country. However, low rates of surface runoff and groundwater recharge are typical with internal rivers flowing only up to 75 days per year. The total dam capacity in Botswana was 380 km^3. Ground water plays a critical role, supplying two-thirds of the water consumption. Estimations are that over 21,000 boreholes exist in the country although some are in disrepair. Renewable surface water resources are calculated to be 12.2 km^3 with consumption of 195 m^3 per year. Due to the eminent challenges, an innovative project

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on recycling wastewater for irrigation has been developed. Botswana is signatory to and participates actively in the OKACOM, ORASECOM and ZAMCOM which are transboundary river basin commissions for the management of the Okavango, Orange and Zambezi rivers respectively (Matlock, 2008).

Malawi

Malawi is generally considered to be relatively rich in water resources, which are stored in the form of lakes, rivers, and aquifers. The Zambezi basin covers 91% of the country. There are two main water sources, Lake Malawi (28,760 km^2) part of the Zambezi basin and Lake Chilwa which is shared with Mozambique. There are also two other smaller lakes, Chiuta and Malombe covering 303 km^2. In total there are nine big dams and 700,750 smaller dams giving a total dam capacity of 43 km^3 (Kundell, 2008a).

About 67% Malawians have access to clean water. It has been estimated that more than 30,000 boreholes have been drilled and a number of shallow wells sunk. Total renewable surface water was estimated at 17.8 km^3 per year and per capita consumption of 1,005 m^3 per year but projected to reach levels of scarcity by 2025. A number of wetlands are spread over the country and these include Elephant and Ndindi marshes in the Lower Shire Valley, the Vwaza Marsh in the Rumphi district, and the Chia Lagoon in Nkhotakota. The major wetlands of Lake Malawi and Lake Chilwa are closely monitored under the RAMSAR and UN Biodiversity Conventions (Kundell, 2008a).

A great part of Malawi's water resources, such as Lake Malawi, Lake Chilwa, Lake Chiuta, and Shire, Ruo and Songwe Rivers are shared with the neighbouring countries of Mozambique and Tanzania as transboundary waters. To facilitate management of these water resources Malawi has been implementing two bilateral projects, stabilization of the Songwe River course jointly with the Tanzania, through a Joint Permanent Commission of Cooperation (JPCC). A Joint Water Commission has also been set up with Mozambique. Malawi is also actively participates in the Zambezi Watercourse Commission (ZAMCOM), since Lake Malawi and the Shire River system form sub-basins of the Zambezi watercourse. No major conflicts have arisen (Kundell, 2008a).

Mozambique

Mozambique has 104 identified river basins that drain the central African highland plateau into the Indian Ocean. The majority of the rivers are seasonal, flowing up to four months per year. The country's total dam capacity is 64,474 km^3 on the Zambezi River with storage capacity of 39.2 km^3. In addition to the two main lakes, there are more than 1,300 small lakes. Ground water plays an important role both in urban and rural areas. Well yields in the Zambezi and Incomati basins are up to 70,000 m^3 per day. Total renewable water resources were 217.1 km^3 and consumption of 36 km^3. Almost all of Mozambique's important water is shared with other countries (Kundell, 2007).

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1) The Incomati basin, shared with South Africa and Swaziland. Water from this basin is intensively used in South Africa, mainly for irrigation.
2) The Limpopo basin, shared with South Africa, Botswana, and Swaziland. The largest irrigation scheme of Mozambique, Chokwé, is located in this basin. This is one of the most intensively used and populated as such that the river is dry for three or four months in a normal year and even up to eight months in a year in drought years.
3) The Maputo basin, shared with South Africa and Swaziland, has an area of rich biodiversity recognized by UNEP and having the status of a world conservation area.
4) The Pungue basin is shared with Zimbabwe.
5) The Rovuma basin is shared with the United Republic of Tanzania.
6) The Save basin, shared with Zimbabwe is now permanently dry due to intensive use in Zimbabwe.
7) The Umbeluzi basin, shared with South Africa and Swaziland is used to supply water to Maputo and irrigation schemes in Mozambique and Swaziland.
8) The Zambezi basin, shared with Angola, Namibia, Botswana, Zambia, Zimbabwe, Malawi, and the United Republic of Tanzania is the most important in Mozambique as it accounts for about 50% of the surface water resources of the country and about 80% of its hydropower potential at the Cabora Bassa dam.

A number of agreements that have culminated in river management and commissions have been signed between Mozambique and upstream neighbouring countries regulating the use of shared watercourses including LIMPCOM and ZAMCOM.

Lesotho

Lesotho is located entirely within the Orange River basin and a member of the Orange-Sengu River Commission (ORASECOM) created in 2000. Lesotho is also a partner with South Africa on the Lesotho Highlands water Project (LHWP) with a treaty signed in 1986. The project is aimed at supplying water to South Africa through mutual transfer water while providing Lesotho with facilities to generate its own electricity (Kundell, 2008b). After completion of all phases by 2020 the project will convey 2.2 km^3 per year of water to South Africa. The other major sub-basins include:

- the Senqu (Orange), which drains two thirds of Lesotho (24,485 km^2); four large dams will be constructed under the Lesotho Highlands Water Project (LHWP).
- the Makhaleng, with a catchment area of 2,911 km^2;
- the Mohokare (or Caladon) marks the border with South Africa and has a catchment area of 6,890 km^2.

