The Okavango River basin is one of the last non-industrialised river basins in Africa, supporting a wide range of human livelihoods and ecosystems. It is also a basin that has been misinterpreted by many commentators. This book sets out to document facts that are relevant to the management of the waters of the Okavango River system in a peaceful manner, and starts to explore the possibility of developing a management regime that is different to that being used elsewhere in the world. The book is the product of interaction between OKACOM, the formal government structure responsible for the development of viable management approaches, scientists and civil society. It has been generated as part of the Green Cross International *Water for peace programme* at the 3rd World Water Forum and is offered as the start of a journey towards a management paradigm that reflects African ideals rather than industrial development models as applied elsewhere.

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Transboundary rivers, sovereignty and development: *Hydropolitical drivers in the Okavango River basin*

Anthony Turton, Peter Ashton & Eugene Cloete (editors)

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COVER PHOTO

Aerial view of a portion of the Okavango River approximately 10 kilometres downstream of the small village of Bagani, Namibia, showing a typical sand island in a bend of the river. The island is located near the northern boundary of the Mahango Game Reserve, and has been formed by successive deposits of sediments laid down during periods of high flow. A series of vegetated scroll bars are clearly visible on the island. During periods of low flow (such as those shown here), the low water levels allow local residents to walk across the half-exposed sandbanks onto the island where they collect reeds for thatching and allow their livestock to graze on lush growths of grasses and sedges. Immediately downstream of the island (foreground of photograph), falling water levels have exposed a large area of sandbank, with other sandbanks clearly visible in the very shallow water. Furrow-like 'troughs' in these submerged sandbanks (foreground) trap large volumes of detritus particles, and provide a suitable substrate for a wide variety of microorganisms, invertebrates and small aquatic plants to grow. Exposed sandbanks, such as those shown in the photograph, provide important seasonal nesting sites for the endangered African skimmer (*Rhynchops flavirostris*). However, because of the low water levels and ease of access, the skimmers are vulnerable to predation from local residents and their dogs, as well as disturbance and trampling by livestock. During exceptionally high flows, the Okavango River overflows its banks and floods out across the flat landscape, inundating large areas of floodplain (visible as grassland in upper left of photograph). This photograph was taken in December when water levels were at their lowest.

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FOREWORD

Southern Africa and the international water problematique

Few regions offer as much contrast in the field of international water as Southern Africa. On the one hand, there is a vast and growing literature that cites water as a likely cause of wars in the 21st century, and the 15 international basins in the Southern African Development Community (SADC) are regularly named as points of tension, second only to the arid and hostile Middle East. On the other hand, the region now has more experience in negotiating water treaties and implementing joint management bodies than any other region on earth, save the European Union. Furthermore, South Africa's new water law, with its guarantees of water for human consumption, ecosystem health and obligations under international agreements, is quite literally on the cutting edge of water jurisprudence.

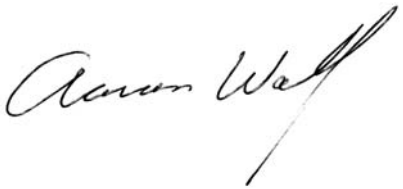
Southern Africa, in general, and the Okavango River basin, in particular, have much to teach the world in the management of international water, and this book is a most welcome tool to this end. There are 261 international basins of which only 55 include treaty mechanisms to guide joint management. The Okavango is representative of much of the world of international water, including a certain level of tension, a lack of some of the most basic data and development plans that may be contradictory to others' aims. It is also representative in the underlying assumption that cooperation is an imperative, not only because more development options result, but because of the implicit understanding that it is the right way to proceed.

This important book helps to bring these experiences to the world and, in doing so, also helps to fill some critical gaps in both the academic and applied literatures. For one, it will provide useful ammunition to argue against those who see war over water resources as inevitable. With every cooperative framework negotiated and every joint study concluded, the concept of water as an inducement to international cooperation rather than violence becomes more imbedded in the global psyche.

Another gap being filled here is the almost total lack of theory about the problematique of international water. With the exceptions of Allan and his colleague at the London School of Oriental and African Studies (SOAS), Turton, who continued to be a lone voice in the theoretical wilderness for years, and a small smattering of literature (especially Blatter and Ingram's *Reflections on water*), the dialogue has been almost devoid of any theoretical underpinnings.

Finally, this book will bring a greater understanding of the Okavango itself – a useful and fascinating case study on its own. For many of us outside of the region, the 'jewel of the Kalahari' is a bit of an enigma. We know about its lush ecosystem, its

centrality to the area and, possibly, something of its hydropolitics. But there have been few places to look for the level of detail found in this publication – detail exquisitely wrapped in the language of those who so obviously care deeply for the basin and all it brings to the region.



Aaron T Wolf
Associate Professor of Geography
Department of Geosciences
Oregon State University, United States

SPECIAL MESSAGE

Equitable and sustainable use of the water resources of the Okavango River basin

It is a great honour that the Okavango River basin, which Botswana shares with Angola and Namibia, is among the six basins chosen by Green Cross International for the *Water for peace* programme. The aims of the programme, which include the prevention of conflicts and the promotion of cooperation over water resources, are ideals deeply cherished in Botswana. I am delighted to have the opportunity to contribute to the ongoing debate on the equitable and sustainable use of the water resources of the Okavango, which is an essential policy aspect of environmental protection.

For many of us, the Okavango River basin means water. The importance of this water can be explained in a few simple, but terrifying statements:

- The population of the Southern African region is currently estimated at 190 million, and is expected to double by 2025.
- More than 40% of the population in the region lack access to safe water for basic human needs.
- Avoidable water-related diseases are still prevalent in the region, resulting in high mortality rates and reduced productivity levels.
- Within the Southern African Development Community (SADC), more than 60 million people lack access to safe drinking water.

As a result of expanding population and economic pressures throughout the world, interest in water resources has correspondingly increased. This interest has stimulated an expansion of investigative facilities and programmes by governments, universities and other organisations such as Green Cross International. Rapid advances have been made in data collection, the modelling of hydrologic processes, and development planning and management of water resource systems.

Like in most developing countries, Botswana faces the challenge of resolving the problem of getting adequate affordable supplies of water on a sustainable basis. This challenge is fortunately also high on the agenda of the World Commission on Water for the 21st century.

The National Water Master Plan of Botswana provides a basis for water sector planning, development, management and legislation. It also provides the framework for regional cooperation. The plan has shown that, after 2020, all of Botswana's internal water resources will be fully committed. Under such circumstances, the country will have no option but to resort to international water resources to augment local supplies.

In this context, the Okavango River basin is regarded as an important life support system for all those residing in it. It is also a unique wetland environment that supports

a fragile ecosystem – the Okavango Delta. The delta continues to attract interest both within Botswana and, indeed, worldwide. As such, all possible efforts are focused on making wise use of the resources it provides. 'Wise use' means that the resources of the system are utilised in a sustainable manner to derive maximum benefit from it. It is for this universal goal that Angola, Botswana and Namibia cooperate in the management of the common resource under the Permanent Okavango River Basin Water Commission (OKACOM). Worldwide, 261 river basins are shared between two or more countries. The initiative of Green Cross International is therefore a valued and important aspect of the management of this shared, fragile resource.

People have been tampering with the environment for a very long time. The great transformation from primitive hunting and gathering to settled civilisation occurred when people began to convert swamps, forests and savannahs into farms to cultivate domesticated varieties of plants and animals. This has been the most radical change in the environment that mankind has made until this very day. Over the course of time, this transformation altered the ecology of entire continents. There is good reason to believe that ancient civilisations rose and fell as a result of this process. I believe that we have learned from the experience of past generations. We cannot avoid working together for our collective prosperity. This is an essential milestone in our relationship as human beings.

In this respect, it is gratifying to note that leaders throughout the world increasingly recognise that no country can exist in isolation, and that there can be no sustainable development of the economies of the world without international cooperation. The value of crossborder collaboration in trade, politics, diplomacy, arts and culture, as well as of environmental management is now established beyond doubt in regional economic integration as a basis for economic globalisation.

We live in a world where the information superhighway has created a global village with interesting implications for its residents. Life in a global village implies a shared future, peaceful coexistence, interdependence, mutually beneficial exploitation of resources, and increased production efficiency due to factor mobility and expanding markets.

Undoubtedly, some people will be aware that, in certain highly developed countries, economic growth has been achieved in recent decades in no small measure at the expense of the commonly shared environment. The profits have been phenomenal, but some of the resultant damage is irreversible. Extinction of some species is inevitable.

The debate on how to deal with the problem continues apace. Some argue that the solution lies in private ownership of the common resource, emphasising the likelihood that public ownership of natural resources would lead to overexploitation. They share the view that rising prices will retard the rate of exploitation of the resource and thus conserve it.

I believe that one aspect of this book is to unravel these economic and administrative complexities that are often a source of great conflict in the utilisation

of commonly shared resources. Some of us have observed, over a long period of time, why ordinary economic market arrangements, which are most often considered to be efficient guides for the use of private resources, do not necessarily lead to the efficient use of environmental resources. New instruments have to be devised to deal with this management problem.

OKACOM is looked upon to help in establishing standards, in stating the goals of the programme of action, and in providing a yardstick to evaluate performance in the management of this common and shared resource.

Green Cross International and its cooperating agencies are commended for their support of initiatives in the Okavango River basin. Greater challenges still lie ahead with regard to the implementation of the strategies that emerged from the workshop and which are captured in this book. I would therefore like to express the wish that the conclusions and recommendations would be sufficiently robust to prepare us well for the future.

Sir Ketumile Masire
Former President of Botswana
Maun, Botswana

SPECIAL MESSAGE

Namibia and cooperation on the Okavango River basin

Namibia has the most arid climate of all member states of the Southern African Development Community (SADC). In order to give effect to the principles of regional economic integration, development and cooperation as advocated in the SADC treaty, the country has to rely on extremely scarce and unreliable water resources to support socioeconomic development.

In view of this situation, the Namibian government identified the need to gain access to the water of the perennial rivers on the northern and southern borders of the country. This called for close collaboration with the other sovereign states that are riparian to these border rivers as the development of the water resources of common interest cannot be done unilaterally and in isolation. An approach that creates an environment for cooperation is crucial to ensure that the water resources of shared rivers would significantly contribute towards the peace, security, welfare, mutual benefit and prosperity of the people of the riparian states.

Namibia has been developing its Eastern National Water Carrier in phases as the managed water demand increased over time since the late 1960s eventually to link the ephemeral water sources in the interior of the country to the Okavango River. When this project is completed, it will increase the sustainable, assured safe yield of the existing ephemeral water resources and stabilise the security of the water supply. Namibia is also interested in harnessing the hydropower and sharing in the irrigation potential of the Okavango River.

The Namibian government ratified and therefore embraced the modern principles reflected in international and regional water law respectively embodied in both the Convention on the Law of the Non-Navigational Uses of International Watercourses adopted by the United Nations General Assembly and the Revised Protocol on Shared Watercourses in the SADC Region.

The Ministry of Agriculture, Water and Rural Development is presently engaged with the water institutions in the other Okavango basin states to execute a project, funded by the Global Environmental Facility, that will prepare a strategic action programme for investigating the potential of the Okavango watercourse system. This will entail a basin-wide environmental assessment that will lead to the development of an integrated management plan for the basin.

The Namibian government is firmly committed to joint cooperation between the riparian states on shared watercourses, the concept of integrated water resource management, sustainable resource utilisation and the preservation of the natural environment. In its desire to achieve these objectives, Namibia is party to the Permanent Okavango River Basin Water Commission (OKACOM) and wishes to extend and consolidate the existing good neighbourliness, friendly relations and close

cooperation between the parties to promote the coordinated and sustainable development of all the natural resources of the Okavango basin.

H K Angula
Minister of Agriculture, Water and Rural Development
Namibia

CHAPTER 1

An introduction to the hydropolitical drivers in the Okavango River basin

Anthony R Turton, Peter Ashton and Eugene Cloete

Introduction

The Okavango river basin is one of the last near pristine aquatic ecosystems on the African continent. This ecosystem is extremely complex, with occasional links to the Zambezi River via the Selinda spillway, which backs up in times of high flow in the Cuando/Chobe/Linyanti and floods into the Okavango Delta. There is also a downstream hydraulic connection from the outflow of the Okavango Delta to the Makgadikgadi saltpans, which are also fed via the Nata River from Zimbabwe. The whole Okavango system is endoreic in nature, with the floodwaters of both the Cuito and Cubango rivers that rise in the well-watered Angolan highlands, 'disappearing' into the sands of the Kalahari Desert and the 'thirsty' atmosphere above the Okavango Delta. The two downstream riparian states on the Okavango system – Namibia and Botswana – are extremely arid countries. In fact, the Kavango (as it is known in Namibia), or the Okavango (as it is known in Botswana), is the only exploitable perennial river that flows through the territories of both these sovereign states.

Angola, as the upstream riparian state, is relatively water rich, straddling five transboundary river basins (Cunene, Cuvelai, Okavango, Zaire and Zambezi). Yet, Angola has been debilitated for almost three decades, first by a war of independence, then a civil war that destroyed much of the country's infrastructure. This created a legacy of starvation with the massive internal displacement of people, while the upper reaches of the Okavango River basin became littered with thousands of landmines and other items of unexploded military ordinance. Finally, given the unique characteristics of the Okavango Delta, which forms part of a large Ramsar site, the whole river system can be regarded as being an 'internationalised' basin, with a range of stakeholders that extend beyond the norm for most transboundary rivers in Africa. In short, the Okavango River and its associated terrestrial and aquatic ecosystems pose significant challenges for the modern trend towards the integrated water resource management of the entire basin.

Why is the Okavango River basin so important?

It is argued in this book that the Okavango River basin is important for three major reasons. First, it is the last near pristine river system in Africa. It is described as 'near

Map 1

The distribution of perennial rivers in Africa

Note: Sites where disputes over water have occurred are indicated on the map with circles.

pristine', because it has already been adversely affected during the last four decades by the construction of veterinary fences in the Botswana portion of the catchment (Pearce 1993). These have destroyed the centuries-old seasonal migration paths of plains animals that would move in great numbers from the Kalahari and Namib deserts, and the Makgadikgadi pans, into the Okavango Delta, the Savuti/Chobe/Linyanti complex and the Zambezi basin around the Victoria Falls area. In fact, one of the current features of the lower reaches of the Okavango basin is the large number of elephants, whose population growth is resulting in significant habitat destruction. Further, the Okavango River system is but one component in a complex ecological web of crosscutting linkages, embracing perennial rivers, seasonal wetlands and varying types of desert and semi-desert, with water availability in both spatial and temporal terms being one of the fundamental driving variables. Yet, ecosystems are not only important for plants and animals. They also support human activities and entire economies, and their health is a critically important precondition for political stability, particularly in semi-arid regions.

Secondly, the Okavango River basin is strategically important for all three riparian states. For Angola, the upper reaches are located in an area of relative water abundance that used to be part of the area traditionally controlled by UNITA, one of the belligerents in this country's protracted civil war. In the immediate post-war era, the government of Angola is confronted by the pressing need to relocate large numbers of internally displaced refugees, to demobilise former combatants and integrate them into some form of sustainable economic activity, while generally 'jumpstarting' the economy. The mobilisation of water resources is one of the key elements in developing a sustainable economic future if the threat of a return to civil war is to be averted.

For Namibia, the Kavango River is one of the most important sources of perennial water available in the entire country, together with the four other perennial rivers (Cunene, Cuando/Linyanti/Chobe complex, Zambezi and Orange) that form part of the borders of the country. Ironically, these border rivers are located far from those areas where the need for water is most pressing. Advanced planning envisages a pipeline from the Kavango River at Rundu, linking into the Eastern National Water Carrier at the town of Grootfontein (CSIR 1997; Ashton & Manley 1999; Ashton 2000a; 2000b; 2002). For the government of Namibia, this pipeline is seen as a form of 'insurance policy' that will enable existing (internal) water resources to be used when available, secure in the knowledge that if they fail, the Kavango River would always be there as a reliable backup.

For Botswana, the Okavango Delta supports a key component of the country's growing tourist industry and sustains many thousands of rural inhabitants in a harsh environment that is made habitable only because of the relatively predictable availability of water. In the past, the Okavango Delta was seen as a potential source of supply for mining and industry (UNDP/FAO 1976; Trolldalen 1992; Scudder et al 1993), but the plans have been shelved. After the initial announcement of Namibian plans to build the proposed pipeline, tensions arose that were fuelled largely by irresponsible and

inaccurate media reports (Weekly Mail & Guardian 1996a; 1996b; Electronic Mail & Guardian 1997; Ramberg 1997), but these have subsided, at least between the members of the Permanent Okavango River Basin Water Commission (OKACOM) (Treaty 1994). As expected, media rhetoric generally continues to be sensationalist and seldom provides an accurate or balanced reflection of the reality of the situation.

The Okavango River basin presents a classic example of potentially opposing national interests when prioritising strategic concerns over the use of transboundary waters. Central to this is the dominant paradigm that is based on sovereignty as a fundamental component. Significantly, Wolf (2002a) refers to the sensitivity that sovereignty poses in the management of transboundary waters, and supports the notion of coordination rather than integration as was proposed by Turton (1999; 2002a). This consequently serves to highlight one of the central challenges for OKACOM: how to develop policy for the integrated management of the water resources in the Okavango River basin to the mutual benefit of all three riparian states, without the individual states losing their sovereign control over these resources. This is a huge challenge, and one that this book addresses.

Thirdly, the Okavango River basin can be seen as a key component of a Southern African hydropolitical complex (Turton 2001a; 2002b; 2003a; 2003b; 2003c). The logic behind this is based on the broad security complex theory of Buzan (1991:210) and Buzan and others (1998), which Schulz (1995) has refined to apply to river basins where water scarcity becomes linked to the national security aspirations or threat perceptions of the respective riparian states. In this regard, the Southern African hydropolitical complex is said to be centred in the four most economically developed countries in Southern Africa – South Africa, Botswana, Namibia and, to a lesser extent, Zimbabwe (once economically powerful, it has now been reduced to near economic ruin as a result of the emergence of a kleptocratic government model). These countries are all riparians in two pivotal transboundary river basins – the Orange and Limpopo – and also share other international rivers with less developed neighbours – Zambezi, Cunene, Okavango, Incomati, Maputo, Pungué and Save (see Turton 2003c for more details). This proposed hydropolitical complex (Turton 2002b; 2003c) links the four most economically developed countries in the Southern African Development Community (SADC) with seven other less developed states via nine shared transboundary river basins (see figure 1). Planned linkages or transfers of water between transboundary river basins are examples of the interconnected nature of transboundary rivers that are central to the concept of a hydropolitical complex in Southern Africa (Turton 2003a; 2003b; 2003c), among others:

- the mooted Chobe/Vaal water project (Borchert & Kemp 1985; Borchert 1987; Trolldalen 1992:138);
- the Senqu linkage with the Vaal/Orange (Ninham Shand 1956; Young 1961; Carter 1965; James 1980; Blanchon 2001);
- the mooted Zambezi/Vaal connection that involved parts of the Okavango basin (Midgley 1987:15; Scudder et al 1993:263);

Figure 1

The Southern African hydropolitical complex as encapsulated in the first hypothesis

Riparian state	International river basin: Pivotal basins: Orange	Pivotal basins: Limpopo	Impacted basins: Okavango	Cunene	Incomati	Maputo	Pungué	Save	Zambezi
Namibia	PS		PS	PS					PS
Botswana	SC	PS	PS						PS
South Africa	PS	PS			PS	PS			
Zimbabwe		PS					PS	PS	PS
Angola			IS	IS					IS
Mozambique		IS			IS	IS	IS	IS	IS
Swaziland					IS	IS			
Lesotho	IS								
Zambia									IS
Malawi									IS
Tanzania									IS

PS = pivotal state IS = impacted state SC = special case

Source: Turton, 2002b; 2003c

- the mooted Zambezi/Limpopo linkage (Heyns 2002:167); and
- the mooted Congo/Zambezi/Okavango linkage (Heyns 2002:166).