Although ground water is important, yields are very low as only 12% of the wells yield above one litre per second. The Lets'eng-la-Letsie wetland in the Quthing district was tentatively designated as a Ramsar site by the Government as part of its accession to the Ramsar

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Convention (Kundell, 2008b). Major dams that have been constructed in the framework of Phase I of LHWP include:

- Katse Dam on the Malibamatso River catchment in the Central Maluti Mountains;
- Mohale Dam on Senqunyane River catchment and has a storage capacity of 0.86 km^3
- Muela Dam acts as the tailpond of the Muela hydropower station;
- Mashai Dam (3.3 km^3), Tsoelike Dam (2.22 km^3), and Ntoahae Dam will be constructed in the later phases of the project.

Namibia

A number of dams have been constructed and their total capacity is 708.5 km^3. Most to the rivers in Namibia are seasonal in nature; their crucial contribution is the channelling of water to a number of wetlands that are of national importance. These are swampy or marshy and are often used for hunting and seasonal fishing, domestic stock farming, small mining enterprises and small-scale gardening. The ecology of these wetlands is very fragile and over-exploitation of water resources, especially on the Kunene River, and the Orange River is a potential threat to wetlands. The Namibian government has proactively initiated several interventions for their protection and management including listing as Ramsar sites. There is a great increase in the use of treated wastewater, especially for irrigation. Treated water can be as much as 40% of freshwater consumption. Wastewater recycling is practiced by a number of mines and future estimates are as high as 10 million m^3 per year. In addition to waste water cycling, Namibia has embarked on a coastal desalination project. The main river basins in Namibia are shared with other countries (Kundell, 2008c). The Zambezi River Basin with a basin area of 17,426 km^2 in Namibia is the country's richest water source and is shared with Angola, Botswana, Malawi, Mozambique, Tanzania, Zimbabwe, and Zambia. The Okavango River basin shared with Angola and Botswana has an area of 106,798 km^2 in Namibia. The southwest coast basin including the Kunene River (shared with Angola) covering an area of 17,549 km^2.

The Orange River Basin has an area of 219,249 km^2 in Namibia and is shared with Botswana, Lesotho, and South Africa. The flow in the lower parts of the Orange has been reduced by nearly two thirds, especially over the last 35 years since the start of the Orange River Project (ORP) in South Africa. This project transfers water from the Caledon and Orange Rivers to rivers outside of the basin that flow towards cities in the Eastern Cape Province in South Africa. The interior basins, including the Cuvelai River basin and part of the Kalahari desert, cover an area of 199,718 km^2. Namibia gets up to 30% water from shared rivers making the country highly dependent on its neighbours, especially South Africa and Angola (Kundell, 2008c). Consequently, Namibia has entered into various agreements to secure water resources. These include:

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- the Permanent Joint Technical Commission (PJTC) of 1990 between Angola and Namibia on the Kunene River Basin and Joint Operating Authority tasked with the operation of the regulating dam on the Kunene River at Gove in Angola;
- the Joint Permanent Water Commission (JPWC) of 1990 between Botswana and Namibia concerning the development and utilisation of water resources of common interest in the Kwando-Linyanti-Chobe System, Zambezi River Basin the Okavango River before OKACOM was formed;
- the Permanent Okavango River Basin Water Commission (OKACOM) between Angola, Botswana, and Namibia was established in 1994 and oversees developments in the Okavango basin;
- The Permanent Water Commission (PWC) of 1992 between Namibia and South Africa that manages water matters of mutual concern.

South Africa

South Africa is the most water-stressed country in the region, getting 80% of its water from neighbouring countries. The country has the highest number of agreements virtually with every neighbour and now plans to tap waters from the basin in which the country is not riparian State. There are typically four river systems with Orange River basin being the largest covering about 48% of the country (606,000 km2), with Vaal and Caledon as main tributaries (Kundell, 2008d). The other river systems are:

- Limpopo system, with major tributaries such as the Crocodile and the Elephants River; this basin has a mean annual runoff of 5.1 km^3 draining approximately 14% into the Indian Ocean;
- Tugela River, cover approximately 29% of the country with a mean annual runoff of 28 km^3;
- the other rivers cover approximately 9% including Olifants and the Breede Rivers systems that drain the Fold Mountains of the south-western Cape into the Atlantic and Indian Oceans with a mean annual runoff of 5 km^3.

The total surface water available is 50 km^3 and consumption was 12.496 km^3. South Africa is one of the countries with the highest number of dams in world, with total dam capacity of 28,500 km^3. With ever increasing demand and dwindling water resources, South Africa has diversified to sea water. Desalination and demineralization plants have been installed and supply more than 18 million m^3 of water per year. South Africa has championed most of the transboundary water management initiatives and is part to all the commissions including ORASECOM and LIMPCOM. Several bilateral agreements were also made with the neighbours to facilitate water access or transfer like the LHWP, KOWA and other joint water commissions (Kundell, 2008d).