The significance of this hypothetical condition is profound. If a hydropolitical complex does in fact exist in the SADC region, then the way that transboundary rivers are managed becomes a strategic regional concern if peace is to be a lasting condition. In fact, it can be argued, that the New Partnership for Africa's Development (NEPAD) will likely fail if transboundary waters are not effectively managed. This rather bold statement is based, in the first place, on the fact that NEPAD is about poverty

alleviation. One of the core indicators of poverty is the lack of access to safe drinking water and basic sanitation, a condition that exists in most of the Okavango River basin and elsewhere in Southern Africa. Secondly, NEPAD is about economic development and sustained growth. It can be argued that this noble ideal simply cannot be realised if water supply is not secured to the extent that agriculture and industry can thrive, and new investments can be attracted to the SADC region. Why would any foreign investor consider investing capital in a region that has a history of political instability, and lacks the basic hydraulic infrastructure on which to develop future economic prosperity? Thirdly, NEPAD is about good governance. It can be argued that there is no better way to cultivate good governance than in the management of shared water resources, because water is ultimately basic to all human existence. In fact, the management of shared water resources via *waterschappen* (loosely translated as 'water cooperatives' for the management of flooding) became the very foundation on which democracy grew in the Netherlands.

The management of transboundary rivers such as the Okavango is a critical component of the future economic security of the respective riparian states. It can be argued that this aspect alone, given the unusually large number of transboundary rivers that occur in the SADC region, can become one of the foundations of the subsequent functional integration of SADC. This could occur in much the same way that the modern-day European Union (EU) evolved over time from the smaller European Economic Community, the European Atomic Energy Community (or Euratom) and the European Coal and Steel Community. Seen in this light, the management of transboundary waters in Southern Africa holds the key to either a political culture of cooperation, or one of conflict. The Okavango River basin can therefore be regarded as ideal material for a classic case study of the need to avoid conflict and promote cooperation if lasting peace with sustained economic growth and satisfactory human development is to become the norm in future.

Origin and purpose of this book

During the Second World Water Forum held in The Hague in 2000, one of the issues that were raised as pressing needs was the management of transboundary rivers. Driving this need was the then dominant 'water wars thesis' that saw violent conflict becoming the norm in water scarce parts of the world in the near future (Solomon & Turton 2000). Green Cross International, a non-governmental organisation (NGO) with a strong environmental security agenda, led the way by hosting the National Sovereignty Panel (Curtin 2001; Turton 2001b; Heinzen 2001) where it launched two reports on *National sovereignty and international watercourses* (Green Cross International 2000a) and *Water for peace in the Middle East and Southern Africa* (Green Cross International 2000b). The National Sovereignty Panel, consisting of Mikhail Gorbachev (chairperson and former president of the Soviet Union), Sir Ketumile Masire (former president of Botswana), Fidel Ramos (former president of

the Philippines) and Ingvar Carlsson (former prime minister of Sweden), laid the foundation for the *Water for peace* programme.

Concurrently, Wolf's work at Oregon State University on the transboundary freshwater dispute database provided empirical evidence that water resource management tends to be a catalyst for peace rather than conflict. This has subsequently led to the emergence of a new school of hydropolitical thought (Wolf 2002a; Turton & Henwood 2002) that seeks to focus on understanding the fundamental drivers of potential conflict in order to mitigate such conflict and stimulate cooperation. This has led, among others, to the establishment of the Universities Partnership for Transboundary Waters that seeks to develop knowledge and textbook material for use in future training and research programmes.

Green Cross International provided funding via the Department of Development Cooperation of the Royal Dutch Ministry of Foreign Affairs and the Swedish Foreign Ministry to undertake research on the Okavango River basin as part of its *Water for peace* programme, which involves six international river basins (Danube, Jordan, Volta, Okavango, La Plata and Volga). The programme is coordinated by Green Cross International and UNESCO at the Third World Water Forum in Kyoto in 2003. The objective of the *Water for peace* programme is to promote peace in the use of transboundary watercourses by addressing conflicts (and potential conflicts) and fostering cooperation among states and stakeholders. The ultimate goal is to facilitate the integrated management of shared water resources for the benefit of all parties (Green Cross International 2002:5).

This book is a product of the Green Cross International *Water for peace Okavango pilot project* managed by the African Water Issues Research Unit (AWIRU) of the University of Pretoria. It draws upon other like-minded initiatives that have been developed since the Second World Water Forum. The broad objectives of this book are to:

- support OKACOM, as the legitimate intergovernmental agency responsible for the management of the Okavango River basin, in the generation of knowledge that will be useful in the development of alternative policy options;
- foster a healthy relationship between OKACOM and the scientific community, by sensitising the latter to the needs of the former, and by cultivating a professional environment where future research needs can be appropriately articulated, properly coordinated and sustainably funded in a manner that is conducive to the development of appropriate knowledge;
- map the hydropolitical dynamics of the Okavango River basin in sufficient detail so that OKACOM commissioners can understand the basic drivers of potential conflict and be able to avoid it, while cultivating the dynamics of cooperation instead;
- initiate the development of adequate policy for consideration by OKACOM that will suit the needs of the three riparian states as they strive to attain their independent national development objectives, while attempting to reach

convergence around a set of common core values and goals, thus institutionalising the existing cooperative sentiments;
- generate accurate case study material for consideration by riparian states on any of the other 14 international river basins that exist in the SADC region;
- build sustainable capacity, among others, within the SADC Water Sector by generating African literature on African water issues; and
- contribute meaningfully to the changing water management paradigm that is shifting from a rights-based approach towards a more equitable benefits-sharing approach.

Central to the attainment of these objectives are two key initiatives:
- The *Water for peace Okavango pilot project* held a workshop in Maun from 9-11 September 2002. It was funded by both the Dutch and Swedish foreign ministries through Green Cross International and managed by AWIRU. The workshop enabled OKACOM commissioners to meet outside their scheduled OKACOM meetings for the first time, and to present a joint paper on their vision for the future. A number of leading researchers also had the opportunity to present specialist input for consideration by OKACOM. These papers have been edited for publication in this book.
- The European Union currently funds the project on *Water and ecosystem resources in regional development* (WEERD) in the Okavango basin. AWIRU is responsible for the development of a series of policy-related papers for consideration by OKACOM in the WEERD project. These papers will be largely informed by the outcome of the *Water for peace Okavango pilot project*, thereby linking apparently disconnected initiatives into a more sustainable and cohesive endeavour.

Hypotheses

This book is based on three hypotheses, which it seeks to develop. The first hypothesis is related to the existence of a hydropolitical complex in Southern Africa (see figure 1 above). Seen through this conceptual lens, it would be a mistake simply to analyse the actions of the riparian states in the Okavango River basin. These same states are also co-riparians in other transboundary river basins and diplomatic negotiations over one basin can cascade into other basins. For example, the three Okavango riparian states could be potential rivals in issues arising from the Okavango River, but could conceivably form a coalition and thereby increase their negotiating power in deliberations on the future management of the Zambezi River where they are also riparians. The same holds true for the Orange River, where Botswana and Namibia could form a coalition and thereby enhance their joint negotiating position with South Africa and Lesotho in the Orange/Senqu River Commission (ORASECOM) (Treaty 2000). These shifting patterns of potential amity and enmity

that would otherwise go undetected, can be analysed in terms of a hydropolitical complex.

The second hypothesis relates to the development of a new definition of hydropolitics that moves away from the existing bias towards water and conflict and focuses instead on cooperation potential (Turton 2002c). Hydropolitics is thus defined as the systematic study of the authoritative allocation of values in society with respect to water (Turton 2002c). This new definition embraces the dynamic aspects of water resource management, while including the elements of scale and range, all highly relevant to the Okavango River basin.

The third hypothesis is based on the empirical work of Wolf (1998; 2002b) and Wolf and Hamner (2000). When interpreted in the broadest sense, their research indicates two critical hydropolitical phenomena that have to be better understood:
- There is a propensity to cooperate rather than to fight over shared water resources.
- The likelihood of violence over water is inversely related to the scale of interaction.

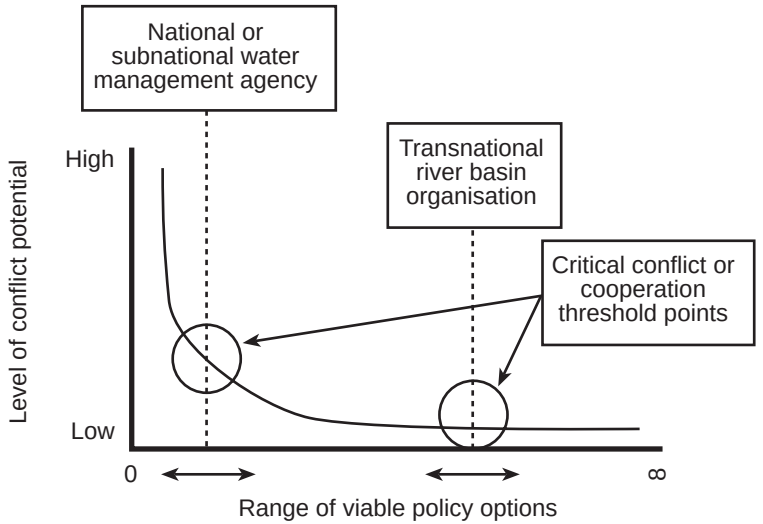
Based on empirical evidence, an individual rather than a country is more likely to use physical violence in seeking recourse to a perceived water injustice. This is particularly relevant in Southern Africa where protracted civil war has been the norm, and where large numbers of weapons and an array of military ordinance are readily available. This evidence also highlights the need to develop viable ways of reintegrating former combatants into the economy and rehabilitating them through the implementation of skills development programmes.

These deductions are interpreted in the third hypothesis (see figure 2). Conflict potential increases dramatically in a non-linear fashion, as the range of potential coping strategies, expressed as the number of viable policy options, tends towards zero. The likelihood that a cooperative spirit will develop increases dramatically in proportion to the available number of viable policy options. In other words, the greater the number of viable policy options, the greater the likelihood of peaceful coexistence and cooperation within a given system.

The third hypothesis thus postulates that the reason for lower levels of conflict potential between countries is related to the wider range of remedies that are available in the international political economy – the so-called 'watershed' versus 'problemshed' scale of analysis (see chapter 11; Allan 1998; 1999; 2000; 2002; Turton 2000). Conversely, the reason for the higher conflict potential when moving closer to the level of the individual is probably related to the limited range of available coping strategies. Consequently, it is hypothesised that the critical element contained in the empirical findings made by Wolf (1998; 2002b) and Wolf and Hamner (2000) is the range of available coping strategies, or stated differently, the range of viable policy options that can be developed. This ties in with the work of Ohlsson (1999), Ohlsson and Turton (1999), Turton and Ohlsson (1999), Turton (2002d; 2002e) and Turton and Warner (2002) that identified 'second-order resources' as the key determinants – the social resources needed to develop a viable range of coping strategies during times of

Figure 2

Relationship between conflict potential and the range of viable policy options in a given transboundary river basin



drought or flood, along with the capacity to develop institutions and negotiate compromises. A rational person will only fight over water once all other options have been exhausted, or if this individual perceives that no other options are available.

There are two critical threshold points in policy development that have to be carefully understood in terms of this hypothesis.

The first relates to the management of water resources at the international level, as conflict can potentially arise at this level if there are insufficient viable policy options. This is likely to be the main focal point for organisations such as OKACOM, and will certainly be an important and welcome outcome of the WEERD process. In terms of the third hypothesis, conflict potential is lower at the international level because the respective governments have recourse to a wider range of potentially viable policy options. The dotted line (specifically the one on the right) in figure 2 is thus capable of shifting either to the left or to the right. The ideal is for the dotted line to be as far as possible to the right, where a wide range of viable policy options attenuates any potential conflict. It is possible, however, for the dotted line to be located further to

the left, where the two critical conflict or cooperation threshold points can converge, resulting in acute conflict. In terms of the third hypothesis, acute conflict could potentially occur when a river basin organisation is incapable of generating a wide enough range of viable policy options to accommodate the needs of all the riparian states, thereby allowing conflict to erupt. This is clearly an undesirable condition and should be avoided at all costs.

The second relates to the subnational scale, where a marked increase in conflict potential arises, as the range of viable policy options tends to zero. This is unlikely to be the main focal point of OKACOM deliberations as this occurs at the subnational level and is therefore within the sole competence of the national government concerned. However, OKACOM can play a major role in harmonising policy in order to mitigate against this possible outcome.

These three hypotheses can be used by the reader as a backdrop to the information presented by the different authors. The aim is to achieve a greater degree of conceptual clarity, while contributing to the development of hydropolitics as a scientific discipline, with both explanatory and predictive capabilities.

Structure of the book

This book brings together a variety of specialists, each with a unique writing style. No attempt was made to change the style of presentation, as this represents the individual perspective of each contributor.

However, the reader's attention is drawn to one key issue. The construction of knowledge is a fundamental element in the study of hydropolitics, because this is central to the position taken by respective riparians vis-à-vis specific issues, and the subsequent case that they develop to support this position during negotiations. In the case of the Okavango River basin, perhaps the main difficulty relates to disagreements between stakeholders over the use of scant and often incomplete baseline data on river flows and the extent of inundated area within the Okavango Delta. This situation is not unique to the Okavango system. Indeed, it is a characteristic of almost all African river systems: the available data are often sparse, incomplete or span a very short period of time. However, given the importance attached to the unique Okavango system, this feature has assumed greater importance among stakeholders. There is therefore a strong case to be made for stakeholders to reach agreement on the available baseline data relating to all issues relevant to the future management of the Okavango River basin (see box 1 for details of the extent of variation in the area of the Okavango Delta).

A second, associated problem relates to the fact that some authors may present a case from the perspective of a specific riparian state. If stakeholders disagree with any of the statements made, there is a tendency to dispute the correctness of the numbers used in support of the original argument. This further emphasises the need for stakeholders at all levels to reach agreement on the accuracy or 'acceptability' of the

Box 1

The extent of the Okavango Delta

Many reports on the Okavango Delta have used widely different figures to delineate the area and extent of this unique wetland system. This situation has arisen because of the incomplete understanding of the dynamic nature of the Okavango Delta, different opinions on which ecosystem components actually constitute the Okavango Delta system, and differing perspectives held by individual authors. Unfortunately, this confusion hampers efforts to improve the understanding of the Okavango Delta, and constrains the ability to reach consensus on suitable management approaches for the system as a whole.

The area of the Okavango Delta fluctuates between 6,000 and 8,000 km^2 during the dry season to approximately 15,850 km^2 during the flood season. Erratic regional rainfalls across the Okavango catchment cause significantly variable river inflows and these, in turn, give rise to the highly variable pattern of flooding in the Okavango Delta. The precise pattern and extent of flooding each year depend on antecedent conditions (extent and duration of previous floods), as well as the timing and duration of rainfalls in the catchment and direct rainfalls onto the Okavango Delta (Wilson & Dincer 1976; McCarthy & Ellery 1998; Ashton & Manley 1999). The rising and falling flood pattern each year also determines the spatial extent of the different ecosystem components within the Okavango Delta (Ellery & McCarthy 1994; Ashton & Manley 1999; Gumbricht et al 2002).

The Okavango River enters Botswana as a single broad river, approximately 200 metres wide and 4 metres deep, which meanders within a broad floodplain (the so-called 'Panhandle') before branching out to form the Okavango Delta. The Okavango Delta consists of a series of permanent river channels, semi-permanent drainage channels, lagoons, islands and floodplains that link up and then separate again during the course of an annual flood. Several habitats can be recognised in the Okavango Delta, including permanent swamps that are permanently flooded, seasonal swamps that are dominated by seasonally flooded grasslands, and over 150,000 islands that vary in size from several metres to tens of kilometres across (Smith 1976; Ellery & Ellery 1997; Gumbricht et al 2002). A number of extensive dryland savannah habitats known as 'sandveld tongues' extend into the Okavango Delta from the surrounding Kalahari and form important terrestrial ecosystem components within the system.

available baseline data. This is highlighted by the fact that, while there is agreement at national level between the respective Departments of Water Affairs in Namibia and Botswana on the 'correctness' or 'accuracy' of the available data for river flow volumes measured at Mohembo, other stakeholders have questioned the validity of the data. Clearly, the responsibility for 'accepting' the validity of the data or deciding that the data is 'acceptable' rests with the respective government department with line function responsibility for custodianship of the water resources in the Okavango Delta.

Another example of this type of problem is the debate about the extent of the Okavango River basin, which is hydraulically part of the Zambezi (at least on the extremely rare occasion of high floods in the Chobe/Linyanti), while the most affected riparian states have agreed among themselves that, for the purposes of management, the Okavango basin consists of three riparian states – Angola, Namibia and Botswana. Thus, the Nata River arises in Zimbabwe, but is not considered to be part of the Okavango River basin, since it only flows into the terminal Makgadikgadi Pan system. This is entirely in accord with accepted scientific approaches, both geographical and hydrological, which consider the Nata and Okavango rivers to be distinct parts of the larger Makgadikgadi system. The intellectual integrity of the authors included in this book is respected by the editors, who are neither actively promoting the dissemination of factually incorrect data, nor responsible for the accuracy of data included in the book. Instead, the data is presented by the respective authors at their own discretion, without input by the editors, who choose to remain impartial. Authors should be able to defend data in subsequent interactions between themselves and other interested scientists, as policy positions are prepared in the near future.

This book has been structured around a core logic involving three sections:

- Section 1 provides an introduction to the hydropolitical dynamics of the Okavango River basin. The intention is to introduce the reader to the range of issues found in the Okavango River basin. Although these issues are all important, some can be regarded as critical drivers. The latter can consequently be considered as independent variables in their own right, whereas others are mediating factors that could act as dependent or interceding variables.
- Section 2 presents detailed conceptual perspectives. These will equip the reader with greater conceptual depth and thus provide an enhanced understanding of the context in which the overall hydropolitical problematique is embedded.
- Section 3 draws these elements together in a conclusion aimed at laying the foundation for further detailed assessment of the hydropolitical complex of the Okavango River basin. It is from these hydropolitical assessments that future policy development will emerge.

Section 1 consists of seven chapters (including this introduction). The contribution by Peter Ashton and Marian Neal (chapter 2) introduces the reader to a number of strategic issues relevant to the Okavango River basin. In particular, the complexity

surrounding the actual size and component parts of the basin is presented in an accessible manner. This issue is extremely important. Two of the criteria for agreement on water allocation in terms of the Helsinki Rules are the extent of the basin area in each riparian state, and the relative contribution to streamflow by each riparian state. One of the drivers of the overall hydropolitical process in the Okavango River basin is the extreme variability of streamflow, which is introduced in this chapter. The central role of sovereignty is also introduced, along with an analysis of key international legal principles and existing international treaties on water of which the respective riparian states are signatories. The central need to share data in terms of the Helsinki Rules is touched upon, and is further elaborated in the contribution by Anthony Turton (chapter 4). The major contribution of chapter 2 is the conceptualisation of the five strategic issue groups – external geographic characteristics, system characteristics, external groups, socioeconomic drivers and impacts, and the basin states themselves – showing how they impact on one another, and on the Okavango catchment, the Okavango Delta and the Makgadikgadi catchment. This will go a long way in assisting with the development of future policy options.

João Porto and Jenny Clover present an overview of the peace process in Angola in chapter 3. This is undoubtedly one of the great unknown aspects of the overall hydropolitical equation in the Okavango basin. The truth is that the Okavango Delta is still relatively pristine because the civil war has prevented the development of hydraulic infrastructure in the upper reaches of the basin. Details of the peace process are analysed, and the conclusion is made that a return to war is highly unlikely. Several pressing needs are highlighted, among them the relocation of internally displaced people in time to plant the next crop and thus avert a humanitarian crisis, as well as the disarmament of belligerents and their integration into the economy.

The contribution by Anthony Turton (chapter 4) focuses on the need to share data as an element of the desecuritisation of water resource management. This chapter deals conceptually with two forms of peace – negative peace and positive peace – and two forms of security – supply security and national security. These are all key drivers of the hydropolitical process in the Okavango River basin. A model is developed that links the four concepts. The problematique of potential securitisation is identified within the context of a hydropolitical complex, which was presented earlier in this introductory chapter as the first hypothesis. The role of data is analysed in the context of institutional development, where it is shown that two distinct elements are necessary. The first is the capacity to generate data, whereas the second is the capacity to legitimise such data and the methodologies used to interpret it, as critical elements in institutionalising the conflict potential and building sustainable and harmonious cooperation between the various riparian states. This is highly relevant to the third hypothesis that has suggested that potential conflict is mitigated by the availability of a wide range of viable policy options. Without the capacity to collect, process, interpret and accept data, the capacity to generate viable policy options within OKACOM will remain absent.

The three riparian states, in a joint chapter, present the OKACOM perspective, along with a brief history of the organisation (chapter 5). Isidro Pinheiro from the Angolan government, Piet Heyns from the Namibian government and Gabaake Gabaake from the Botswana government are the authors of this chapter. It provides an insight into the Okavango River basin from the perspective of each of the riparian states, as well as some detail of the proposed pipeline in Namibia. As far as can be ascertained, this is the first time that OKACOM has written a combined document of this nature that reflects a common vision.

The chapter by Larry Swatuk provides a philosophical approach to the management of the Okavango Delta as a Ramsar wetland (chapter 6). The focus on the delta highlights the need to manage the Okavango River basin as a whole if the management of the delta is to be successful. It also builds on the notion of variability that Ashton and Neal introduced in chapter 2. Swatuk laments the fact that national interest and state sovereignty are factors in the hydropolitics of the Okavango River basin, as they are seen as problems rather than solutions. This is broadly consistent with the work by Turton (1999; 2002a) and Wolf (2002a), opening up the prospect for the examination of the potential for policy coordination as opposed to policy integration in future.

Ruud Jansen and Masego Madzwemuse present details of recent research by the IUCN into the evolution of a management plan for the Okavango Delta in chapter 7. This plan has been the subject of wide consultation to date and is in a relatively advanced stage of development. The critical need to harmonise the Okavango Delta Management Plan with the Okavango Basin Management Plan is introduced for consideration as a future focus of policy development.

Section 2 is structured around chapters that deal with conceptual perspectives, in an attempt to contextualise fundamental processes occurring in the Okavango River basin within a more conceptually sophisticated discourse. The contribution by Alan Nicol (chapter 8) draws comparisons between the Okavango and Nile river basins, highlighting similarities and differences. One of the key elements that is identified is the aspect of scale, in particular, the relative complexity that occurs at higher levels of scale, in keeping with the expanded definition of hydropolitics presented as the second hypothesis. The central issue of water and development is introduced and contextualised for both basins, and the need for effective institutional development is highlighted in support of the third hypothesis.

Given the fact that the Okavango River basin is an endoreic system – one of only a few in the region – the unique aspects of such ecosystems are introduced in chapter 9 by Mary Seeley, Judith Henderson, Piet Heyns, Peter Jacobson, Tufikifa Nakale, Komeine Nantanga and Klaudia Schachtschneider. The reader is introduced to some of the unusual environmental aspects of such systems, and their uniqueness in terms of management approaches. This is one of the aspects that makes the transfer of knowledge from other river systems largely irrelevant, particularly in the case of the Okavango River basin. Finally, the importance of ephemeral and endoreic river systems in terms of maintaining socioeconomic activities is discussed.

The management of transboundary river basins is impossible without a legal instrument. Chapter 10 by Laurence Boisson de Chazournes deals with the development of the United Nations Convention on the Law of Non-Navigational Uses of International Watercourses. The building blocks provided by legal concepts included in the convention are analysed in some detail, in an attempt to provide the layperson with sufficient knowledge of these important elements of hydropolitics.

The initial definition of problems determines the way in which solutions are developed. In this respect, Anton Earle introduces the conceptual distinction between 'watersheds' and 'problemsheds' (chapter 11). Water scarcity is at best a localised issue, as there is a relative abundance of water at the global level. The strategic significance of groundwater is analysed, as it relates to the international trade in wheat and other cereals. The trade in 'virtual water' (Allan 1998; 1999; 2000; 2002) has made an important contribution in preventing the once confidently predicted water wars (Cooley 1984; Cowell 1990; Starr 1991; Bullock & Darwish 1993; Gleick 1994; De Villiers 1999) from actually taking place (Homer-Dixon 1999; Turton 2000).

Central to the long-term sustainable management of transboundary rivers is good governance and sound policy. Bastien Affeltranger and Alexander Otte analyse some of the key elements of policy and governance, making a clear conceptual distinction between the two (chapter 12). The important aspect of public participation is introduced to the reader, and some of its methodological challenges are discussed.

A thorny issue in any future basin-wide management plan for the Okavango River basin would involve the complex task of determining instream flow requirements for various management regimes along different reaches of the river. This will become a cornerstone in any future management plan, and Heather MacKay and Brian Moloi unpack some of the key elements of this process in chapter 13. Some methodologies are discussed along with the overall relevance of instream flow requirements to policy-making. The implementation of instream flow requirements parameters is questioned, an issue that is taken up by Petrus Brynard in chapter 14. Brynard's work focuses on the *process* of policy-making, as it would apply to the Okavango River basin, rather than the *content* of such policy. A key issue that is highlighted is the problem of implementation. Yet, before criteria for instream flow requirements can be factored into policy options, there is a critical need to manage and interrogate data. Craig Schultz discusses some decision support tools that can be of use to OKACOM by presenting some well-known and locally used methodologies in chapter 15. These three chapters together are critically important because they deal with the complex issue of assessing the outcome of the authoritative allocation of values in society with respect to water, and are thus a central component of hydropolitics as defined in the second hypothesis. The issue revolves around the questions by whose authority an allocation is made; what values are used in making these allocations; and under whose authority these allocations will be implemented and enforced. Virtually all documented hydropolitical conflict has these aspects as central components.

Section 3 draws together the deliberations of experts in the previous two sections and lays the foundations for a subsequent and more detailed assessment of the hydropolitical dynamics of the Okavango River basin. In chapter 16, Anthony Turton, Peter Ashton and Eugene Cloete present a set of key elements. These elements are the fundamental drivers of the hydropolitical process, while interceding variables act on these drivers to result in different possible outcomes. An understanding of these elements is needed to embark upon policy development for the Okavango River basin, taking cognisance of the third hypothesis and, in particular, focusing on the two critical conflict or cooperation threshold points presented in figure 2.

Conclusion

This book does not intend to be a definitive tome on the hydropolitical dynamics of the Okavango River basin. Instead, it seeks to capture the essential elements of the hydropolitical process as they relate to the Okavango River basin in an attempt to start off on the long road to more complete knowledge. This book is an attempt to present a point of departure and to chronicle the commencement of a long journey, rather than a descriptive analysis of a final destination. In order to develop conceptual clarity and to foster scientific analysis, three hypotheses were presented in this chapter to assist the reader in analysing the complexity that is evident in the Okavango River basin. These are as follows:

- The first hypothesis relates to the existence of a hydropolitical complex in Southern Africa (presented in figure 1). This is an important interceding variable in the overall Southern African regional security complex as initially defined by Buzan (1991:210). The close proximity of so-called pivotal states in the SADC region – South Africa, Botswana, Namibia and to a lesser extent Zimbabwe – that are all economically developed, but highly water-stressed, leads to the reasonable conclusion that water scarcity can become a limiting factor to their future economic growth potential. As such, access to water in transboundary river basins can become either an element of potential conflict – and thus a potential security concern for each riparian state; or a catalyst for potential peace – and thus a fundamental driver of integration within SADC.
- The second hypothesis relates to a new and expanded definition of hydropolitics based on the unique circumstances of the SADC region. This sees hydropolitics as the systematic study of the authoritative allocation of values in society with respect to water (Turton 2002c), with the elements of both scale and range becoming relevant. These are certainly applicable to the hydropolitics of the Okavango River basin, particularly when trying to develop policy options that address the two critical conflict or cooperation threshold points that form part of the third hypothesis (figure 2).
- The third hypothesis relates to the apparent inverse relationship between conflict potential and scale as noted by Wolf (1998; 2002b), and to the apparent non-linear

relationship between conflict potential and the range of viable policy options (figure 2). Emerging from this as yet untested model is the existence of two critical conflict or cooperation threshold points. The fundamental elements of this hypothesis will need to be unravelled by the readers as they work their way through the respective chapters of this book. The editors will attempt to make some comments based on their observations of this case study material through the conceptual lens provided by the third hypothesis, in an effort to contribute to the debate of policy-related aspects in the near future.

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CHAPTER 2

An overview of key strategic issues in the Okavango basin

Peter Ashton and Marian Neal

Abstract

The Okavango basin, consisting of the Okavango River catchment plus the Okavango Delta, is an important and yet highly vulnerable component of the larger Makgadikgadi basin, which comprises portions of four Southern African countries. Though the Okavango River and its tributaries are vital sources of water in an otherwise arid region, all plans to use water from this system have attracted intense local and international concern. The three underlying principles of state sovereignty, state responsibility and good neighbourliness between states are linked directly to the relationships between states and form the basis for transfrontier cooperation on all issues. In addition, several other strategic factors will also need to be considered by the basin states when a management plan is developed for the Okavango system. Ultimately, effective management of the Okavango basin and its water resources will depend on close collaboration and mutual trust between the states concerned.

Introduction

Water is an extremely precious and important resource in Southern Africa, where all aspects of social and economic development are totally dependent upon the availability of adequate water supplies (Conley 1995; SARDC 1996; Ashton 2000a). Areas that possess sufficient water can attract and sustain a wide variety of human activities, while water-short areas are sparsely populated and inhospitable. In addition to directly supporting human life and economic activities, water also maintains all ecosystem components and functions that provide the basic life support systems for humans. Until recently, however, competing human and ecosystem needs for water in regions where water supplies were scarce or unpredictable were often resolved in ways that damaged or degraded the ecosystems concerned (Pallett 1997). This is being replaced by a growing awareness that many current methods of water resource exploitation cannot be sustained indefinitely and should be replaced by new approaches that avoid or minimise conflicts between human and ecosystem needs for water (Shela 1996; Ashton 2000b). This change in emphasis is particularly important for transboundary systems shared by more than one country.

The sustainable management of transboundary river systems shared by more than one country relies on the collective goodwill and collaborative efforts of all the basin states involved (Wolf 1999; Lundqvist 2000; Ashton 2002). The provisions of national and international water law, as well as any international or regional watercourse management treaties and protocols ratified by the basin states, help to guide the activities of individual countries sharing a river basin (Wouters 1999). In the final analysis, however, it is the decisions and actions of national governments and individual stakeholders that play a decisive role.

In Southern Africa, the water-rich Okavango Delta and its tributary rivers provide a classical example of a transboundary system where human and ecosystem needs compete for scarce water supplies in an otherwise arid region (McCarthy & Ellery 1998). Because of its perennial flows, the Okavango River and the world-renowned Okavango Delta system function as a form of "linear oasis" (Bethune 1991). The comparative abundance of water supplies has prompted numerous plans and attempts to divert or abstract water from the system for domestic, agricultural and industrial uses (UNDP/FAO 1976; JVC 1993; Heyns 1995a). Most of these attempts have not proceeded because of the adverse social, economic or environmental consequences that could arise (IUCN 1993) and, to date, very small quantities of water are withdrawn from the system (MGDP 1997; Ashton 2003). As a result, the Okavango River and Okavango Delta system remain largely intact from an ecological viewpoint while the need for water remains acute, or is worsening in many surrounding areas.

The extraordinarily rich biodiversity and scenic beauty of the Okavango Delta and its component ecosystems have attracted widespread national and international concern about the future of this unique system (see Ellery & McCarthy 1994; Ramberg 1997). In particular, attention has been focused on attempts to avoid forms of manipulation or management that could lead to adverse ecosystem changes. While many individuals, organisations and governments welcome this attention, some see it as a subtle form of external interference in matters of territorial sovereignty (Heyns 1995b; Pallett 1997). Recurring droughts and escalating regional water shortages in Botswana and Namibia (see Ashton 2000a; 2000b; 2003), coupled with mounting local and international concerns for the biological integrity of the Okavango Delta and its inflowing rivers, have accentuated the need to reach consensus on appropriate ways of managing the system (Ellery & McCarthy 1994). Since the Okavango catchment drains three countries (Angola, Botswana and Namibia), all stakeholders and authorities must agree on any water resource management actions that are deployed.

In an attempt to assist these efforts, this chapter examines the different strategic issues that already, or may in future influence water resource management decisions and actions in the Okavango basin. Particular attention is paid to the role and influence of international treaties and protocols to determine the type and degree of control that they could (or should) exert on stakeholders and authorities. Importantly, an

assessment of this nature relies on a clear understanding of the basic features of the Okavango system, as well as the demands for water that could be made of it. Accordingly, this chapter provides a brief background description of the geographical and hydrological context of the Okavango system, as well as its role, linkages with, and importance within the larger Makgadikgadi drainage basin.

Geographical and hydrological context

The Okavango system forms part of the Makgadikgadi basin, which drains portions of four countries (Angola, Namibia, Botswana and Zimbabwe; see map 1) and is one of the driest and most sparsely populated catchments in Southern Africa. The basin is endoreic (internally draining), and receives inflows from one perennial river system in the north-west (the Okavango River), as well as several smaller, ephemeral or episodic rivers in the drier southern portion of the basin, which only contain surface water flows for short periods after heavy rainfall (Pallett 1997). Spatial and temporal variations in rainfall over the catchment cause wide differences in the quantities of runoff that each sub-basin contributes to the overall Makgadikgadi basin system (McCarthy et al 1998; 2000; Ashton 2003).

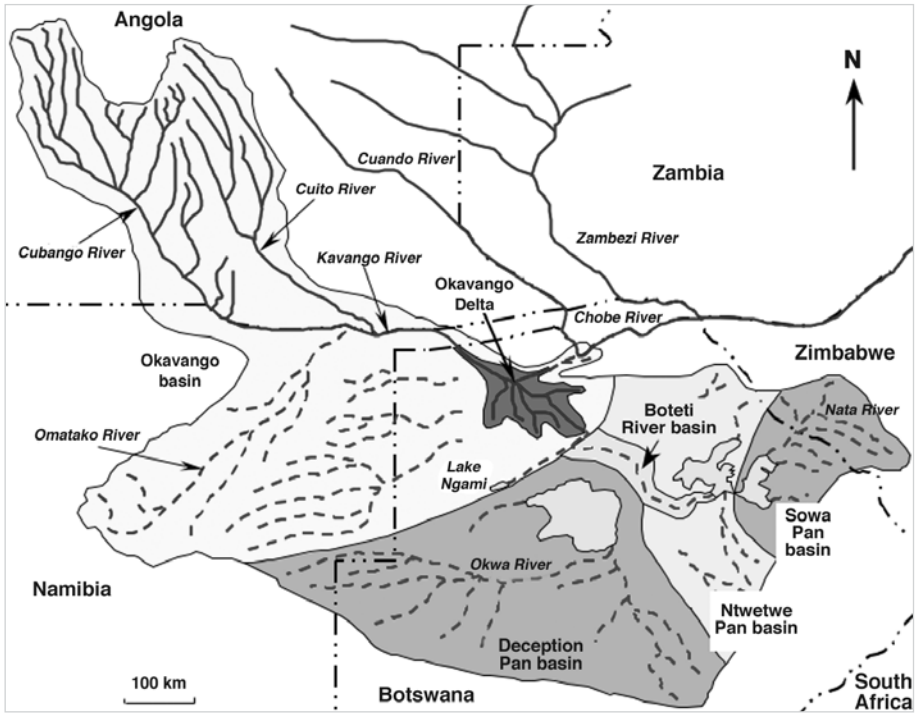
Based on its topographic and hydraulic characteristics, the Makgadikgadi basin can be divided into four distinct sub-basins or catchments that seldom have direct hydraulic contact with one another, and a small river basin (the Boteti River) that directs occasional outflows from the Okavango Delta to the Makgadikgadi pans. The Ntwetwe and Sowa pans comprise the Makgadikgadi Pan system in the east, while the Deception Pan complex forms the southern portion of the basin. Sowa Pan, the easternmost sub-basin of the Makgadikgadi basin, receives seasonal inflows from the Nata River system that rises in western Zimbabwe (Pallett 1997; Ashton 2000a; map 1). Apart from the more obvious surface water resources in the Makgadikgadi basin, there is some evidence that the southern portions of the basin may be more closely linked together through a series of shared groundwater aquifers (MGDP 1997). However, the full extent of these possible groundwater linkages is unknown and will need to be clarified in future.

The areas of the different sub-basins of the Makgadikgadi basin are shown in table 1. The Makgadikgadi basin covers an area of approximately 725,293 km^2, with Botswana providing the largest proportion (46.9%), followed by Angola (27.6%), Namibia (22.7%) and Zimbabwe (2.8%). The Okavango catchment or sub-basin covers an area of some 413,550 km^2 (in Angola, Botswana and Namibia), with an additional 15,844 km^2 contributed by the wetland area of the Okavango Delta plus its islands (in Botswana). The combined area of the Okavango sub-basin and the Okavango Delta comprises approximately 59% of the Makgadikgadi basin (table 1).

Direct rainfall in the Okavango Delta contributes approximately a quarter (3,205 Mm^3 = 24.5%) of the total annual water budget, while the Okavango River inflows provide 75.5% (McCarthy et al 1998; 2000; Ashton & Manley 1999). For the period

Map 1

The Makgadikgadi basin, the extent of the four sub-basins, the Okavango Delta, the Boteti River drainage basin and the different tributary rivers



Ephemeral and episodic rivers are shown as dashed lines, while perennial rivers are shown as solid lines.
Source: Map redrawn from UNDP/GEF 2001.

Table 1

Comparison of the area of each Makgadikgadi sub-basin within the different countries comprising the basin, and their proportional contribution to the area of the Makgadikgadi basin

Sub-basin	Country contribution (km²)				Total area (km²)	Proportion (%)
	Angola	Namibia	Botswana	Zimbabwe		
Okavango River	200,192	153,783	59,575	0	413,550	57.02
Okavango Delta	0	0	15,844	0	15,844	2.18
Boteti River	0	0	10,920	0	10,920	1.51
Deception Pan	0	11,241	153,302	0	164,543	22.69
Ntwetwe Pan	0	0	74,028	0	74,028	10.21
Sowa Pan	0	0	26,389	20,019	46,408	6.39
Totals	200,192	165,024	340,058	20,019	725,293	100.00
Proportion (%)	27.60	22.75	46.89	2.76	100.00	

Note: See map 1 for the position of each sub-basin.