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Swaziland

The four main river systems in the country are Komati and Lomati rivers in the north and in the south, the Mbuluzi and Usuthu Rivers, rising in Swaziland and flows into South Africa before entering Mozambique. Pongola River is the fifth system contributing to surface water. A large proportion (42%) of the surface water comes from South Africa. The total renewable water resources of the country are 4.51 km^3 per year and consumption of 1,042 m^3 per capita per year. The total dam capacity of the ten major dams is about 585 km^3. Seven of the dams are used for irrigation, one for hydroelectric generation and one for domestic water supply. Swaziland has also entered into various agreements for managing water resources in collaboration with neighbouring countries (Zaikowski, 2008):

- Joint Water Commission treaty signed with South Africa in 1992 to advise the two countries on all technical matters relating to management and use of water resources of common interest;
- Treaty on the Development and Utilisation of the Water Resources of the Komati River Basin of 1992 entered between the governments of Swaziland and South Africa. This resulted in the formation of a bilateral company in 1993, the Komati River Basin Water Authority (KOBWA).

Zambia

Zambia lies entirely within two large river basins, the Zambezi River basin and the Congo River basins. There are five main internal river systems. There are about 1,700 dams with total capacity of about 106 km^3, inclusive of 50% of Lake Kariba (94 km^3) on the Zambezi River, which is shared with Zimbabwe. The information on dams is fragmented and unreliable. Wetlands, including dambos are a major source of livelihood, cultural and spiritual attachments and cover 3.6 million ha or 4.8% of the total land area. The total renewable water is about 106, 000 km^3 (Kariba contributing 94,000 km^3). Most of the water (80%) is internally produced. Water use was about 167 m^3 per capita per year. The Zambezi and Congo rivers benefit from three major river systems.

- The upper Zambezi River system originates in Angola and is joined by the Luangwa and Kafue tributaries in Zambia and eventually flowing into Mozambique after forming the border with Zimbabwe.
- The Kafue River system covers an area of 152,000 km^2 and has two important dams, the Itezhi-Tezhi dam and the Kafue Gorge dam.
- The Luangwa River has a catchment area of 165,000 km^2 and drains most of the central parts of the country before joining the Zambezi River.
- In the north, the Chambeshi River and the Luapula River supply water to the Lakes Mweru and Mweru-Wantipa and drain their water into the Congo River system.
- The small Tanganyika drainage system is also part of the large Congo River system.

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Zimbabwe

Zimbabwe is generally a dry country with only 37% of the country receiving adequate rainfall for production. For the rest of the country, the rainfall is insufficient, erratic and unreliable, making supplementary or full-time irrigation indispensable for successful agriculture. Zambezi River, to the north, and Limpopo River in the south, comprise the major river systems on which the seven river catchments are based. The sub-catchments are Save, Runde, Mzingwane, Gwayi, Sanyati, Manyame and Mazowe. Like South Africa, the Zimbabwe government embarked on an aggressive large- and medium-size dam construction with total capacity of about 103 km^3, including 50% of Lake Kariba. Zimbabwe has been actively participating in the management of transboundary water resources along its borders through the ZAMCOM and LIMPCOM (Ornes, 2007).

KEY ISSUES AND ACTIONS AND MEASURES TO ADDRESS THEM

Water use and demand

The sub-region is generally an agricultural dependent community for both crop and livestock production, making it very vulnerable to temporal and spatial changes in water availability (Beekman et al., 2003). In addition, water remains a strategic resource that is a major input into various sectors, such as health, industry, mining and power generation. There is a general trend of increasing investment in water resource management for development purposes. However, agriculture is by far the largest consumer of water in the region, using between 70 and 80% of available resources (Figure 4) (Malzbender and Earle, 2007). Land under irrigation increased by 62% between 1961 and 1997.

In addition, water demand for domestic use, power generation, industrial uses, and mining in the SADC region continues to increase. This increase is mainly attributed to high urban growth rates. In the period 1990-1995 the region's annual urban growth rate was 5.3% compared to a world average of 2.6%. It has been estimated that by 2020 the population of SADC will be 262 million (Zhou, 2002). It is also estimated that in the period 2005-2010, this rate will average 4.6% ranging from 3.1% in South Africa to 5.9% in Malawi. Whilst there is a significant decrease, the rate for the relatively less developed countries will continue pushing the water demand even higher (Mpande and Tawanda, 1996). Generally water consumption has been doubling every 20 years especially in arid and semi arid areas where irrigation accounts for about 70.0% of water used (Bogoe, 2008).

Some of the southern African countries will exceed limits of renewable, economically usable, land based water resources before the year 2025. This has been attributed to increase in development (irrigation, industrialisation and urbanisation) causing environmental degradation like salinisation, sedimentation and pollution. These countries

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will experience water stress (defined as less than 1700 m^3 per capita per year) and water scarcity (defined as less than 1000 m^3 per capita per year) (Savenije and van der Zaag, 2000)). These countries are Lesotho, Malawi, South Africa, Tanzania and Zimbabwe (SARDC, unpublished; Mpande and Tawanda, 1996; Beekman et al., 2003).

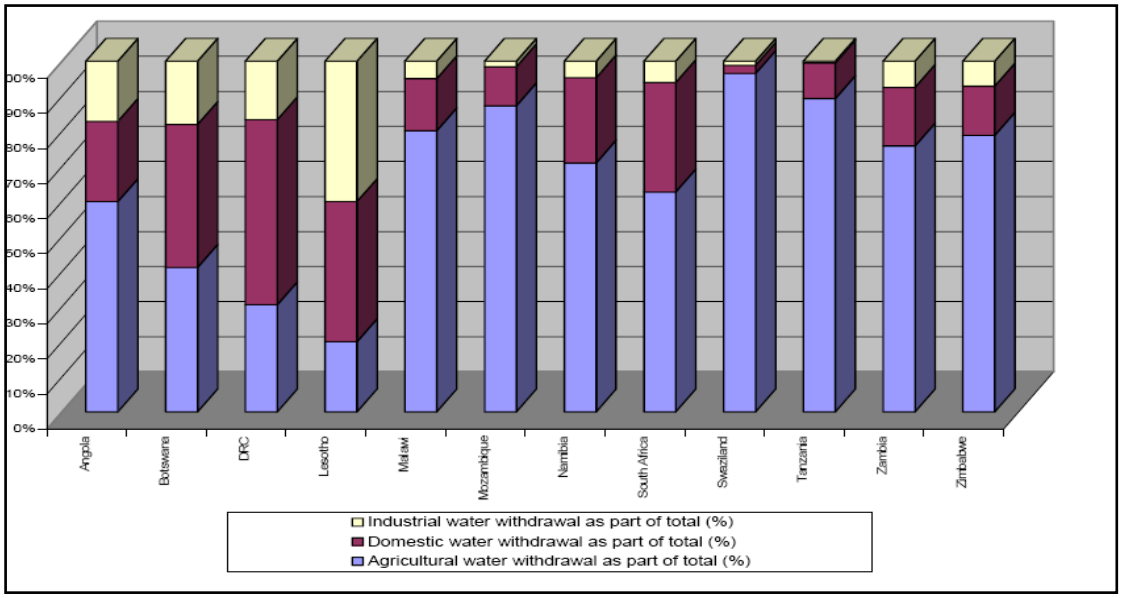

Figure 4: Southern Africa Development Community freshwater withdrawals by sector.
Source: Malzbender and Earle (2007).

Coping with water scarcity

For countries in the southern part of the SADC to cope with water scarcity caused by both climate change and population growth, they will have to trade with the water rich countries in the northern part of the Community. The Bulawayo Zambezi water project in Zimbabwe and the Lesotho Highland Water Project (LHWP) in South Africa are good examples of this (Mutembwa, 1998). The Zimbabwe project will see Zambezi water transferred as far south as Bulawayo in Matebeleland South Province, Garborone in Botswana and maybe to Namibia and South Africa (Conley, 1996). The LHWP will be one of the largest in the world being able to deliver five dams, channelling water 2,200 million m^3 through 200 km tunnels at its completion. However, the project is beset with some challenges as there appears to have been underestimation of water demand in Lesotho and downstream settlements in the Orange basin towards the sea (Mutembwa, 1998). It has been shown that Lesotho will be facing absolute 'water scarcity' by 2025, five years after the completion of the LHWP. These two examples have illustrated that in undertaking inter- basin water transfers, there are other considerations that should be made (Mutembwa, 1998) such as:

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- formulation of intra- and inter-basin transfer policies, particularly when one of the envisaged recipients (e.g. South Africa in the case of the Zambezi) is not a riparian State; does a country have to be truly a riparian to have a right of extraction?
- application of criteria for sharing water, including who decides allocation or use of the water, on the basis of what information and for what period of time;
- clarification of the basis of quotas to countries, their perceived needs, their present and future populations, their frontage to the Zambezi (or any river under consideration) or contribution to total mean annual run off;
- inter- and intra-basin transfer policies at the moment do not include non-riparian States and these proposals might open avenues for such negotiations and policy development;
- water rights and quotas have to be worked out and the basis clarified, including information requirements and duration of access.

However, sharing water is no longer enough; the most contentious issue on the Zambezi is likely to be how to share the benefits derived thereof. This will include issues of compensation to those basin States likely to be disadvantaged by the inter-basin transfer of water. In addition, such abstractions are likely to impact negatively on the Victoria Falls itself. The Victoria Falls is considered a world heritage site as well as crucial for Victoria Falls hydro-power station run by the Zambia Electricity Supply Corporation (ZESCO). In most countries, the new policies emanating from legislative reform have not been fully developed and/or implemented. Notably is the link between water policies and catchment management is minimal, localised and/or non- existent (FAO, 2006).