1932 to 2001, the annual Okavango River inflow at Mohembo has averaged 9,863 Mm^3. Overall, the Angolan portion of the Okavango catchment provides some 94.5% of the total runoff in the Okavango River, while 2.9% originates in Namibia and the remaining 2.6% is contributed by Botswana (Ashton & Manley 1999; table 2). In effect, virtually all of the surface runoff is contributed by slightly less than half (46.6%) of the Okavango catchment (413,550 km^2), while the remainder (53.4%) contributes almost nothing to the catchment's surface water resources (table 2).

Prolonged periods of severe drought during the 1980s and 1990s reduced annual flows in the Okavango River at Mohembo by between 15% and 45% (figure 1; McCarthy et al 2000; Ashton 2003; Ashworth 2002), with a corresponding decline in the long-term average annual inflow. Flows in many other Southern African river systems show similar patterns of decline during the last 20 years and this pattern seems to be part of an 80-year cycle of high and low flows (McCarthy et al 2000). Declining inflows to the Okavango Delta have been matched by equally dramatic

Table 2

Comparison of country contribution and relative proportion of the Okavango basin contributing to average annual inflows at Mohembo

Country	Country contribution to average annual river inflows (Mm^3)	Country contribution to average annual river inflows (%)	Area of Okavango basin contributing to annual river inflows (%)	Area of Okavango basin NOT contributing to annual river inflows (%)
Angola	9,320.5	94.5	38.7	0.9
Botswana	256.4	2.6	3.8	36.7
Namibia	286.1	2.9	4.1	15.8
Total	**9,863.0**	**100.0**	**46.6**	**53.4**

declines in the volume of water flowing out of the Okavango Delta to the Thamalakane and Boteti rivers (Ashton & Manley 1999; Ashworth 2002). These declining river flows have coincided with periods of growing demand for water to meet the needs of domestic and other water users in Botswana and Namibia (MGDP 1997; Ashton 2003).

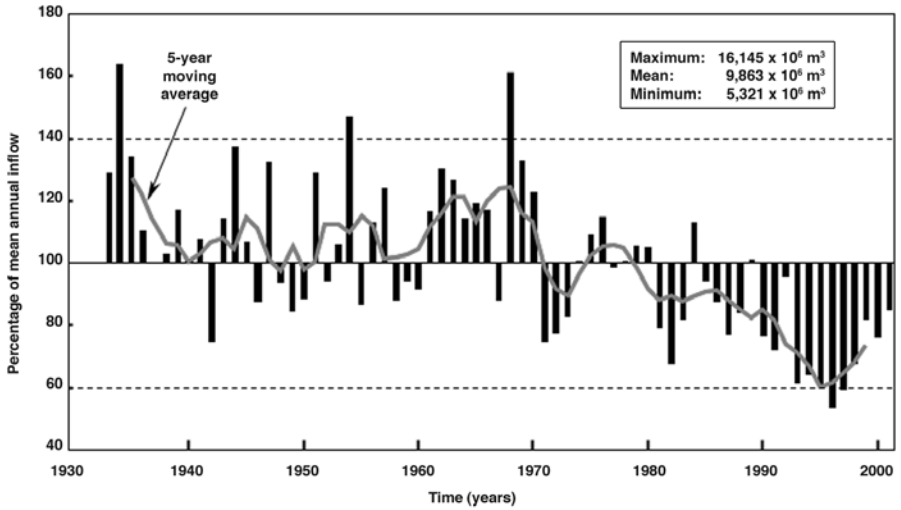
Because the use of water by one country in a shared river basin can influence users in other states, it is essential that water use should be carefully regulated to prevent unintentional hardship or conflict (Wouters 1999). International water law, as well as treaties, protocols and specific national policies and legislation provide critically important cornerstones for the effective and efficient management of shared water resources. However, while legal regulation of the interests and sovereignties of individual basin states may be necessary, this presents challenges that are both technical and judicial in nature (Pallett 1997). It is therefore appropriate to review the context in which international water law and the provisions of other international treaties and protocols may apply to the Okavango basin.

International water law

Importantly, international water law lacks the compulsory jurisdiction and enforcement that characterise domestic legal systems. Rather, it relies on its

Figure 1

Annual variations from mean annual flow (100%) in the Okavango River at Mohembo for 1933-2001, compared with the five-year moving average for the same period



Sources: Data for 1932-1974 was calculated from flows gauged at Mukwe, a short distance upstream in Namibia (Ashton & Manley 1999); data for 1975-2001 reflects flows measured at Mohembo, taken from McCarthy and others (2000) and Ashworth (2002). Each hydrological year runs from 1 October to 30 September.

acceptance by the affected states and the opinion of the wider world community. The basis of modern international water law has been derived over many decades and the most notable achievement has been the development of the Helsinki Rules on the uses of international rivers (ILA 1966). The principles embodied in these rules have been expanded into a set of 33 draft articles that are designed to assist each basin state in negotiating a reasonable and equitable share in the beneficial uses of available water resources (ILC 1994). These articles form core components of the United Nations Convention on the Law of Non-Navigational Uses of International Watercourses (UNCSW 1997) (key practical issues linked to the Helsinki Rules are listed in box 1).

Box 1

Practical aspects of the Helsinki Rules

In the determination of a country's reasonable and equitable share of the water of an international (shared) river, the Helsinki Rules (ILA 1966) suggest a number of factors that must be considered and taken into account. Some of these factors are:

- the geography of the basin, particularly the extent of the drainage basin in the territory of each state;
- the hydrology of the basin, and the contribution of water by each state;
- the climate affecting the basin;
- the nature of the use of water from the basin in the past, present and future;
- the population dependent upon the water of the basin in each state;
- the economic and social needs of each state and the comparative costs of alternative means of satisfying these needs;
- the availability of alternative water resources and the comparative costs of utilising these resources;
- the avoidance of unnecessary waste in the use of the water of the basin;
- the possibility and practicality of compensation to one or more basin states as a means of resolving or adjusting conflicts between basin states; and
- the degree to which the needs of one state may be satisfied without causing substantial injury to another basin state.

Importantly, the Helsinki Rules claim that a basin state may not deny another state the reasonable use of water in an international drainage basin for the purpose of reserving the water for itself. Furthermore, an existing reasonable use may also continue unless it can be shown that it needs to be changed or stopped to accommodate a more beneficial and urgent use. This creates the possibility of making future adjustments, reflecting the flexible nature of the Helsinki Rules.

The draft articles drawn up by the International Law Commission strongly promote the concepts of prior and ongoing consultation between basin states, and the mutual sharing of data and information in reaching consensus (ILC 1994). A key aspect of these articles is that, in the event of two states coming into conflict, the obligation not to cause harm to another state prevails over the concept of equitable use that is stated in the Helsinki Rules (Wouters 1999). This is based on the argument that the use of water by one state cannot be equitable if it causes harm to another (ILC 1994). The principle of equitable sharing does not mean that each state has an equal

share (of the water), but rather that the social and economic needs of each state must be accorded equal consideration when arriving at a judgement.

In addition, the draft articles indicate that all states sharing an international river basin should jointly form a river basin management authority or organisation that can equally represent the interests of each state (ILC 1994). This approach has been adopted successfully elsewhere in Southern Africa (Pallett 1997) and is the basis for the Permanent Okavango River Basin Water Commission (OKACOM) agreement between Angola, Botswana and Namibia (OKACOM 1994).

National policies and legislation

In the context of national policies and legislation, Angola, Botswana and Namibia have clear policies and laws that govern the ownership and use of water and land. In each country, the respective national constitutions consider all water to be a national (public) good that is owned by the state, where the relevant state department administers all water uses on behalf of the state (Republic of Botswana 1990; Republic of Namibia 2000a; ANGOP 2002). A brief summary is provided for each country below.

Angola

In Angola, the management and use of water are currently regulated as part of the Environmental Framework Law (Republic of Angola 1998). This law is based on articles 12 and 24 of the Angolan Constitution (Republic of Angola 1992) and defines the framework for protection and management of the environment and all natural resources, while promoting the principles of sustainable development and the guidelines of Agenda 21. A specific Angolan Water Law that incorporates these features has been developed (Ministry of Fisheries and Environment 2000; Russo et al 2002) and has recently been promulgated (ANGOP 2002).

In terms of Angolan law, all water is owned by the state, and the relevant organ of the state (government department) is the formal custodian of the country's water resources. Water resource management is decentralised to provincial authorities wherever possible (ANGOP 2002). With the recent cessation of the Angolan civil war, the Angolan government's overriding concern has been to overcome the social, economic and environmental damage caused by this protracted conflict. Accordingly, policy frameworks and strategic plans are based on the fundamental principle that the sustainable use of the natural environment is essential. This is encapsulated in two key documents, the National Environmental Management Programme (PGNA) and the National Environmental Strategy (ENA). Responsibility for the formulation and implementation of all aspects of environmental management currently lies with the Ministry of Fisheries and Environment (Russo et al 2002). At present, water use in Angola is administered by the Department of Agriculture since agriculture is the

largest water use sector in the country. The Angolan Department of Water Affairs will administer Angola's new water law now that it has come into effect.

Botswana

The Botswana Department of Water Affairs, part of the Ministry of Mineral Resources and Water Affairs, is the designated custodian of Botswana's water resources (Khupe 1994). Importantly, the line function activities of any other ministries that can impact on the use of water resources, or otherwise lead to their degradation, have to be coordinated through the Department of Water Affairs. This is in line with Botswana's Constitution and its national policies of environmental conservation and resource protection (Republic of Botswana 1990; 1991; Khupe 1994).

In Botswana, ownership of all land and water rests in the state. Traditional land and water-use patterns are respected in the constitution of Botswana and take precedence over new developments. All proposals for new water development projects must comply with the requirements of the National Water Master Plan (Khupe 1994). Several of Botswana's natural resource and land management policies, as well as policies that relate to land ownership and tenure, have important implications for the use of surface and groundwater resources (Khupe 1994). All developments related to water, or likely to impact upon water resources are required to meet the provisions of the National Water Master Plan (SMEC/KPB/SGAB 1992).

Currently, there is a high level of collaboration between government ministries within a national planning framework around the conservation of natural resources. Since independence in 1966, Botswana has produced several phased national development plans and, in addition, has a comprehensive National Water Master Plan that is regularly updated (SMEC/KPB/SGAB 1992). All water resource developments in Botswana are now coordinated closely with the aims and objectives of Botswana's national development plans (Khupe 1994).

Namibia

In Namibia, the Department of Water Affairs is part of the Ministry of Agriculture, Water and Rural development (MAWRD), and is responsible for water resource management (Heyns 1995b). The supply of water for domestic and industrial purposes is controlled by the state-run utility, NamWater (Heyns et al 1998).

The control, conservation and use of water in Namibia used to be regulated by the Water Act no 54 of 1956 (including amendments up to 1979) and the Water Amendment Act no 22 of 1985 (Heyns et al 1998). These two acts were originally promulgated in South Africa and were applied during the period prior to, and shortly after Namibia's transition to independence. A new Water Act for Namibia is in the process of being finalised (Republic of Namibia 2000a). Under the original

(South African) Water Act (which still holds in Namibia until the new act is passed by parliament), riparian landowners have a right to use (but not to own) surface water that flows across their land or which lies adjacent to their land (Heyns et al 1998).

The Namibian Department of Water Affairs is charged with the responsibility of acting as custodian for the country's water resources (Heyns 1995a; Republic of Namibia 2000b). The line function activities of several other ministries (e.g. the ministries of Lands, Resettlement and Rehabilitation, of Environment and Tourism, of Works) can have a major impact upon the country's water resources. These activities are coordinated through the Department of Water Affairs (JVC 1993; Heyns et al 1998). This is in line with the concern for environmental issues, and the prevention of natural resource degradation, as expressed in the Constitution of the Republic of Namibia (Republic of Namibia 1989). Namibia's Second National Development Plan (NDP2), which covers the period until 2006 (Republic of Namibia 2001) makes explicit reference to the key role that water plays in Namibia's development plans and the need to align the activities of all government departments that have an influence on the country's water resources (Heyns et al 1998).

International conventions and treaties

In addition to the framework for international cooperation provided by the principles embodied in international water law, certain international conventions (table 3) are also relevant to water management decisions in the Okavango basin, since these have either been signed, ratified or are being considered for future accession by the basin states concerned. The key provisions of the five international conventions and the respective responsibilities that they place on those states that have agreed to comply (or that may in future agree to comply) are briefly reviewed below.

Ramsar Convention on Wetlands of International Importance

The Ramsar Convention on Wetlands of International Importance seeks to promote international awareness and cooperation in the conservation of threatened wetland ecosystems, particularly where these ecosystems support unusually large numbers of specific species or an unusually wide diversity of species. Wetlands that are considered to have special significance in an international or global context are judged to be of particular importance (Ramsar 1971).

Both Botswana and Namibia have ratified the Ramsar convention, while Angola (together with four other Southern African countries) is still considering its position. Among the key provisions embodied in its charter (Ramsar 1971), the convention requires each contracting party to:

- designate at least one wetland to be included in the List of Wetlands of International Importance;

Table 3

Ratification dates of key international conventions by Angola, Botswana and Namibia

Country	Ratification date				
	Ramsar*	UNCBD*	UNCCD*	UNCSW*	UNFCCC*
Angola	N/P	1 Apr 1998	30 Jun 1997	N/P**	17 May 2000
Botswana	9 Dec 1996	12 Oct 1995	11 Sep 1996	N/P	27 Jan 1994
Namibia	23 Aug 1995	16 May 1997	16 May 1997	N/P***	19 May 1995

Notes:
* Ramsar = Ramsar Convention on Wetlands of International Importance
UNCBD = United Nations Convention on Biological Diversity
UNCCD = United Nations Convention to Combat Desertification
UNCSW = United Nations Convention on the Non-Navigational Uses of International Watercourses
UNFCCC = United Nations Framework Convention on Climate Change
** N/P: not yet party to convention (based on available information)
*** Namibia has signed the UNCSW, but has not yet ratified it.

- formulate plans that promote the conservation and wise use of wetlands in their territory; and
- consult with other contracting parties regarding the implementation of the convention's obligations, especially where a designated wetland and its associated water system extend over the territories of more than one contracting party.

In accordance with these requirements, Botswana and Namibia have each registered and declared appropriate wetland systems as of 'international importance'. Botswana's listing of the Okavango Delta as a Ramsar site in 1996 has accorded this system the status of a wetland of international importance, and the designated area of the site (65,000 km^2) makes it the largest designated Ramsar site in the world. The site encompasses the 15,844 km^2 Okavango Delta and its islands (table 1), plus a wide area of peripheral drainage and associated terrestrial ecosystems that are some three times larger than the Okavango Delta itself. The designation of the Okavango Delta as a Ramsar site has been widely welcomed by local and international bodies that have long recognised the unique and valuable nature of the system.

As noted above, one of the specific provisions of the Ramsar convention requires other contracting parties that share part of a designated site or its inflowing rivers to

participate in the conservation and wise use of the designated site (Ramsar 1971). Thus, while the Okavango Delta is physically located in Botswana, as a contracting party to the convention, Namibia is also obliged in terms of the Ramsar convention to contribute to conservation efforts since some 3% of the water that enters the Okavango Delta originates within Namibia's borders (Wilson & Dincer 1976; McCarthy et al 1998; Ashton & Manley 1999). The fact that Angola is not yet party to the Ramsar convention is worrying, since it contributes over 94% of the river inflows to the Okavango Delta. Angola is considering its position in this regard, which is a promising prospect.

United Nations Convention on Biological Diversity (UNCBD)

Together with every other country in Southern Africa, Angola, Botswana and Namibia have ratified the United Nations Convention on Biological Diversity (UNCBD) and aligned themselves with the convention's articles and provisions. The articles of the convention clearly affirm that contracting parties retain the sovereign right to exploit their own resources in accordance with their own environmental policies. However, in doing so, they bear the responsibility to ensure that activities within their jurisdiction do not cause damage to the environment of other states or of areas beyond the limits of their national jurisdiction (UNCBD 1992). Other key articles of this convention that refer explicitly to transboundary resource use, oblige contracting parties to:

- cooperate with other contracting parties, either directly or through competent international organisations, in respect of areas beyond national jurisdiction and on other matters of mutual interest, for the conservation and sustainable use of biodiversity; and
- introduce appropriate procedures that require environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biodiversity aiming to avoid or minimise such effects and, where appropriate, allow for public participation in the procedures (UNCBD 1992).

Since all three basin states have ratified this convention, they are required to bear in mind any activities taking place within their borders that may have a detrimental effect on the biodiversity and ecological functioning of systems located outside their jurisdiction. In terms of these provisions, any decision by a basin state to utilise any of the water resources that sustain the biodiversity of the Okavango River or the Okavango Delta should be agreed to by all basin states.

United Nations Convention to Combat Desertification (UNCCD)

The United Nations Convention to Combat Desertification addresses the problems associated with the widespread degradation of land in arid, semi-arid and dry sub-

humid areas that is caused primarily by human activities and climatic variations (UNCCD 2001).

All Southern African countries, including Angola, Botswana and Namibia, have ratified the convention. Key provisions of this convention require contracting parties to:

- promote cooperation among affected country parties in the fields of environmental protection and the conservation of land and water resources, as they relate to desertification and drought;
- undertake to strengthen subregional, regional and international cooperation; and
- cooperate in the preparation of subregional and/or regional action programmes to harmonise, complement and increase the efficiency of national programmes (to combat the effects of desertification).

Typically, such cooperation between neighbouring states may include agreed joint programmes for the sustainable management of transboundary natural resources, scientific and technical cooperation, and the strengthening of relevant institutions (UNCCD 2001).

Because the Makgadikgadi basin is one of the driest catchments in Southern Africa, land-use patterns within the catchment can have a negative influence on the ecological structure and functioning of associated ecosystems. The location of the Okavango River and the Okavango Delta within the Makgadikgadi basin suggests that these systems may be vulnerable to activities that occur in the Makgadikgadi basin. In particular, the wider regional water shortages might emphasise demands for additional water from the Okavango system to supply the growing needs of domestic, agricultural or industrial water users (Ashton 2003).

United Nations Convention on the Law of Non-Navigational Uses of International Watercourses (UNCSW)

The United Nations Convention on the Law of Non-Navigational Uses of International Watercourses (UNCSW 1997) is designed to apply to the uses of international watercourses and their waters for purposes other than navigation, and to ensure that suitable measures are taken for the protection, preservation and management of these watercourses and their waters. South Africa is the only Southern African country that has ratified this convention to date, although Namibia is also a signatory (Republic of Namibia 2000c). Other Southern African countries are considering their positions with regard to this convention. Given the large number of shared river systems in Southern Africa, this is a welcome development. To date (July 2002), an insufficient number of countries have ratified this convention for it to be in force.

However, despite the fact that the convention is not yet in force, several important provisions (UNCSW 1997) include requirements that:

- Watercourse states must use an international watercourse in an equitable and reasonable manner. In particular, any plan to use or develop an international watercourse must seek to attain optimal and sustainable utilisation of the system and its benefits for all the watercourse states concerned.
- Watercourse states that use an international watercourse within their territorial boundaries must avoid causing significant harm to other watercourse states.
- Before a watercourse state initiates or allows the implementation of any action that could have a significant adverse effect upon other watercourse states, it must inform such states of its intentions. In addition, each state must be given all the available technical data and information, including the results of any environmental impact assessment, to enable them to evaluate the possible effects of the planned actions.
- Watercourse states – individually and, where appropriate, jointly – shall protect and preserve the ecosystems of international watercourses.
- All international watercourses and their related installations, facilities and other works shall be protected by the principles and rules of international law that are applicable in international and non-international armed conflict, and must not be used to violate those principles and rules.