Large water-resource developments and/or excessive abstraction of water from rivers affect their flow regimes, water chemistry, and sediment and temperature regimes, and consequently overall biodiversity. For example, reduction of river flows in Mozambique has allowed saline intrusion (sea water) up the rivers. Little is known about the extent and effect of saline water intrusion but it can have potentially devastating effects on coastal water supplies, especially to the capital Maputo (SARDC, unpublished). Some of these impacts have been detailed by Chenje and Johnson 1996:

- collapse of a river fishery, e.g. lower Zambezi river, Mozambique;
- decline of an important estuarine wetland, e.g. Berg river, South Africa;
- reduced flow to and flooding of the famous Kafue flats, Zambia;
- Carbora Bassa in Mozambique: many of the mangroves in the delta dried out and died back;
- the community structure of the floodplain vegetation changed, with a substantial increase in trees in Carbora Bassa in Mozambique;
- meanders and oxbows on lower Zambezi, once a feature of the floodplain, became clogged with reeds and trees in Mozambique;

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- the productive, flood-dependent grasslands were depleted of grasses, the favoured food plants of herbivorous mammals, including the formerly abundant buffalo, practically disappeared from the delta in Mozambique;
- vast, vegetated islands, many of which became inhabited by people, appeared in the river channel in Mozambique;
- saltwater intrusion, due to reduced river flows in the Incomati, Limpopo, Buzi and Pungwe rivers;
- typhoid in the local community in Pongolo floodplain; and
- proliferation of a blackfly pest of livestock in Orange river in South Africa.

This has led to many countries exploring the possibility of mitigating against this through the allocation and management of flows to maintain river functioning. In the SADC, South Africa and Zimbabwe are the only countries that have legislation on environmental flows for the maintenance of rivers (SARDC, unpublished).

Coping with climate change

The water scarcity situation in the SADC is being worsened by global warming. The major impact of global warming on water has been predicted to be the reduction in soil moisture and runoff. Like the rest of Africa, the general trend in the SADC is that the main river basins have experienced a reduction in runoff of about 17% for the past decade (Manase, 2009). Zambezi has been projected to have the worst scenario with decreased precipitation of about 15%, increased evaporation of up to 25% and decreased runoff of 40%. Additionally, the SADC region has not made significant strides in adopting technical strategies for optimizing water resources, like water pricing and demand management. Crop-watering techniques are still inefficient and wasteful. Few industries and households embrace water-reuse technologies (Manase, 2009).

Virtual water trade

This has been proposed and is a potential strategy for adapting to water stress (Beekman et al., 2003). Virtual Water (VW) is defined as the amounts of water used to grow crops (virtually embodied in the crops) and traded internationally. Virtual water trade is very low in southern Africa, a situation attributed to political instability and lack of economic, institutional, and human capital in the water rich countries in the north. Suggestions are that the more developed but water stressed countries the higher is the tendency to invest in the grain production and transportation infrastructure in the water rich but less developed SADC States, as opposed to new large water transfer schemes. Although it has been ruled as unfeasible under current conditions in SADC, it should be considered as it has the ability to contribute to increased food security without increasing water scarcity (Beekman et al., 2003). One example is Botswana where, instead of investing in self-sufficiency in food production (increased irrigation) they have adopted an alternative policy of economic

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development for food security in which the economy has to be strong enough to purchase food from abroad (SARDC, unpublished).

The rights approach to water management

Benefit sharing mechanisms have been developed and adopted as the best option in sharing water resources in order to overcome contentious issues of property rights. A river basin is indeed a common resource and use by one State affects the use by another. This raises the question of whether water rights can be separated from benefit sharing. In many cases water sharing implies water transfer of fixed amounts. It has been argued that for any compensation to be claimed a right should be conferred. Thus benefit sharing and water rights should be jointly implemented (Qaddumi, 2008).

However, in many legislation water rights are tied to land rights. As such water rights have been conferred to land owners with direct physical access to water (Hodgson, 2004). The water right in this case is not transferable unless associated with land rights. Such jurisdictions were used in pre-colonial, and even to some extent in post-colonial periods, in Namibia, South Africa and Zimbabwe. The new legislation reforms clearly specify the volume of water that is subject to each right together with the associated institutional arrangements for their allocation, registration, monitoring and enforcement. For instance, in South Africa, water rights come with demands for catchment management activities dependent on the amount and use of the water. From the perspective of society, modern water rights permit the orderly allocation and sustainable use of valuable water resources. This also gives security to permit holders to invest in water management. A water right is defined as a legal right to abstract and use a quantity of water from a natural source, such as a river, stream or aquifer (Hodgson, 2006).

In Zimbabwe the Water Act of 1998 reformed the water sector to improve equitable distribution and stakeholder participation. The major change was that, water can no longer be privately owned. Instead a permit system is in place and administered by Catchment Councils. Water is now treated as an economic good and the "user pays principle" applies. Pollution of water is now an offence and the "polluter pays" principle applies. The reforms resulted in the formation of The Zimbabwe National Water Authority (ZINWA), a parastatal agency responsible for water planning and bulk supply. The Zimbabwe National Water Authority works with seven river catchment councils to which it has devolved responsibility for managing river systems and enforcing laws and regulations at the local level (Ornes, 2007).