In terms of the provisions of this convention, if it comes into force, Angola, Botswana and Namibia would need to ensure that any planned development (e.g. irrigation agriculture) or water abstraction from the Okavango system does not cause deterioration in the goods and services derived from the system by the other basin states. Similarly, the provisions of the convention also require contracting parties to share information on possible plans to modify river flows or withdraw water from the system, and to work together to prevent any ecosystem damage that might occur as a result of such plans being implemented.

United Nations Framework Convention on Climate Change (UNFCCC)

The primary objective of the United Nations Framework Convention on Climate Change is to achieve the stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner (UNFCCC 1992). Angola, Botswana and Namibia have all ratified this convention. Although the convention is not directly related to the issues of water consumption and resource management, it plays a significant role in countries, such as these basin states, where water scarcity is an ongoing concern. In the key articles of this convention (UNFCCC 1992), contracting parties are required to:

- cooperate to promote a supportive and open international economic system that would lead to sustainable economic growth and development in all parties, particularly developing country parties;
- promote sustainable management, and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases including biomass, forests and oceans, as well as other terrestrial, coastal and marine ecosystems; and
- cooperate in preparing for adaptation to the impacts of climate change, develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods.

Regional treaties and protocols

Over the years, Angola, Botswana and Namibia have entered into several regional protocols and agreements with one another and with other neighbouring states. While these agreements and protocols may not be accorded the same status as global treaties, they still represent important strategic accords or contracts that formalise, assist and promote international cooperation between the respective signatory parties. The different agreements are briefly reviewed below.

Bilateral and multilateral commissions

Angola, Botswana and Namibia have entered into several bilateral agreements with each other and with their neighbours to coordinate the management of transboundary water issues in river basins shared between them (Pallett 1997; Tarr 1998; Taylor & Bethune 1999; MAWRD 2002). These agreements have included the formation of joint permanent technical commissions (JPTC) or permanent joint water commissions (PJWC) between the countries concerned. The specific commissions are:

- Joint Permanent Technical Committee (JPTC) on the Limpopo River between Botswana and South Africa (1983);
- Permanent Joint Technical Commission (PJTC) on the Cunene River between Angola and Namibia (1990);
- Joint Permanent Water Commission (JPWC) between Namibia and Botswana, to deal with the utilisation of water resources from the Cuando/Linyanti/Chobe river system, as well as the Zambezi and Okavango rivers (1990);
- Permanent Water Commission (PWC) on the Orange (Gariep) River between Namibia and South Africa, with a separate specific agreement on the Vioolsdrift and Noordoewer Joint Irrigation Scheme (1992);
- Permanent Okavango River Basin Water Commission (OKACOM) between Angola, Botswana and Namibia (1994) (see below for further details); and

- Orange-Senqu River Commission (ORASECOM) between Botswana, Lesotho, Namibia and South Africa (2000).

In addition, the Zambezi River Basin Commission (ZAMCOM) on the Zambezi River is currently under discussion between Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia and Zimbabwe.

Revised Protocol on Shared Watercourse Systems in the SADC Region

Every member state of the Southern African Development Community (SADC) has signed the Revised Protocol on Shared Watercourse Systems (SADC 2001) that replaced an earlier version. However, only Botswana and Namibia have ratified the protocol to date (SADC 2001). The original protocol and its revision (SADC 2001) represent a significant development, and indicate shared and heightened awareness of the critical importance of water resources for the entire Southern African region. Key provisions of the revised protocol include:

- The utilisation of shared watercourse systems within the SADC region is open to each riparian or basin state, in respect of the watercourse systems within its territory and without prejudice to its sovereign rights.
- Member states within the basin of a shared watercourse system shall maintain a proper balance between resource development for a higher standard of living for their people, and conservation and enhancement of the environment to promote sustainable development.
- Member states within a shared watercourse system undertake to establish close cooperation with their neighbours in the study and execution of all projects likely to have an effect on the regime of the watercourse system.
- Member states shall utilise a shared watercourse system in an equitable manner. In particular, a shared watercourse system shall be used and developed by member states to attain its optimum utilisation and for benefits consistent with the adequate protection of the watercourse system.

Clearly, the provisions of the revised protocol (SADC 2001) are very similar to those contained in the United Nations Convention on the Laws of Non-Navigational Uses of International Watercourses (UNCSW 1997).

The provisions of the revised protocol entitle Angola, Botswana and Namibia to develop water systems that flow within the boundaries of their sovereign territories. However, the provisions also require each state to inform its neighbours of any plans to develop or modify a shared river system, to work together to ensure that each state shares in the benefits of such plans, and to ensure that environmental degradation is avoided or minimised. As the lowest state in the Okavango catchment, Botswana is the most vulnerable to any upstream developments in Angola or Namibia. Given the

virtually pristine condition of the Okavango Delta at present, any sustained change to flow regimes in the Okavango River system could have significant adverse impacts on the Okavango Delta.

Permanent Okavango River Basin Water Commission

In 1994, Angola, Botswana and Namibia established the Permanent Okavango River Basin Water Commission (OKACOM) to investigate ways to accommodate the legitimate water needs of the three countries in a sustainable manner, and to collaborate in the management of the basin's water resources in general (OKACOM 1994). The objective of OKACOM is to act as a technical advisor to the three contracting parties on matters relating to the conservation, development and utilisation of water resources. Each of the three parties has appointed a commissioner to represent the country's interests.

The functions of the commission, as stipulated in article 4 of the OKACOM Agreement (OKACOM 1994), are to advise the three contracting parties on:

- measures and arrangements to determine the long-term safe yield of the water available from all potential water resources in the Okavango River basin;
- reasonable demands for water from consumers in the Okavango River basin;
- criteria to be adopted in the conservation, equitable allocation and sustainable utilisation of water resources in the Okavango River basin;
- investigations, separately or jointly by the contracting parties, related to the development of any water resources in the Okavango River basin, including the construction, operation and maintenance of any water works;
- prevention of pollution of water resources and control over aquatic weeds in the Okavango River basin; and
- measures that can be implemented by one or all of the contracting parties to alleviate short-term difficulties resulting from water shortages in the Okavango River basin during periods of drought, taking into consideration the availability of stored water and the water requirement within the territories of the respective parties at that time.

The OKACOM agreement specifically advocates the use of Agenda 21 principles that were developed at the United Nations Conference on the Environment and Development as an action plan for sustainable development worldwide (UNCED 1992). It also acknowledges the Helsinki Rules on the use of international waters (ILC 1966). Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their needs and aspirations" (WCED 1987). The key principles of Agenda 21 that are relevant to the functions of OKACOM include:

- States retain the sovereign right to exploit their own resources according to their own environmental and development policies, and must ensure that all activities

within their area of jurisdiction do not damage the environment of other states or areas outside the limits of their national jurisdiction.
- In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.
- Environmental issues are best handled with the participation of all concerned citizens, at the relevant level.
- Environmental impact assessments, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.
- States shall provide prior and timely notification and relevant information to potentially affected states on activities that may have a significant adverse transboundary environmental effect and shall consult with those states at an early stage and in good faith.

Practical implications for management of the Okavango basin

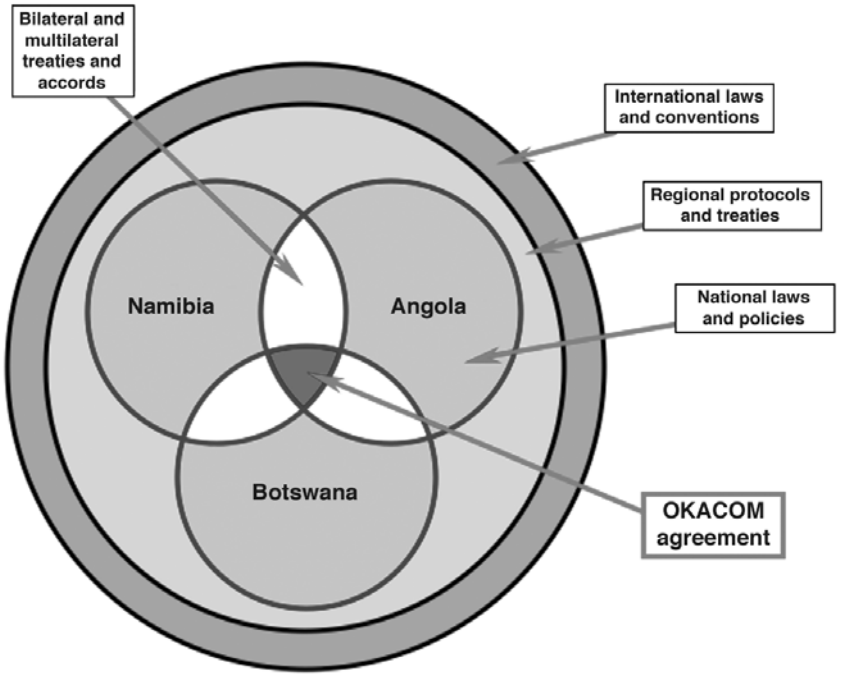
The preceding discussion on national and international dimensions of water resource management has highlighted several key points in international water law, as well as in regional and international conventions and treaties that can exert a complex influence on decision-making in the Okavango basin (figure 2). Importantly, international water law sets down the philosophy and tone for interstate collaboration. These principles are further defined and explained in the specific conventions that deal with particular issues.

It is important to emphasise once again that no external party is able to enforce the principles of international water law or the provisions of specific treaties and conventions (IUCN-ROSA 2001). Similarly, a third party can only be called upon to resolve a dispute if all the states concerned have agreed to such an intervention. Instead, conflict prevention depends on the goodwill of the authorities concerned, their acceptance of and adherence to the spirit underlying the principles, and their individual and collective commitment to work together in a spirit of cooperation and collaboration.

In every case, the three underlying principles of state sovereignty, state responsibility and good neighbourliness between states are directly linked to the relationships between states and form the foundation for transfrontier cooperation on all issues and matters of concern (Wouters 1999). In essence, the complementary nature of these principles entitle each state to act without outside interference, provided that its actions are not harmful to other states and are carried out in a manner that respects the rights of its neighbours. Two central tenets of any water-sharing agreement between states that share a particular water resource are, firstly, that each state is entitled to a fair and equitable share of the resource in question

Figure 2

Conceptual diagram showing the relationships between the three basin states (Angola, Botswana and Namibia), the OKACOM agreement, other bilateral and multilateral commissions, treaties and accords, and the framework provided by national laws and policies, regional protocols and treaties, and international laws and conventions



and, secondly, all water use in terms of any such agreement must be reasonable, beneficial and equitable. However, international water law and the provisions of specific treaties and protocols provide very little guidance on these contentious issues and it is left to the individual states to reach an agreement that is acceptable to all.

The SADC Treaty (SADC 1992) and the Revised Protocol on Shared Watercourse Systems (SADC 2001) provide additional definition and guidance on regional integration and cooperation between Southern African states, while incorporating the three principles outlined above. Importantly, though it is not strictly prescriptive, the SADC Treaty provides an enabling environment that helps states to address the objectives of promoting economic growth, reducing poverty, and enhancing the quality of life of all people in the region. Significantly, the SADC Treaty perceives that collaboration between states should be based on sovereign equality, respect for human rights, equity and mutual benefit to all participants, while also recognising that citizens and non-governmental organisations are important stakeholders.

International conventions and the SADC Treaty and protocols share many similarities in their objectives and intent because they were derived from similar sets of guiding principles. However, differences in managerial systems within specific countries and the diverse array of rights, obligations and practices of stakeholders have made it difficult to implement these instruments in practice (Ashton & Chonguica 2002). In particular, the presence of a dual legal system in most Southern African countries has often led to the trivialisation of customary or traditional laws and practices. As a result, many individuals and communities become alienated from management and planning processes because they perceive that their beliefs and value systems have been discounted (IUCN-ROSA 2001). In addition, management decisions taken at central government level have often ignored, marginalised or abrogated prior patterns of resource use by communities that have developed coping strategies to contend with naturally variable supplies of resources. This is primarily due to the fact that international laws and treaties are concerned with the rights of states and not those of people as individuals.

Southern African countries have recognised the need to manage water resources in an integrated way at the catchment or river basin level and are starting to set up catchment management agencies at national level and river basin organisations at regional level (Pallett 1997; IUCN-ROSA 2001). However, these structures are not yet well developed and still need to bridge the gaps between individual and community water users, central government ministries and institutions, and multilateral institutions. This is particularly difficult in the case of water resource management, because it is a multisectoral issue that affects all aspects of social and economic development (Ashton & Chonguica 2002). An important consideration is the need for truly effective public participation in the planning processes as a means to strengthen community support for and involvement in all water resource management decisions that affect their livelihoods (GWP 2000). Community support is a critically important feature, because the collective actions of individuals and communities on the ground, rather than those of state ministries or institutions, determine whether or not water resource management principles, policies and programmes are effective.

The need to involve communities in decision-making processes is widely recognised in all international treaties and protocols, but little guidance is given on how to achieve this. The emphasis on sovereignty issues in treaties and protocols leaves it up to individual states to decide how and to what extent communities will be involved, with the result that each state tends to adopt its own preferred approaches. There is no agreed system or set of standards whereby states can ensure public participation, nor are there any guarantees that the systems used will achieve the desired outcomes (GWP 2000; IUCN-ROSA 2001). Since there are no mechanisms whereby citizens can hold states accountable for these commitments, it is also not surprising that these differences have contributed to public perceptions that there is a need for greater transparency in decision-making processes.

In terms of international law and in accordance with international treaties and protocols, states are empowered to utilise and manage the resources within their areas of territorial sovereignty (ILA 1966; ILC 1994). However, where these activities may have an influence or effect on a neighbouring state, the states concerned are required to collaborate closely with their neighbours to develop a mutually acceptable solution that does not cause harm to one or more neighbouring states (Wouters 1999). This emphasis locates responsibility for transboundary resource management firmly within the ambit of national governments and removes any form of control from communities (IUCN-ROSA 2001). Importantly, the terms and provisions of existing laws, treaties and accords seldom make any meaningful provision for possible future changes to match or take account of possible future variations in resource availability (IUCN-ROSA 2001). This issue is particularly pertinent in the case of international or bilateral agreements between countries to share a specific water resource such as the Okavango basin. As each country's demand for water grows, the declining per capita availability of water or the implications of climate change may require modifications to the original legal agreement.

The high degree of mutual trust and commitment to collaboration and cooperation that are needed to achieve the effective and integrated management of a shared water resource are seldom easy to incorporate into existing institutional structures. In reality, many of the policies, priorities and strategies that are needed extend well beyond the boundaries of conventional line-function government departments (Ashton & Chonguica 2002). Experience gained in Africa and elsewhere has shown that an independent organisation (such as a river basin organisation) is most likely to be able to represent the interests of all countries sharing the basin in question (Lundqvist 2000; Van der Zaag & Savenije 2000; Van der Zaag et al 2000). However, experience has also shown that most river basin organisations tend to regard water development purely as a hydrological problem. Indeed, the staff complement of most of these organisations comprises technical experts from the water sector, with little or no representation from the agriculture, mining, forestry, finance and planning sectors. This hampers appropriate consideration of the multifaceted, cross-sectoral approaches that are needed to transcend traditional administrative boundaries. Unless the

institutional arrangement makes provision for the integration of all these disciplines, it will not be able to demonstrate an appropriate system of corporate and public governance that meets the needs of all participants (Ashton & Chonguica 2002).

The creation of such a transboundary institution requires each state within the river basin or management unit to accept and support the roles and responsibilities of its partner countries, while committing itself to the maintenance of a spirit of harmony and goodwill among its partners (Halter 1991; OKACOM 1994; Pallett 1997; GWP 2000; Lundqvist 2000; Van der Zaag et al 2000). An important element of such international partnerships is the realisation that each party's rights and obligations are mutual and reciprocal, rather than unilateral (Wolf 1999; Van der Zaag & Savenije 2000). In the specific case of a river basin organisation, the basis for any agreement on the volumes of water required by a country relies on the ability of each country to manage its water resources in a fair and equitable manner (Ashton 2000a; 2000b; 2002).

In relative terms, Angola has abundant water resources, while both Botswana and Namibia are water-scarce countries (Conley 1995). In addition, the three countries are at different levels of social, political and economic development and each country is likely to have different priorities and objectives in terms of its future needs for water (Ashton 2003). Accordingly, each will place different degrees of emphasis on water resource management issues in its segments of the Okavango basin. Notwithstanding these possible differences, the three countries have bound themselves to the provisions of the OKACOM agreement and, in doing so, have signalled their intention to collaborate on all aspects of the future management of the Okavango basin (OKACOM 1994). This proactive agreement between the three states provides a useful framework for the possible future evolution of OKACOM into an independent, multidisciplinary river basin organisation that would be responsible for the equitable management of the basin. The recent end of the civil war now enables Angola to address the development needs of its citizens who live in the Okavango catchment and, in particular, their needs for water (ANGOP 2002).

Recent population estimates (Ashton 2000b; FAO 2000; UNAIDS 2002) suggest that the combined population of the Okavango basin was in the order of 1.113 million in 2000. Approximately 76% of the Okavango basin population live in Angola, while the Namibia and Botswana segments of the basin contain 13% and 11% of the basin population, respectively (Ashton 2000b; 2003). Despite the dramatic effects of the HIV/Aids pandemic sweeping across Southern Africa (Ashton & Ramasar 2002), the Okavango basin population is likely to increase to approximately 1.686 million by 2020 (Ashton 2003). By combining the population estimates for 2000 with data on current land-use patterns (FAO 2000), the total volume of water needed within the catchment during 2000 was estimated at 23.2 Mm^3/year (Ashton 2000b; 2003). Angola would require approximately 13.8 Mm^3 (60%) of this total, while 4.1 Mm^3 (18%) and 5.2 Mm^3 (22%) would be needed by Botswana and Namibia, respectively. It is important to note that these estimates are for consumptive water needs only and

exclude allowances for the water needed to maintain essential ecosystem services within the Okavango River or the Okavango Delta (Ashton 2003).

Estimates of the future water needs for the Okavango basin countries will depend on population growth rates and the development trajectories of each country (see plate 1). Given the available projections for Namibia (Heyns 1995a; Republic of Namibia 2000b), plus generous estimates of the possible future water needs to meet social and economic development priorities in Angola and Botswana (Ashton 2003), the combined water requirements of the three countries in 2020 would be equivalent to some 3% (300 Mm^3/year) of the mean annual runoff of the Okavango River at Mohembo. Of this volume, Angola's consumptive needs would be approximately 40%, while those in Botswana and Namibia would amount to 18% and 42%, respectively (Ashton 2003).

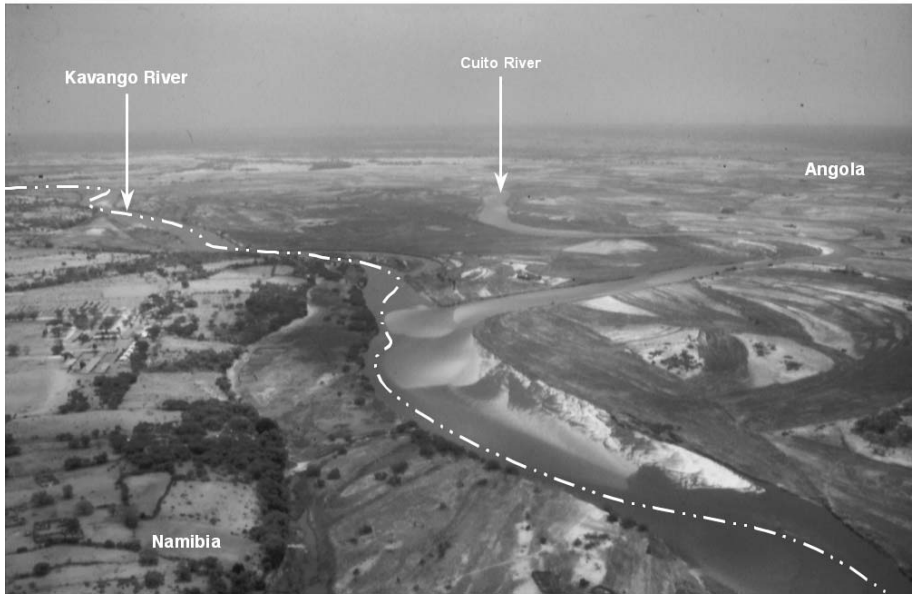
Given that natural flows in the Okavango River have varied between -45% and +65% of the mean annual flow (McCarthy et al 2000; Ashton 2003; figure 1), a 3% decrease in mean annual flow is well within the normal range of variation (Ashton & Manley 1999) and may not appear to be significant. The wide interannual variations in natural inflows to the Okavango Delta (Ashton & Manley 1999; McCarthy et al 2000) are significantly larger than those that could occur if the anticipated needs of water users are met. The fact that these natural variations have not led to catastrophic ecological consequences in the Okavango Delta as predicted by some people (e.g. Greenpeace 1991; Ramberg 1997), supports the contention that the Okavango Delta ecosystems are resilient and have become adapted to natural variations in inflow (McCarthy et al 2000).

The absence of sufficient information regarding the scale, significance and resilience of ecosystem responses within the Okavango Delta to decreased inflows of the magnitude suggested here makes it extremely difficult to predict with any accuracy or certainty the likely scale of responses to a *sustained* decrease in inflow. While it is clear that a sustained decrease in inflows to the Okavango Delta will reduce the flooded area of this wetland (Ramberg 1997; Ashton 2000a), the precise extent and location of such a reduction and its implications are unknown. Therefore, it is essential that the likely extent and consequences of such a decrease must be fully evaluated as a matter of urgency.

Another critically important physical feature is the dependence of the Okavango Delta on inflowing loads of sediment in the form of sand transported as bed-load along the inflowing river channels. It is this sand that elevates the river channels above the surrounding terrain and allows their waters to flow outwards from the channel to inundate this land (Ellery & McCarthy 1994; McCarthy & Ellery 1998). If the inflowing sand load is reduced, for example, by being trapped within an upstream impoundment, the river channels would incise into the surrounding terrain and the flooded area would be greatly reduced (Ashton 2000b; McCarthy et al 1998; 2000). This would have enormous long-term consequences for the ecological structure and functioning of the Okavango Delta. Clearly, therefore, any attempts to impound water

Plate 1

Aerial view of the confluence of the Kavango and Cuito rivers



Notes: Aerial view of the confluence of the Kavango and Cuito rivers, with the Kavango (flowing from top left to right bottom of the photograph) forming the border between Angola and Namibia. The small village of Katere in Namibia and its associated areas of cultivation are visible on the left the photograph.Large sections of the riparian vegetation on the Namibian bank have been removed for building materials and fuel.This photograph was taken during December when river flows are at their lowest.The Cuito River floodplain in Angola (on the right) shows clear signs that the river channel has meandered widely across the floodplain, leaving numerous scroll bars. The shallow channels between these bars are lined with silt deposits and support numerous small wetlands.The Cuito River brings large quantities of fine sand down from its catchment, depositing these into the channel of the Kavango River where they are easily visible during low flows. The combined flow of the Kavango and Cuito rivers transports this sand downstream into the Okavango Delta where it fulfils a vital role in the ecosystem, raising water levels and sustaining lateral flooding away from the river channels.

or alter river flows in the catchment upstream of the Okavango Delta should be very carefully evaluated to ensure that such schemes do not alter the patterns of sediment (sand) transport.

In addition, it is vitally important that Angola, Botswana and Namibia collaborate to derive accurate estimates of the volumes of water that each state may justifiably require. In this process, the three countries will also need to agree on suitable criteria that can be used as the basis of decisions regarding fair and equitable shares of the water resources that each country may safely withdraw from the system for its own uses. Clearly, the three countries must also ensure that all water abstractions are carefully controlled and managed (Ashton 2000a), while any resulting impacts on the Okavango Delta are monitored and evaluated as vigilantly as possible.

The highly complex nature of the problems facing the Okavango basin states should not be underestimated. The three states will need to harness their respective resources to ensure that the solutions derived are both amicable and sustainable in the long term. While it is inevitable that the three states will need to call on external agencies for additional technical and financial assistance, great care should be taken when accepting advice or assistance from outside parties. In particular, it will be important for Angola, Botswana and Namibia jointly to avoid any externally applied pressure or coercion to achieve particular environmental or social objectives that may jeopardise the achievement of their respective national and regional goals for social and economic development. Ultimately, Angola, Botswana and Namibia share responsibility for the effective management of the water resources within Okavango basin and for maintaining cordial relations with one another.

Whatever decision is taken on the future use of water from the Okavango basin, Botswana and Namibia will continue to face escalating water shortages and must ensure that their citizens' reasonable needs for water are promptly met. Angola also faces an enormous challenge to stimulate sustainable social and economic development in the aftermath of its civil war. If the basin states fail to achieve an equitable solution to water resource management in the Okavango basin, this could hamper social and economic development in these countries and in the SADC region as a whole.

It has been suggested that Botswana and Namibia could make use of alternative water sources within or adjacent to their territories as one way of reducing their potential demands for water from the Okavango system (Conley 1995; Heyns 1995a). Given the generally arid nature and shortage of available surface water resources in both countries, groundwater resources and the respective border rivers shared with other states are likely to be the only options that can be exploited cost-effectively (Pallett 1997). Both countries already depend heavily on groundwater resources and it is clear that these sources also have finite limits to their exploitation (MGDP 1997; Ashworth 2002; MAWRD 2002). Ultimately, water abstraction from the various border rivers that Botswana and Namibia share with their neighbours offers the most likely long-term, sustainable solution for meeting the water needs of these countries (Heyns 1995b; Shela 1996).

Charting the way forward

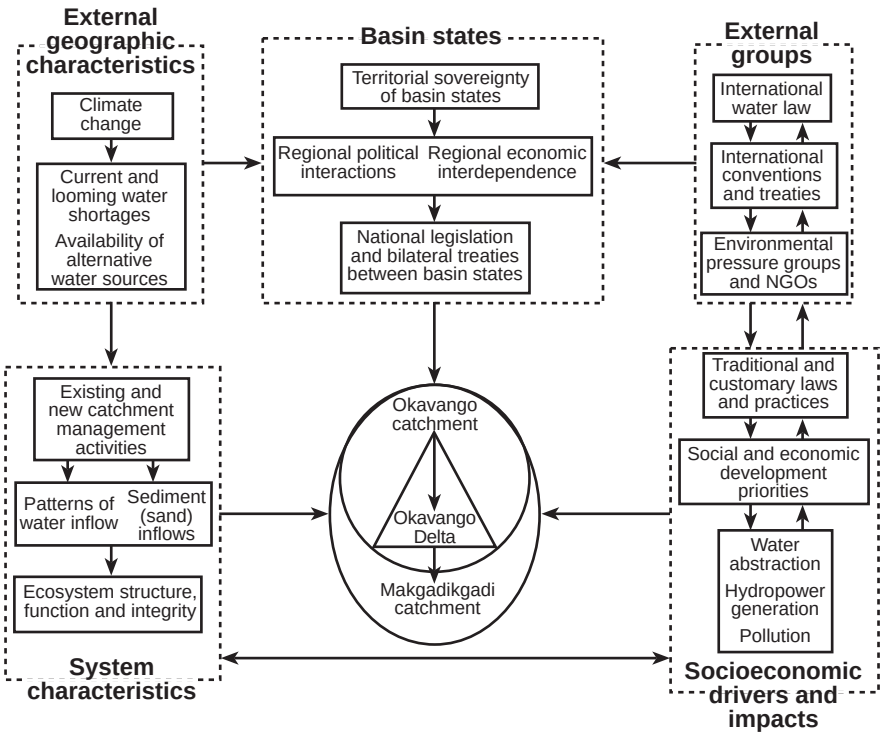
The preceding discussion has highlighted the wide variety of strategic issues that individually and collectively influence water resource management in the Okavango basin. It is clear that these issues encompass a wide range of spatial and temporal scales, while their influence extends from local to national and international levels and spans ecological, social, economic, institutional and political frameworks. For convenience, the various strategic issues have been grouped into logical units based on their relationships to one another and the ways in which their influence is exerted (this grouping or framework is shown as a conceptual diagram in figure 3). This arrangement of the key strategic issues highlights their diversity and also serves as a useful foundation on which to evaluate possible ways of moving forward. Their inter-relationships are explained briefly below.

In figure 3, the central position occupied by the three basin states reflects the importance of their territorial sovereignty and their vital role in jointly reaching a harmonious solution to questions of water-sharing and water resource management in the Okavango basin and, with Zimbabwe's involvement, in the larger Makgadikgadi basin. In the case of the Okavango basin, the three basin states are supported and guided by the provisions of international laws and treaties, as well as regional and bilateral treaties, protocols and accords that have been ratified. External agencies, NGOs and even individuals also provide financial and technical support for decision-making at this level. Working together, the three states have to achieve a delicate balance between exploiting their resources to promote sustainable social and economic development within their countries, and ensuring that the structure, functioning and integrity of the Okavango system retain the ability to deliver the required ecosystem goods and services. External characteristics, such as climate change and the looming water shortages that are also linked to the availability of alternative water resources, will typically be outside the control of the basin states, although they will influence decision-making.

This conceptual diagram and its accompanying explanation can be used by the three basin states to complement their existing deliberations and decision-making processes under the auspices of the OKACOM Agreement (OKACOM 1994). This proactive agreement between these three states is a highly significant achievement and should be supported by all parties that may be concerned with water resource management issues in the Okavango basin. In essence, OKACOM represents the most legitimate institutional vehicle for the basin states and external agencies to work together towards mutually agreeable solutions. A critically important issue that OKACOM will need to resolve is the question of what constitutes a 'fair and equitable share' of the Okavango basin's water resources that each state may use for its own purposes. There is a very strong likelihood that disputes will be avoided if this issue can be resolved to the satisfaction of all parties. Earlier, it was noted that water resource management in a shared river basin should transcend the normal line

Figure 3

Components and interrelationships between groups of key strategic issues that influence decision-making in the Okavango basin and Okavango Delta



function responsibilities of single government departments if it is to be effective. If OKACOM evolves in the future into a river basin organisation, it will be appropriate to review its existing structure and, if necessary, adapt it to ensure that it is able to reflect the diversity of needs and issues that must be dealt with. In addition, effective public participation is needed to ensure that the decisions taken can be implemented on the ground.

While the territorial sovereignty of each state is normally recognised as being paramount and unassailable in international law, states also bear several associated

responsibilities that guide and direct any interactions with their neighbours. These obligations are particularly pertinent in the case of a shared water resource such as the Okavango River, because they specify that states may not act unilaterally in any way that may have an adverse impact on their neighbour(s). These principles are designed to form the backdrop for harmonious relationships between states, enabling them to reach agreement on all matters related to the exploitation of shared resources.

A number of external agencies and NGOs have expressed concern that any attempt to withdraw water from the Okavango River or its tributaries could have catastrophic consequences for the ecological structure, functioning and integrity of the unique Okavango Delta. While there is some information to substantiate these claims, the precise extent of any change and its implications for the Okavango Delta are largely unknown. From an ecological perspective, the mosaic of ecosystem components in the Okavango Delta clearly reflects the wide variety of flooding regimes that occur on annual and longer timescales. The information available indicates that the natural range of variation in river inflows far exceeds the change in flows that would occur as a result of water abstraction to meet the likely collective needs of Angola, Botswana and Namibia. Nevertheless, the high level of uncertainty about the possible consequences of sustained water abstraction from the system should be seen as a strong warning signal that the system could face serious risks of irreversible damage. As the relevant authorities, the three basin states must evaluate the likely significance of these risks and the resulting consequences if these risks are deemed to be acceptable. Recently, Gumbricht and his co-workers (2002) at the University of the Witwatersrand used remote-sensing techniques and historical flow analyses to develop a model to predict the maximum extent of inundation in the Okavango Delta. This model appears to have a very high level of accuracy (90%) and should prove to be an extremely useful tool when water resource managers need to evaluate the likely consequences of water abstraction from the Okavango River.

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CHAPTER 3

The peace dividend in Angola: Strategic implications for Okavango basin cooperation

Joao Gomes Porto and Jenny Clover

Abstract

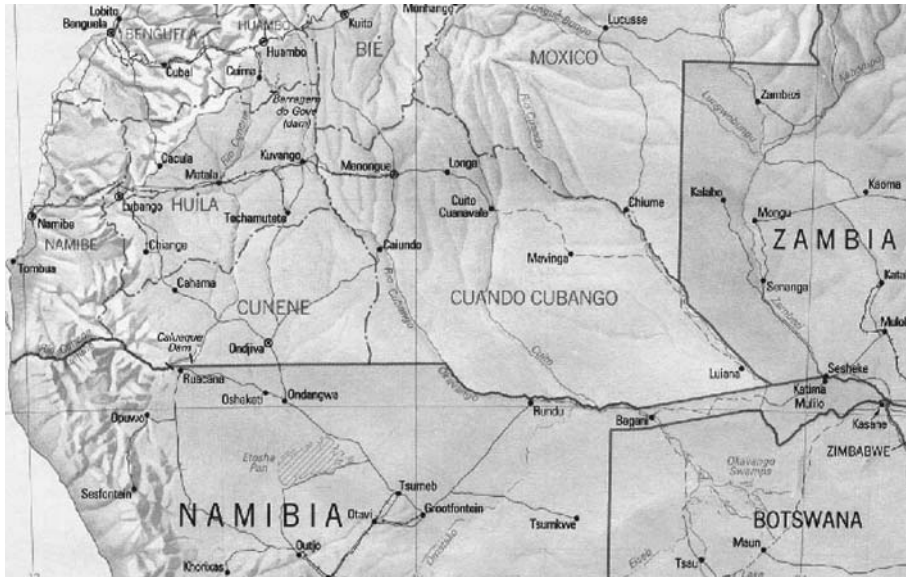
On 4 April 2002, an historical ceremony at the National Assembly in Luanda officially brought to an end the longest running high intensity conflict in Southern Africa. The signature of the Memorandum of Understanding by the military leaders of the two belligerent parties and their unequivocal commitment to the 1994 Lusaka protocol paved the way for what many analysts considered the most promising window of opportunity for the resolution of Angola's civil war of nearly three decades. In fact, for the first time in years, the majority of analysts, policy makers (Angolan and foreign), donors, non-governmental organisations and humanitarian agencies agree that a return to war by UNITA is not only unlikely, it is a logical impossibility. The end of the war in Angola poses a number of interesting questions regarding its relations with its neighbours, in particular, interstate cooperation in issues of strategic importance for the region. Among these, cooperation around the Okavango River basin, involving Angola, Namibia and Botswana, currently assumes particular relevance. Rising in the Angolan highlands, the Okavango River basin covers an area of 200,192 km^2, most of which is located in Angola. However, very little is known about water use in the upper catchment area, largely a result of the fact that the province of Kuando-Kubango has been inaccessible due to the war and no in-depth studies on water usage have so far been carried out. Moreover, while Angola will not face water scarcity problems in the foreseeable future, the Okavango River basin is unlikely to fulfil the combined water demands of Namibia, Botswana and a peaceful Angola. Paradoxically, while peace in Angola will allow for much needed development of Kuando-Kubango – possibly entailing changes to the upper reaches of the basin – these may negatively impact the Okavango River system, affecting the two other riparian states. As a consequence, stakeholders are taking a keen interest in Angola as it emerges from war, contemplating whether its medium term development plans will require significant increases in water use and whether these could have negative environmental consequences.

Introduction: The end of war in Angola

On 4 April 2002, an historical ceremony at the National Assembly in Luanda, Angola, brought to an end the longest running civil war in Southern Africa. The

Map 1

Angola showing provincial divisions in the Okavango basin region



signature of the Memorandum of Understanding by the military leaders of Union for the Total Independence of Angola (UNITA) and the Angolan Armed Forces (FAA) and their unequivocal commitment to the revival of the 1994 Lusaka protocol paved the way for what many analysts considered the most promising window of opportunity for the resolution of this 27-year civil war. At the time of the signature of the memorandum, there was a general perception that this classic textbook case of complex, deep-rooted and protracted conflict was coming to an end. This perception was based on UNITA's impending military defeat after more than two years of unstoppable FAA advance; its leadership crisis following the death of Jonas Savimbi and other prominent UNITA leaders and, finally, UNITA's realisation that this could be its last opportunity to secure a legitimate political role in Angola's future.

Today, a year after the signature of the memorandum, a clear picture has surfaced of the extent and nature of the tasks needed to sustain and deepen Angola's recently won peace. Moreover, the various cycles of war fought in Angola since its independence in 1975 have destroyed its economy and infrastructure, leaving the majority of Angolans destitute and impoverished. The viciousness, severity and

duration of armed conflict in this Southern African country has left in its trail more than 1.5 million casualties, four million internally displaced people (a third of the population) and close to half a million refugees in neighbouring countries. The sheer magnitude of the combined challenges facing Angola is, not surprisingly, difficult to grasp:

> "[A]lmost 80,000 former UNITA soldiers and around 360,000 of their family members must be reintegrated socially and economically, as must the 33,000 troops due to be demobilised from the Angolan Armed Forces. Millions of internally displaced people, as well as the hundreds of thousands of refugees outside Angola's borders, who have begun returning home spontaneously and through official movements, must be assisted to rebuild their homes and livelihoods. State administration must be extended and strengthened in all areas of the country, as we have pointed out elsewhere. State administration must be extended and strengthened in all areas of the country, and Angola's shattered infrastructure rebuilt from its current pitiful state" (Porto & Parsons 2003).

At the time the war ended, the overarching priority of the government of Angola was the quartering, demilitarisation and demobilisation of UNITA's armed forces. As a result, the Memorandum of Understanding was solely designed to deal with the military and security aspects of the conflict, regulating in detail the various steps necessary for the demilitarisation of UNITA. The parties did not feel the need to renegotiate previous peace accords (the 1991 Bicesse peace accords and the 1994 Lusaka protocol), and the memorandum was developed to deal with "all outstanding military issues under the Lusaka protocol." The quartering, demobilisation and disarmament process of UNITA began following the signature of the memorandum in April 2002 and, five months later, the parties announced that it had been successfully completed and that only the socioeconomic reintegration of UNITA's armed forces remained. On a political level, several observers interpret this as evidence of considerable and credible political will shown by both the government of Angola and UNITA to conduct this process successfully. In fact, UNITA's Management Commission (the structure created to lead the movement after the death of Jonas Savimbi) was consistent in its desire to put an end to the war and comply with its obligations under the Memorandum of Understanding. No breaches of the ceasefire were officially reported and the quartering, demobilisation and disarmament of UNITA's military forces proceeded largely in an orderly fashion. Nevertheless, and to a large extent, this was a result of the military conditions prevailing at the end of the war. At the time of Jonas Savimbi's death on 22 February 2002, UNITA's military forces were severely weakened, its regional commands uncoordinated, with its troops facing critical shortages of food and fuel supplies, among others. War weariness, disorientation at the loss of its top leadership, hunger and disease left UNITA with no alternative but to sit at the negotiation table and swiftly agree to a comprehensive

ceasefire agreement in Luena. That the implementation of the Memorandum of Understanding proceeded at a similar pace should therefore not come as a surprise, for the same conditions apply.