This whole issue of water rights is the human right to water. This is linked to the right to health and the right to food. Governments are under obligation to ensure access to water by all. Any payment for water services has to be based on the principles of equity, ensuring that these services are affordable for all, including socially disadvantaged groups. Equity

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demands that poorer households should not be disproportionately burdened with water expenses compared to richer households (Derman, 2008). This makes the permit system on which the user pay principle is based difficulty to implement. In Zimbabwe this has been difficult to implement in urban areas as the government cannot cut-off water supplies to the urban poor. However, the Zimbabwean Water Act states that, only water used for commercial purposes requires a permit in terms of Section 34 (Derman, 2008).

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CHAPTER 3 Forests and Water Supply in the Sub-Region

FORESTED CATCHMENTS AND WATER

A lot of arguments have been advanced that forested catchments supply a high proportion, cleaner and safer water for domestic, agricultural, industrial and ecological needs. Loss of forests has been blamed for everything from flooding to aridity and for catastrophic losses to water quality (Dudley and Stolton, 2003). However, the relationship between forests and water is hardly understood, let alone managed (Dudley and Stolton, 2003; Calder et al., 2007). Historically forest cover has been said to be the best land use for maximum water yield, regulation of seasonal flows, high water quality and preventing floods in downstream areas. This led to aggressive promotion of forest cover on upstream watersheds. A new school of thought has suggested that forest ecosystems are the major users of water, tree canopies reduce ground water and steam flow by intercepting precipitation. It has been established that partial or complete removal of the tree cover accelerates water discharge, increasing the risk of flooding during the rainy season and drought in the dry season, suggesting that forest cover's contribution to regulating hydrological flows has been overestimated (FAO, 2006; Calder et al., 2007; Hamilton, 2008).

Even then, impacts of forest removal are localized and evident only at the micro level and in association with short-duration and low-intensity rainfall events but at larger scale land use management has not been proven to be of consequence (Hamilton, 2008).The impacts of land use on water resources are said to be dependent on many ecological and socio-economic factors. The factors include climate, topography, soil structure, economic ability and awareness of the farmers, management practices, and the development of infrastructure. The precise impact of forested catchments on water supply therefore varies, making generalisations difficult (Dudley and Stolton, 2003).

The one unchallenged contribution of forests to the hydrological balance of watershed ecosystems is maintaining high water quality by minimizing soil erosion, reducing sediment in water bodies and filtering litter and other pollutants (Dudley and Stolton, 2003; Hamilton, 2008). Unlike water quality, the issue of water flow and forest cover in catchments is more complex. The impact of land use on runoff depends on many variables, the most important being the water regime of the plant cover in terms of evapotranspiration, the soil water holding capacity (infiltration capacity), and the ability of the plant cover to intercept moisture (Dudley and Stolton, 2003). Many studies suggest that both in very wet and very dry forests, evaporation is likely to be greater from forests than from other land use systems resulting in decreases in water from forested catchments as compared with others, like grasslands or

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crops fields. It has been concluded that planting new forests, particularly of species with high evapotranspiration rates, can often lead to reduced water flow (Dudley and Stolton, 2003). However, in general research suggest that cloud forests and some older natural forests can increase net water flow, but other types of forests particularly young forests and plantations, are likely to have the reverse effect.

This relationship will remain subject for further research and debate for a while. However, the last five years saw a lot of supportive initiatives by regional and global bodies, such as the Ministerial Conference on the Protection of Forests in Europe (MCPFE), the international Network of Basin Organizations (INBO), the Latin American Network of Technical Cooperation in Watershed Management (REDLACH), the Mekong River Commission (MRC), FAO's Committee on Forestry (COFO), FAO's Regional Forestry Commissions and the UNECE Timber Committee (Calder et al., 2007). This understanding, cooperation and/or initiatives have not cascaded down to national level. At this level, there is still need for more research, information exchange, capacity building on forest water relations. This is further complicated and more crucial as climate change exerts more pressure on the forest-water relationship and the need to adapt forestry and water policies.

One country in the region that has made strides in managing forest-water relations is South Africa. Although the effects of afforestation on water supply were not fully understood, South Africa began implementation of controls as far back as 1972 which enacted a permit system which was further strengthened in 1986. The industrial forests used an estimated 1.2 billion m3 of water which translated to 30% of urban consumption or 10% irrigation consumption (Ministry of Water Affairs and Forestry, 1997). However, afforestation is the only land use being regulated to limit upstream water abstraction making the system inadequate and has necessitated a move towards integrated catchment management. Initially the permits were administered by the Chief Directorate of Forestry in Government but this has since been decentralised to quaternary catchment level under the Water Department. The key issue in issuing permits is to assess the forestry project in relation to all the water needs for downstream development. It should be the most economically sensible proposal after considering other water needs like community use, downstream countries on international rivers, and the requirement to maintain aquatic ecosystems (Ministry of Water Affairs and Forestry, 1997).