Several timetable revisions notwithstanding, the fact that the quartering, demobilisation and disarmament process was observed should therefore not be taken as definitive and conclusive proof that the Angolan peace process is progressing swiftly and unhindered. The successful completion of this process, particularly the socioeconomic reintegration of former combatants to begin in June/July 2003, indicates at best that this process is taking its first steps. Taken as one among several of the conditions necessary for sustainable peace in the short and medium term in Angola, the resolution of the military aspect does not in itself provide protection from potential pitfalls that may undermine the successful completion of the peace process in Angola. This should not be taken to imply that there is a possibility of a return to war in Angola. In none but the most unrealistic scenarios is the possibility of a return to large-scale war in Angola discussed. In fact, for the first time in decades, the majority of analysts, policy makers (Angolan and foreign), donors, NGOs and humanitarian agencies agree that a return to war by UNITA is not only unlikely this time, it is a logical impossibility. Nevertheless, the presence in gathering areas of close to 105,000 former combatants and 360,000 of their family members (March 2003) poses challenges of a security nature that require serious and steadfast attention by the government. That a number of incidents of localised crime and banditry have been reported is evidence of this.

Angola's challenges are as great as they are varied. The resettlement of the internally displaced, the extension of the central administration to areas previously controlled by UNITA and the socioeconomic reintegration of former combatants are, among others, priority activities. Only after these are tackled will the government of Angola be able to address development priorities. Some of these will be discussed below.

Angola's structural indicators of crisis

> "[W]hile the war has unquestionably been the single most important constraint on development, as well as the immediate cause of the humanitarian emergency, other factors, of an institutional and policy-related nature, have exacerbated the serious situation experienced by Angola's people. The new situation therefore requires two types of action. The first is a series of peace-building measures in the short to medium term, aimed at promoting national reconciliation, demilitarisation and recovery. Second, however, there is an urgent need for policy reforms and institutional measures, including measures regarding the management and allocation of public resources, in order to address the other deep-seated problems that have contributed to the situation of economic malaise, widespread poverty, high mortality and social exclusion" (UN 2002).

A peaceful Angola is often considered as having all the necessary conditions to become an economic powerhouse in the Southern African region. However, the rate of socioeconomic development will be severely constrained by present structural conditions. In fact, outside the politico-military field, as was previously pointed out, Angola faces enormous challenges of a social, economic and humanitarian nature. According to the UN country assessment (UN 2002), some of these medium to long-term challenges include:

- reduction of urban and rural poverty through policies that promote improved access of the poor to employment and other resources;
- adequate response to high levels of urbanisation and other demographic problems;
- economic diversification, away from excessive oil dependence through policies that promote development of the non-oil sectors;
- rebuilding of social sectors, with particular emphasis on basic social services;
- mounting of an effective national response to HIV/Aids;
- development of political participation and democratic accountability;
- strengthening of public administration, including systems for ensuring rigour and transparency in the management of public resources.

Angola's population is some 13.1 million with a growth rate of approximately 2.9%. Indicators show that the incidence of poverty in the country is among the worst in the world – not only in terms of income levels, but also in terms of the provision of public services such as health and education. Disparities in income have continued to increase sharply since the mid-1990s with the richest 10% enjoying a marked increase in wealth and the poorest 10% a dramatic decrease in wealth during this period. Inadequate nutrition, contaminated water and rapid urbanisation in a context of virtually no urban planning or urban infrastructure have created an environment in which the risk of disease is high. Angola is currently ranked 161 out of 173 countries on the UNDP's *Human development index*. Children under 15 years comprise over half of Angola's population, and 20% are under the age of five. It is the youth who have borne the brunt of displacement and growing impoverishment, suffering catastrophic loss in terms of family members. More than one million children are believed to have no access at all to education or health facilities.

Mainly as a result of the war and deficient economic policies, Angola is placed at the bottom of the development ladder, described as an "economy under siege", with an economic performance that is at its lowest level since independence in 1975. This is where the paradox, as well as the challenges lie, for Angola possesses an unparalleled natural resource endowment in the form of fertile and varied agricultural lands, rich fishing and forestry resources, large reserves of oil, gas, diamonds, iron ore and gold, as well as strong hydropower potential. For the last three decades, what was once a diversified and prosperous economy (Angola produced surplus coffee, sisal and cotton for export, had a growing light industry, as well as a strong mining sector) has been gradually destroyed as a consequence of almost uninterrupted war, as well

as bad policy choices at central level. These have resulted in escalating macroeconomic instability. According to the Economist Intelligence Unit, Angola has 2.1% of real gross domestic product (GDP) growth and a consumer price annual inflation of 325%. The bulk of Angola's GDP, however, is related to the off-shore oil industry, which contributes 60.3% to GDP, as will be discussed below.

Both the oil sector and the diamond sector have grown exponentially in the last 30 years, making Angola one of the largest diamond producers and the second biggest oil producer in sub-Saharan Africa. The oil sector, in particular, has benefited from a number of new discoveries placing Angola in the coveted position of having the largest reserve growth in the world and putting it in the first place among the world's top 15 oil finders. A vast number of oil companies are involved in Angola's oil business, and side by side with the supermajors (Total Fina Elf, Chevron, Exxon Mobil, British Petroleum, Texaco and Shell), a large number of independents (ENI, C-T, BHP, Ranger, Conoco, Ocean, ROC, PetroGal, among others) are involved, as well as a number of national oil companies. Production forecasts for 2001 were 755,000 barrels per day, 1.4 billion barrels per day for 2005 and 1.8 billion barrels per day for 2008, placing Angola among the world's top producers of oil. Coupled with an important number of new discoveries, the opening of the Girassol field has substantially increased production levels. In addition, the projected construction of a new refinery in the coastal city of Benguela with a forecasted production of 200 million barrels per day has created new opportunities and excitement around this very lucrative and dynamic sector. Furthermore, the government's intention of developing natural gas exploration with the construction of a liquefied natural gas (LNG) terminal in Luanda has made this a very attractive business opportunity for foreign investors.

Yet, although Angola's oil sector has operated with considerable success for the last three decades and has been relatively unaffected by the war, its growing revenues have not trickled down to society as a whole, having been used to finance the war effort to the detriment of all other areas. Controversy surrounding extra-budgetary spending and the lack of transparency in public finances (particularly in the oil business) have prompted strong international pressure from bilateral donors as well as the Bretton Woods institutions (the World Bank and the International Monetary Fund) for greater transparency in public finances. The government of Angola finally agreed to a nine-month staff monitored programme (SMP) in April 2000, which was subsequently extended to June 2001. While the findings of the programme reflect the central challenge facing Angola, the pace of state reform has been disappointingly slow and macroeconomic stability, as well as greater transparency have not been attained.

Nevertheless, while the oil industry has consistently grown, the formal economy in Angola has progressively shrunk, and is at present largely dysfunctional and stagnant. As a consequence, the informal economy – and therefore the non-regulated sector – has grown exponentially. A paradigmatic example is the largest open-air market in Africa, the Roque Santeiro, located just a few miles from the centre of the

capital city, Luanda. Moreover, the protracted civil war has had catastrophic consequences for all other sectors of the economy, in particular agriculture. The country's annual cereal consumption stands at 1.3 million tons, yet it manages to produce only 500,000 tons of food annually. Paradoxically, while agriculture accounts for 76% of Angola's labour force, it contributes a mere 12% to Angola's GDP. The balance is imported and donated by international aid agencies such as the World Food Programme (WFP). In fact, more than one million people, and in particular those internally displaced, survive on the basis of food assistance provided by international relief agencies. Targeting and monitoring of food assistance are guided by interagency vulnerability assessments conducted under the Vulnerability Analysis and Mapping Unit of the WFP. Because agricultural assistance is required in almost all locations, the government is attempting to kick-start this sector.

In addition, the war has seriously affected the road and rail infrastructure in Angola and has made a large proportion of fertile agricultural areas inaccessible. A road network that totalled 75,000 kilometres, of which 8,000 kilometres were asphalted, is in a state of disrepair making it very difficult and highly dangerous to transport people and goods by land. The same applies to the rail network, one of UNITA's favourite targets during the civil war. Port facilities are still operating in Luanda, Lobito and Namibe, catering for an economy that is highly dependent upon imports following the collapse of the domestic manufacturing and agricultural sectors. Transportation by air has become the only viable connection for humanitarian aid delivery, as well as for the oil and diamond industries.

The health situation in Angola continues to worsen. Public health services are so severely debilitated as to be effectively non-existent, with most healthcare provision outside of the main centres, consisting of only the most basic services, having been left to NGOs and church groups. There is only one paediatric hospital in the whole of Angola (situated in Luanda), but even its facilities and resources are limited. Children are often forced to share a bed with two or three others, and no meals are provided. According to UNICEF and the UNDP *Human development report 2000*, Angola's basic indicators were among the worst in the world – one mother in five died while giving birth, and 42% of all Angolan children were underweight for their age. Among the displaced, rates of infant and under-five mortality (236 and 395 per 1,000 live births) are much worse than the already catastrophic national rates of 166 and 292 out of every 1,000 live births, respectively, which are themselves among the highest in the world. Malaria is a leading cause of mortality among children under the age of five, followed by diarrhoeal infections, malnutrition and respiratory infections. More than 50% of children are stunted. In the past two years, because of continuing insecurity, conditions have deteriorated further. An increasing number of moderately malnourished children have appeared at supplementary and therapeutic feeding centres, including a disturbingly high percentage of children between 5 and 12 years, a vulnerable group often undetected by routine nutritional surveys. Vaccination campaigns have not reached many areas, especially during the past few years,

resulting in periodic outbreaks of polio and measles. Fewer than 40% of children receive routine immunisation for diseases that can be prevented through vaccination. Access to basic services is extremely poor with 69% of the population having no access to clean water and 60% without access to sanitation.

HIV/Aids threatens to overshadow these traditional health problems, and as in the rest of Southern Africa, is likely to become the single most serious threat to the health and well-being of Angolans. The development of the disease will place further strain on health services, further impoverish households and create yet more orphans. Although exact figures are not available and the incidence of the pandemic is probably grossly underreported, especially outside of Luanda, close on 8,000 children are thought by UNAIDS to be infected with the virus and an estimated 98,000 of under 15-year olds have lost a mother or both parents to the disease.

Education levels also present a serious situation with 58% of people over 15 being illiterate, and school enrolment as a percentage of the total school age population at a mere 25%. Since 1998, 80% of the schools in Angola have been destroyed or abandoned. Some teaching takes place at understaffed and underequipped schools in the provinces, though most of these schools are in an advanced state of disrepair. There is a general scarcity of teachers. It is only in Luanda that children stand a chance of getting an adequate education, but here too there are severe constraints – less than half the teachers are adequately trained, there is a serious lack of classroom space, and teacher/pupil ratios can be as high as 1:80. Failure rates are high, and few children enter high school. Less than 10% of children are registered at birth, and the lack of documentation limits access to education, health facilities and employment. Aside from this, in a country that has an official poverty rate of 67%, few parents can pay for education. The government has reported that 70% of children between six and 14 years run the risk of being illiterate. The government has consistently spent below 15% of its budget on the social sector – in some years below 10% – and most of this is paid in salaries and for the administration of the health and education sectors.

The current humanitarian crisis

Protracted internal strife for more than 27 years has left thousands dead and many more orphaned, widowed and disabled as a result of the direct and indirect effects of war. The pervasiveness of the conflict over the past two decades has resulted in a near continuous movement of people, causing cyclical waves of displacement. By the time of the Bicesse accords in 1991, there were about 800,000 internally displaced people and 425,000 refugees in neighbouring countries. Only a fraction of these returned to their areas of origin. When the war resumed in 1992 and combat spread to major urban centres, between 1.3 to two million Angolans fled their homes, mostly to provincial centres and to Luanda. In the four years of 'no war no peace' that followed the signature of the Lusaka protocol, very few displaced people returned because of continuing insecurity and lack of confidence in the durability of the peace process. By

the end of 1997, humanitarian agencies estimated that more than one million were still displaced, despite the limited resettlement that had occurred after the two peace agreements.

The resumption of armed hostilies at the end of 1998 aggravated the problem exponentially. Since then an additional three million people (mostly young families, unaccompanied children, and the elderly) have been forced from their homes and been on the move almost continuously. During the period from mid-2001 to early 2002 many civilians were forcibly removed from rural areas, particularly in the east of the country, as part of an FAA strategy to deprive UNITA forces of civilian sources of food. By mid-2002, a third of the population, about 4.3 million people, were displaced and the conditions under which they lived were appalling. Only 1.4 million of the internally displaced people (or *deslocados*) had been confirmed by humanitarian organisations for assistance, and of these some 600,000 were living in temporary resettlement sites and more than 436,000 in camps and overcrowded transit centres. Internally displaced people were found widespread throughout all 18 provinces, with the largest concentrations (running along a vertical axis from Uige south toward Huila) in the provinces of Malanje, Huambo, Huila and Bie. The concentration of displaced people in urban areas under government control has been the primary cause of rapid urbanisation – an estimated 60% – and a dramatic humanitarian situation in urban areas. According to the UN country assessment of 2002:

> "[I]n the urban areas, 63% of the population was living below the poverty line (equivalent to $1.65 a day) in 2000 … the proportion of the urban population living below the extreme poverty line (equivalent to 75 US cents a day in 2000) doubled between 1995 and 2000, reaching almost 25%. This dramatic increase in extreme poverty was closely related to the influx of destitute IDPs into the cities, in a context where urban jobs and income-generating opportunities have been limited by the depressed state of the non-oil sectors of the economy" (UN 2002).

Before the Memorandum of Understanding, aid reached only 10 to 15% of the country largely as a result of logistic constraints (the poor state of airstrips and roads), the precarious security conditions, in the form of attacks on civilians and vehicles, and the presence of landmines. Humanitarian organisations had access to only 60% of the 272 locations where displaced people were concentrated and to approximately 73% of reported displaced populations. With the end of the war, security and accessibility have increased significantly (approximately 40 to 50% of all humanitarian assistance must still be delivered by air), resulting in a new set of opportunities and challenges for the humanitarian community. Despite this, logistic constraints continue to hamper humanitarian operations – airstrips, roads and bridges need repair or rebuilding, and demining activities must continue.

Although the peace process advanced rapidly during 2002, the level of internal displacement remained high with thousands of displaced people emerging from the

bush, often in appalling conditions after having suffered extended periods of hunger and being subjected to harassment, looting and physical assault. In many areas, catastrophic malnutrition rates of more than 45% were recorded among the newly arrived populations. The reason for the starvation was not just conflict, but the particular way in which the war of counterinsurgency was fought, especially in the six months prior to the end of the war. Tens of thousands of civilians living in military contested areas were systematically attacked by armed elements and relocated, sometimes forcibly, into municipal and provincial centres where international agencies provided life-saving assistance. People were not able to settle and they were not able to cultivate land.

While limited numbers of internally displaced people returned to their areas of origin, a considerable proportion continue to move towards areas where humanitarian operations are under way in search of assistance. In many cases spontaneous return movements were temporary, with family members returning to villages to gather information about the situation or to build shelters and prepare agricultural land. By August 2002, more than 100,000 displaced people had already started to return to their areas of origin throughout the country, and an additional 450,000 were likely to return home by the end of the year. Demobilisation and reintegration of former combatants, the return and resettlement of displaced populations, and increased threats of landmines had resulted in a rise in the need for humanitarian resources in the short term. At the end of August, the UN Office for the Coordination of Humanitarian Affairs (OCHA) reported that approximately 80,000 former combatants, accompanied by 300,000 dependants, remained in the family reception areas.

The approval of the Emergency Resettlement and Return Programme by the government of Angola in June 2002 was a critical step in developing a concerted approach to the looming humanitarian catastrophe. In order to tackle the current emergency, an interagency rapid assessment of critical needs was conducted. The assessment was conducted in 28 locations in 12 provinces and, in the process, several important road corridors were cleared for humanitarian operations. The programme prioritised the return, resettlement and social reintegration of those who had been identified by humanitarian agencies. Its target group included more than 1.5 million people (approximately 310,000 families), as well as assistance to 350,000 former UNITA combatants and their family members.

The substantial humanitarian operation in Angola became the most expensive in the world during 2002 with 10 UN agencies, 100 international NGOs and more than 420 national NGOs, either active or registered in 13 sectors, providing assistance to two million Angolans. Eleven technical ministries and departments and all provincial governments are involved in humanitarian assistance. Overall coordination is undertaken by the Ministry of Social Affairs and Reintegration (MINARS) on behalf of the government and the OCHA, which serves as the coordinator's secretariat. The government and humanitarian partners adopted a rights-based strategy in the 2002 appeal to ensure that assistance was provided in accordance with core constitutional principles and on the basis of international standards. By the end of 2002, 1.1 million

displaced people had resettled or returned to their areas of origin, although only 15% had done so as part of an organised plan and only 30% were living in areas where the preconditions specified in the norms were in place.

Conditions had generally stabilised by the start of 2003, resulting in the closure of therapeutic feeding centres and the withdrawal of many NGOs. The situation with regard to access has only worsened, however, as the rainy season has set in, with many quartering areas (since the disbandment of UNITA called gathering areas) difficult to access and at least one, Sambo in Huambo province, cut off from assistance due to a serious landmine incident. The WFP continues to distribute food aid to populations in the gathering areas, as does the government, as well as seeds and tools. Nevertheless, the humanitarian caseload is unlikely to decline significantly until the harvest in April 2003. The number of people requiring food assistance remains high at 1.8 million and an additional 300,000 may require assistance during the first quarter of the year.

The number of Angolan refugees is also a cause for concern. At the beginning of 2002, there were some 467,000 Angolan refugees in the neighbouring countries of the Democratic Republic of Congo, Zambia and Namibia. Formal repatriation programmes have not yet begun, but by mid-December, about 86,000 were estimated to have returned spontaneously, the majority to areas where basic conditions for return were not in place.

The 'lands at the end of the earth': Overview of the Kuando-Kubango province

The high-altitude and vast province of Kuando-Kubango covers an area of 200,000 km^2 and is sparsely populated. Known during colonial times as 'the lands at the end of the earth', Kuando-Kubango has a variety of different climates, ranging from tropical in the north to semi-desert in the south. Most of its 140,000 inhabitants engage in subsistence agriculture (growing massango, massambala, corn, cassava and beans) and cattle, sheep and goats are the main livestock. In terms of water usage, as highlighted by the UNDP, "current use of the basin's water resources are limited to water supplies to small regional centers and some small scale floodplain irrigation" (GEF 2000). In addition, since independence in 1975, there have been no considerable developments and investments related to the Cubango and Cuito headwater rivers. A 1995 provincial rehabilitation plan indicated that the province's development would entail a considerable investment in water supply, sanitation, agriculture and transport. These are still to be undertaken.