A policy is being put in place to address a number of challenges which include:

- procedures for the application of rapid evaluation of economic, environmental and social competing water demands;
- assessment of the burden which the system places on the prospective small farmer or community;
- placing the permits in the larger context of integrated catchment management; and

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- ways of bringing the true costs of water use to bear on all users, not just the forest sector, to improve the efficiency of water use.

MANAGEMENT OF FORESTS IN WATER CATCHMENT AREAS

A number of swamps and marshes in the region perform very important hydrological functions. Many wetlands store floodwaters and discharge them gradually, helping to maintain steady river flow throughout the year. Most of the natural inland aquatic ecosystems in southern Africa are associated with major drainage systems of major rivers (SARDC, unpublished). Some of the well-known natural wetland ecosystems are:

- the Okavango delta and Makgadikgadi pans in Botswana;
- the Barotse swamps, Bangweulu swamps and the Kafue flats in Zambia;
- the Linyanti-Chobe swamps in Botswana and Namibia;
- the Zambezi delta in Mozambique;
- the Wembere plains and Rufiji delta in Tanzania;
- Etosha pan in Namibia; and
- St Lucia wetlands in South Africa.

Natural forests and woodlands are equally important in preventing excessive run-off which leads to erosion, improving infiltration of water, creating local microclimatic conditions through evapotranspiration. Deforestation thus has the potential effect of decreasing groundwater recharge and increasing aridity. Clearing vegetation thus increases runoff and decreases infiltration rates which subsequently lower the water table. Studies in Zambia showed that 95% deforestation of miombo woodlands increased annual flows by 56 to 74%. In their studies, Sharma (1985) and Mumeka (1986) concluded that clearing 75% of wet miombo woodland in the Copperbelt area of Zambia and temporary conversion to subsistence agriculture resulted in:

1) surface runoff increasing by 10-18%;
2) peak flows increasing;
3) reduction in annual evapotranspiration; and
4) increased base flow.

However, in the region the importance of watersheds as sources of surface water that should be held protected is not fully understood nor appreciated by decision-makers and other stakeholders (SARDC, unpublished).

Although awareness about the environment has generally increased over the past three decades, the actual practice of integration of environmental quality objectives in the legal framework, planning and management of water resources is still limited. There is seemingly over-reliance on environmental impact assessment (EIA) as a tool for effectively integrating

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the environmental concerns in project planning and decision-making. However, a number of institutions are supporting water resources management activities that integrate ecosystem level concerns. These include the World Bank, UNDP, UNEP, Global Environment Facility (GEF) and a consortium of several agencies under the Global Water Partnership, several bilateral agencies, and non-governmental organisations, such as IUCN (SARDC, unpublished).

In spite of all the progress made in transboundary water management and river basin management very little has been done to integrate forests in these initiatives. Watershed management approaches have evolved from forestry to land use and integrated resources management emphasising the participation of local people (FAO, 2006). There is still a weakness in legislation that forestry has not been fully integrated in water management programs. Compartmentalisation has been a major challenge, the new legislative reforms were aimed at forming institutions that define roles of stakeholders and provide for multi-layer water management institutions and recognition of forests as viable land use system in the transboundary ecosystems (FAO, 2006). Article 14 of the SADC Forestry Protocol stipulates that “State Parties shall, where appropriate, establish programmes and enter into agreements to promote the cooperative and integrated management of transboundary forests and protected areas”; however this has not taken off.

In the region three countries have incorporated issues of catchment management into the water policies. In Namibia there is a growing realisation that healthy water resources are linked to well-functioning aquatic and wetland ecosystems making the environment a legitimate water user. The new Forestry Act, no 12 of 2001, includes a clause for the protection of riparian vegetation, and thus legislates against soil erosion and resultant siltation. However, enforcement is still a challenge as vegetation is still being lost in the Okavango and Kunene river basins (Amakali et al., 2005). In South Africa the 1998 Water Act has a provision for the setting up and implementation of the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP). The aim of the program is to monitor the ecological health of all aquatic ecosystems (estuarine and riverine ecosystems) managed by the department, initially known as the National Aquatic Ecosystem Bi-monitoring Programme. This has been incorporated in the local council water licensing system that requires an assessment of the environmental requirements of the rivers and streams concerned to be conducted before a licence can be issued. Additionally, in South Africa, prices for timber from plantations are based on the catchment budget which includes costs for monitoring, management and improving water availability among other factors (Hamilton, 2008).

The SADC has also incorporated issues of forest management in transfrontier conservation areas. The concept of creating transfrontier conservation areas (TFCAs) is recognised as important tool in promoting the conservation of biodiversity and endangered ecosystems in Southern Africa. In May 2006, the SADC Transfrontier Conservation Areas (TFCAs) Office

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was established under the Natural Resource Management Unit (Wildlife Sector), Directorate of Food, Agriculture and Natural Resources. This is based on the principle of collective ownership which is enshrined in the SADC Protocol on Wildlife Conservation and Law Enforcement. Article 4(f) of this Protocol commits the SADC Member States to "promote the conservation of the shared wildlife resources through the establishment of transfrontier conservation areas" (Biodiversity Support Program, 1999).

In SADC protocol on shared water resources, a TFCA is defined as "the area or component of a large ecological region that straddles the boundaries of two or more countries encompassing one or more protected areas as well as multiple resources use areas". There are 17 existing and potential TFCAs within the SADC region. The TFCA approach is very silent when it comes to forests and rivers; its major focus being wildlife. It is also of consequence to note that the location of TFCAs is localised and fragmented in relation to river basins. Even though it is claimed that the terms ''natural resources and ecosystem'' imply a holistic approach, none of the TFCA initiatives are targeted at river basins and forests thereof.

At global level, the new development in policy reform is the alignment of forest and water policies, programmes and strategies. These efforts involve use of incentive based schemes or payment of environmental services. These are used as financing mechanisms for watershed management and other sustainable development processes. It is envisaged that upstream forest stewardship can be compensated by downstream water users through direct payment of forest hydrological services (Calder et al., 2007). In other regions, this relationship is mediated by government agencies. In more recent developments, the United Nations Economic Commission for Europe (UNECE) Convention on the Protection and Use of Transboundary Watercourses and International Lakes in 2007 endorsed the concept of payments for ecosystem services including the conservation and development of forest cover.

In 2006 the International Union of Forest Research Organizations (IUFRO) created a Task Force on Forests and Water Interactions. This is aimed at providing fora and promoting consensus among forest hydrology policy-makers. Similarly, FAO has produced the booklet "Why invest in watershed management" to raise the awareness of policy and decision makers about the needs for and benefits of watershed management.

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CHAPTER 4 Way Forward with Forest-Water Relations in the SADC

HARMONISING INTERESTS OF STAKEHOLDERS IN WATER UTILISATION AND MANAGEMENT

The framework (Protocol), fora and mechanisms (river basin organisation) already exist in southern Africa to mediate consultations and negotiations between different stakeholders. More capacity building is required to make these frameworks and mechanisms functional. A lot of investment is required in this regards especially scientific information on river dynamics. Models that are acceptable to all stakeholders on predictions would be very useful for the long term management of shared water resources and watersheds associated with them.

IMPROVING AND SHARING KNOWLEDGE AND INFORMATION ON FOREST-WATER RELATIONS

Knowledge about forest-water relations in the sub-region is less apparent. There is need, therefore, to mount awareness campaigns on the importance and benefits of these relationships. Campaigns will not be enough, investment in capacity building for information, data generation, and storage will remain crucial. To overcome this problem a number of initiatives, networks and fora have been developed and facilitated in the sub-region. A number of networks are in operation in the SADC; however their main focus is water management. Most of the members of these networks are water managers, engineers who have little interest in forest management. It would seem prudent therefore to use the infrastructure of these networks to promote management of forest-water relations. This process would involve shift of mindsets through lobbying and advocacy as well as capacity building strategies.

Global Water Programme Southern Africa

The Global Water Programme (GWP) Southern Africa aims at forging integration through networking and exchange between policy makers, researchers and practitioners. The partnership has supported the SADC in developing the regional water policy and strategy. This has been done through provision of multi stakeholder platforms for regional consultations. The Network is designed to enhance information sharing and knowledge of IWRM among water practitioners. The partnership has facilitated the development of

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national integrated water resources management plans in Malawi, Mozambique, Swaziland and Zambia (GWP, 2000).

Southern Africa Water Information Network

The Southern African Water Information Network (SAWINET) is web-based source of information on integrated water resources management (IWRM), specifically designed to meet the needs of the southern African water sector (GWP, 2000; Takawira, 2004).

The IWRM Framework

Integrated Water Resources Management (IWRM) seeks to achieve a balance between economic efficiency, social equity and environmental sustainability. The competition for water among sectors should not overlook the need to protect the environment, not only for its own intrinsic value, but also for the benefit of future generations. Achieving this balance in a coordinated manner requires a framework which consists of three main components:

1) an enabling environment;
2) institutional roles at central and local levels; and
3) management instruments that will assist institutions in the discharge of their functions.

WaterNet

The WaterNet is a capacity building initiative that has been active over the last years focusing on building the regional institutional and human capacity in Integrated Water Resources Management (IWRM). The main strategy is training, education, research and outreach by harnessing the complementary strengths of member institutions in the region and elsewhere. Membership is drawn from university departments and research and training based in southern and East Africa.

CAP-Net

Cap-Net is an international network for capacity building in IWRM. The SADC office is located in Pretoria, South Africa. Cap-net is made up of a partnership of autonomous international, regional and national institutions and networks committed to capacity building in the water sector. Networks have proven to be effective at promoting the understanding of integrated water resources management and play a key role in supporting the development of IWRM and the achievement of the MDG's.

African Groundwater Network

The African Groundwater Network (AGW-NET) is an Africa-wide group of groundwater experts that provide capacity building on groundwater management in Africa. Membership is open to practising groundwater professionals and those from related professions.

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