Traditionally a UNITA stronghold, this province was subject to a major government offensive during 2001 and early 2002. Having ensured that the borders with Namibia and Zambia were cut off as supply routes to UNITA, FAA hunter battalions implemented follow-up operations sending UNITA forces into Moxico province. A large number of landmines were laid along the borders as a precaution, and mine infestation has been reported throughout the province, including in areas

near Menongue and Cuito Cuanavale. Largely as a result of this last phase of the war, there are now 66,431 confirmed and 204,024 unconfirmed internally displaced people in the province (OCHA Angola 2002b). Humanitarian organisations have been present only in Menongue (the capital) for the past two years. All roads outside the existing security perimeters are in poor condition and the Cuito Cuanavale airstrip requires repair. The OCHA was only able to enter Caiundo, Mavinga and Savata in April 2002 to conduct a rapid assessment of critical needs, during which the roads from Menongue and Cuito Cuanavale to these locations were opened for humanitarian operations. Access to Mavinga is very difficult as a result of destroyed infrastructure and the fact that roads remain heavily mined.

The assessments conducted by the OCHA revealed high levels of malnutrition, in particular in the quartering and family reception areas in the province. In addition, although recent mortality and morbidity rates are unavailable for the province, the assessment found that the main causes of death and illness are malaria, anaemia, tuberculosis and malnutrition. The OCHA reports that, since January 2002, 2,307 new displaced persons have been confirmed. Temporary resettlement continues for new arrivals at Menongue (OCHA Angola 2002a). These waves of depopulation and displacement in Kuando-Kubango have the potential to affect the hydro-environmental integrity of the source. In fact, some of the main threats to the Okavango River basin arise from patterns of unsustainable development, including overgrazing resulting in accelerated land and soil degradation in Namibia and Botswana; unplanned developments in Angola along the demined transport routes/ corridors in the Cubango and Cuito sub-basins as post-civil war resettlement occurs; and finally, pressure for new and increased abstraction of raw water to service urban expansion and irrigated agriculture.

To face the current situation, the Kuando-Kubango provincial government has identified the following priorities under a provincial emergency plan of action:

- *agriculture and food security* – improve food security by distributing land and providing agricultural inputs and technical support, and promote reforestation in resettlement areas;
- *health and nutrition* – reduce child morbidity and mortality for malaria;
- *water and sanitation* – improve sanitation by constructing pit latrines in areas with high concentrations of internally displaced people, and conduct awareness and information campaigns on safe water and excrement disposal;
- *education* – expand access to education by building emergency schools in resettlement areas;
- *protection* – provide displaced people with proof of identity;
- *mine action* – reduce mine accidents by demining resettlement sites and access routes and conducting mine awareness campaigns; and
- *resettlement* – support the resettlement of 4,000 families in compliance with the norms, and establish a reception area for new displaced people arriving in Cuito Cuanavale.

The peace dividend in Angola: Strategic implications for Okavango basin cooperation

> "[T]he Okavango River Basin remains one of the least human impacted basins on the African continent. Mounting socio-economic pressures on the basin in the riparian countries, Angola, Botswana and Namibia, threaten to change its present character. It is anticipated that in the long term this may result in irretrievable environmental breakdown and consequent loss of domestic and global benefits" (GEF 2000).

> "[V]ery little is known about the water use in the upper catchment, because the Angolan civil war has prevented any baseline data from being collected … ironically, *a possible peace dividend will be the development of the upper basin, which in turn will negatively impact on one of the last pristine river systems in Africa"* (Green Cross International 2000 – authors' emphasis).

Part of Angola's regional strategic importance stems from the fact that it is the main contributor to the Okavango River basin. As can be seen in map 1, the Cubango and Cuito headwater rivers originate in the Angolan province of Kuando-Kubango. Flowing southwards, these two tributaries converge and run along the border with northern Namibia. At the point where the Cubango and Cuito rivers meet, they become the Okavango River, entering the Caprivi Strip in Namibia 50 kilometres downstream before flowing into Botswana. In fact, as pointed out by the UNDP, "the economic and ecological vitality of the Okavango River Basin and its associated wetlands depends upon the detailed character (timing, volumes, duration) and quality of the annual flow regime generated in the source catchments of Angola" (GEF 2000). The Okavango basin straddles sub-humid climatic zones in Kuando-Kubango to arid climatic zones in northern Namibia and Botswana.

Water is one of Angola's richest assets and its efficient use holds the key to equitable social and economic development. Most specialists consider that Angola will not face serious water scarcity problems in the foreseeable future, at least until 2025. However, because the Okavango basin is increasingly unlikely to fulfil the combined demands of a peaceful Angola, Namibia and Botswana, and because activities in the headwaters can significantly affect flows, stakeholders are taking a keen interest in Angola as it emerges from war. In this respect, Angola's medium term development plans for the region are being carefully monitored. Agriculture and the building of any dams in the catchment area (Ellery & McCarthy 1994:159-168) have been identified as some of the potential threats to the Okavango River basin. In fact, the eutrophication that may result from agricultural development in the catchment "may profoundly affect the nature of vegetation communities in the upper reaches of the fan, and thus the patterns of sediment and water dispersal." In addition, "sustained removal of vegetation may result in salinisation of surface water, and would have a

large impact on the ecosystem" (Ellery & McCarthy 1994). In this sense, "the root causes lie with patterns of socio-economic development – population growth, urbanization and industrialisation" (Ellery & McCarthy 1994:4). As highlighted by Green Cross International (2000):

> "[T]he development of any dams will alter the pulsed nature of the flooding, with detrimental environmental effect in the delta. Agricultural runoff will change the nutrient loads, impacting on one of the basic elements of the aquatic ecosystem functioning in the delta."

While upstream abstraction of pollution reduces river flows and water quality downstream, it is also important not to lose sight of the less obvious fact that downstream developments can generate harm upstream unless riparian states share similar values concerning biodiversity and natural heritage. The spread of alien species may be presented as an example of this. Likewise, the Cubango River, which forms part of the international boundary between Angola and Namibia, has the potential for positive or negative externalities.

Development plans generally require significant increases in water use, but these are often premised on mutually exclusive claims for water that have the potential to cause tensions between countries. When countries are able to move beyond an approach premised on maximising usage for individual states, to a system-wide perspective, the potential of cooperative management to increase economic growth, environmental management, and geopolitical stability is raised considerably.

The need for interstate coordination with regard to the Okavango River basin led the three riparian countries to meet in Windhoek in 1993 and to establish the Permanent Okavango River Basin Water Commission (OKACOM) in September 1994. OKACOM represents the most important institutional structure where, through negotiation, all transboundary water issues can be resolved. OKACOM includes the presence of high-level interministerial representation to advise on technical and policy issues. Until recently, the civil war and UNITA's effective control of the province of Kuando-Kubango have mitigated against a stronger involvement of the Angolan government in OKACOM. Nevertheless, "the countries have made it clear that they intend to continue this reliance on OKACOM to address technical and policy issues regarding water resources in the basin" (GEF 2000). Furthermore, OKACOM's mandate entails the involvement of relevant NGOs in monitoring, research, awareness-raising, advocacy and policy development.

The need for coordination at regional level, as well as at national level between the relevant agencies has been recognised as a critical priority. There are no clear international standards for cooperative water management. Though a range of recognised principles and precedents exist, many are conflicting. Generally, the starting points for negotiation are the principles of *equitable and reasonable utilisation* and of *no significant harm*. Politics plays a prominent role in securing such agreements for cooperation, but necessitates that negotiations and opportunities for

joint development are not constrained by capacity imbalances and an inability to analyse and inform policy positions. In this regard, the Angolan sector faces considerable constraints. The country's water resource potential, both surface and groundwater, has not been properly assessed. Water policy and the necessary regulatory framework are not properly defined. In fact, the World Bank has found that almost all of the 187 hydrometric stations that existed in 1975 have been out of service and, at present, only five hydrometric stations, mostly in and around Luanda, are operational. In addition, trained manpower and institutional capacity are largely absent, and the bank found that less than 10 Angolan hydrologists work in the country's public sector. Basic services such as water supply and sanitation are in a very poor state as a result of the lack of infrastructural investment, shortages of replacement equipment and inadequate maintenance. As highlighted by the bank, the institutional situation is further complicated by a lack of technical and managerial capacity in the operating entities and limited commercial experience. Despite Angola's prominent water contribution to the Zambezi, Cunene and Okavango rivers, its lack of capacity has consequently limited its involvement in riparian dialogue for regional cooperation in integrated water resource management (African Water Resources Management Initiative 2000). This lack of capacity is also felt at regional level:

> "[W]hile OKACOM has the mandate to convene all relevant agencies and institutions, in practice this has been difficult to effect since governments' professional resources are severely stretched. Effective consultation and co-ordination at national and regional level is therefore an essential pre-condition for the successful formulation and implementation of an integrated management plan" (GEF 2000).

World Bank support was therefore requested by the Ministry of Energy and Water to launch a water resource management project within a larger Angolan water sector development project that was under preparation for World Bank credit. Following discussions with the ministry, the National Directorate for Water and representatives of the government of Norway, a new programme of support was agreed upon. The World Bank and the Norwegian Energy and Water Resources Administration will provide technical assistance to the National Directorate for Water to undertake a review of policy, as well as legal and institutional issues towards the development of a cross-sectoral policy in Angola.

After the end of hostilities in Angola, the three riparian countries have the opportunity to look at cross-sectoral issues such as regional development and poverty reduction, health, power and food production (agricultural productivity, livestock). Cooperation is fundamentally a political activity, informed by economics that guide the implementation of water resource management decisions. Activities such as collaboration on improved drought management and mitigation strategies, the exploration of hydropower to promote tourism and economic integration can all be

explored in the interests of an integrated, cross-sectoral and participatory basin approach. Basin-wide cooperation necessitates strong cooperation mechanisms. The implications for this, however, is that there must be capacity at national level alongside the promotion of inter-riparian dialogue between the three countries, including joint management and development of the shared watercourse. However, negotiations and opportunities for joint development are currently constrained by considerable capacity imbalances among the countries and uneven ability (limited in the case of Angola) to analyse and inform policy positions and decisions.

Conclusion

The likelihood of a return to civil war in Angola remains low. However, the variety of humanitarian and infrastructural problems in the upper Okavango River basin are extremely complex. Angola's development needs are extensive and pressure is likely to be placed on the water resources of the basin in the near future. The proper management of these very valuable resources is therefore of the utmost importance, not only to ensure that the country can overcome the ravages of war, but also to protect the wealth of the Okavango River basin for years to come.

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CHAPTER 4

The hydropolitical dynamics of cooperation in Southern Africa: A strategic perspective on institutional development in international river basins

Anthony Turton

Abstract

The dominant hydropolitical literature on transboundary rivers relates to conflict. This is not an accurate version of reality for the Okavango River basin. This chapter introduces two concepts of security and two concepts of peace, linking all four into a more nuanced approach. Experience from transboundary rivers in Southern Africa shows that where institutions such as OKACOM exist, they reduce the conflict potential by institutionalising rules and procedures, thereby creating confidence and reducing uncertainty. The securitisation of water resource management is generally undesirable, because it stunts institutional development by undermining the extent to which hydrological data is shared between all riparian states. Consequently, if conflict is to be mitigated, then the management of transboundary rivers needs to be desecuritised, or placed in the normal political domain where it can be openly debated, a healthy condition that results in viable policies.

Introduction

The Okavango River basin is unique in a number of aspects, not least of which is the fact that it is an endoreic system that terminates in the sands of the Kalahari Desert. Here it is essentially 'lost' as evapotranspiration, after flowing through parts of Namibia and Botswana, both of which are developing economically and are also water-stressed. It is also a relatively pristine ecosystem, with limited industrial development along its entire course, which has tended to transform it into an internationalised river basin with many interested roleplayers beyond the three riparian states. The basin includes areas where conflict has been endemic over the last quarter of a century. For example, the largest portion of the basin lies in Angola, which has been embroiled in a civil war since 1975, with high numbers of internally displaced refugees. This has generally destabilised the region where the Okavango basin is situated (Meissner 2000:118). Renegade elements of the Angolan civil war have randomly attacked both military (Europa 1995:2176) and civilian targets on

occasion, some in the Caprivi Strip, thereby undermining the tourist potential of Namibia. Similarly, a series of disputed islands found in the adjacent Chobe/Linyanti wetland complex have seen the mobilisation of troops from both Botswana and Namibia in the recent past (Africa Research Bulletin 1996; Ashton 2000:82-86; Economist Intelligence Unit 1996:7; News Digest 1995; Rakabane 1997; SAPA 1996; Southscan undated; Turton 1998:178-192; Vines 1996). The propensity for heated rhetoric is high (Electronic Mail & Guardian 1997; Pretoria News 1996; Radio Botswana 1996; Ramberg 1997; Republikein 1995; Weekly Mail & Guardian 1996a; 1996b; World Rivers Review 1997) and the Permanent Okavango River Basin Water Commission (OKACOM), according to Swatuk (2000:183), has not been particularly strong in developing, agreeing and implementing institutional management structures. OKACOM has thus not yet shown itself to be sufficiently robust to withstand some of these inherent tensions.

It is against such a background that this chapter on the dynamics of institutional development is set. The chapter introduces the reader to four essential concepts – 'negative peace' and 'positive peace'; 'security of supply' and 'national security' – and then analyses the hydropolitical dynamics of two key phenomena – securitisation and desecuritisation – which can be found in various international river basins in Southern Africa (Turton 2003). It concludes with a discussion of the role that river basin organisations such as OKACOM play in de-escalating the inherent conflict potential by creating a forum in which trust and confidence can be built. Consequently, institutions are a critical element for the peaceful and sustainable utilisation of shared resources like international rivers, particularly in areas of endemic conflict such as those found in many parts of Africa. Such institutions have to be elevated based on their strategic relevance if the African Union (AU) and the New Partnership for Africa's Development (NEPAD) are to reach their objectives of poverty eradication and good governance.

Conceptual issues

The hydropolitical literature, particularly with respect to institutional development, is relatively new and tends to be characterised by vaguely defined concepts. For the purpose of this chapter, and in an attempt to develop conceptual clarity, key concepts to be used are explained below.

Two forms of peace relevant to international river basins

Two distinct forms of peace can be found, each with its own characteristics, and more importantly, each with a different prognosis for long-term economic growth and political stability. Consequently, this conceptual distinction needs to be factored into any institutional analysis, by virtue of the role that institutional development plays in each case. The first is 'negative peace', which exists when there is a mere absence of

war (Ohlsson 1995:5). It is this type of peace that exists in large parts of Southern Africa at present, particularly in the wake of the collapse of the Cold War and the demise of apartheid in South Africa. The second is 'positive peace', which focuses on the existence of prospects for social development (Ohlsson 1995:6). As such, positive peace is more than its counterpart, also consisting of intangible elements such as investor confidence, a normative order based on historic experiences of cooperation, functioning institutions that reduce the transaction costs of cooperation, and economic fundamentals that are conducive to stable and sustained growth.

In terms of this thinking, "water scarcity … is defined as a threat, not first and foremost to international peace, but to the ability of developing countries to pursue a successful social development policy" (Ohlsson 1995:6). Stated differently, human security, as it is now commonly observed, consists not only of the absence of military conflict, but also of the existence of a broader range of conditions that must be met so that human beings can live full lives in the absence of fear and threat. Seen in this light, the strategic objective to be attained in the Southern African Development Community (SADC) Water Sector, is the shift in paradigm from the existing form of cooperation that is inherently a manifestation of negative peace, to a more complex paradigm that is deeply rooted in the more enduring foundation of positive peace. It is contended here that only when the latter objective has been reached, the appropriate levels of economic growth and political stability will be generated that are the very essence of NEPAD. It is therefore argued that an essential element of the AU is good governance, with no better challenge existing than the equitable management of the 15 river basins that are shared between two or more states in the SADC region. In fact, it is this aspect that makes SADC somewhat unique globally, because few other developing regions of the world have so many international river basins that are as strategically important to their respective riparians (see Wolf et al 1999).

Two forms of security relevant to international river basins

Water resource management is generally the domain of specialists, most of whom are engineers by formal training. Yet, the focus of their actions, in the context of international river basins such as the Okavango, falls within the domain of foreign policy and international relations (Henwood & Funke 2002). This is particularly relevant in areas of negative peace as defined above, because the actions of these engineers can be associated with threat perceptions in a national security context, potentially placing them in the domain of high politics. For this reason, it is important to understand that there are two distinct forms of security that can be found in the water resource management discourse of the SADC region.

The first form of security is related to engineering, and what can be called the 'hydraulic mission' of society. The term hydraulic mission has been used by some authors (Reisner 1993:112-114; Swyngedouw 1999a; 1999b) to describe the official state policy that seeks to mobilise water as a foundation of social and economic

development. The concept has also been used by other authors, but using terms such as the 'high dam covenant (Waterbury 1979) and the era of 'heroic engineering' (Platt 1999). All of these essentially describe what is known in engineering parlance as ensuring the 'security of supply' of a given resource. It can therefore be said that local water scarcity prompts engineers to improve the 'security of supply', which is normally done by means of developing infrastructure such as dams, interbasin transfers (IBTs) and water reticulation systems like pipelines and aqueducts.

But this is not the whole story, because in the context of international river basins, particularly those found in arid and semi-arid regions of the world, any attempt to improve 'security of supply' by one riparian country merely cascades perceptions of insecurity elsewhere into the river basin. This means that the second distinct form of security found in international river basins is 'national security'. As Buzan (1991:16) notes, the concept of national security does not lend itself to neat and precise formulation because it deals with a wide variety of risks with little knowledge about their probabilities, and contingencies that are only dimly perceived. Buzan (1991:16-17) cites a number of examples of definitions, at least two of which can be used in the context of water resource management:

> "[National security is] the ability of a nation to pursue successfully its national interests, as it sees them" (Hartland-Thunberg 1982:50).

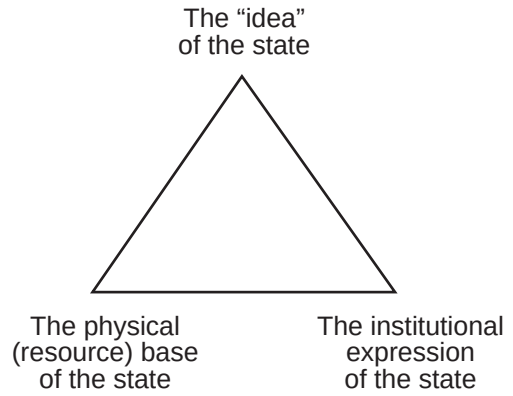
> "A threat to national security is an action or sequence of events that (1) threatens drastically and over a relatively brief span of time to degrade the quality of life for the inhabitants of a state, or (2) threatens significantly to narrow the range of policy choices available to the government of a state" (Ullman 1983:133).

Noting that the concept of 'national security' is inherently difficult to define, Buzan (1991:65) suggests the use of a simple model to guide an exploration into the nature of the state and 'national security' (see figure 1).

Building on this, Buzan (1991:70) suggests that 'national security' implies that the object of security is the nation, raising questions about the linkage between the nation and the state. While the 'idea' of the state is somewhat nebulous and difficult to measure, institutions are more easily identifiable and are usually associated with complementary processes of government (Buzan 1991:85). The physical base of the state, in contrast to the other two components of the state, includes all the natural resources and manmade wealth contained within its borders (Buzan 1991:90). The physical base is also the area where states share the most similarities in relation to security, because threats to the physical objects (natural resources) are common to different states (Buzan 1991:91). This leads Buzan (1991:95) to conclude that, since the state ultimately rests on its physical base, threats to that component of the state count as fundamental national security concerns. Waever (1995:47) concurs, saying that the new discourse on security is about national security that focuses on the people

Figure 1

The component parts of the state



Source: After Buzan 1991:65.

who make up the nation; thus the security of individuals can be affected in terms of economic welfare, environmental concerns and cultural identity. Given the fact that state power is directly linked to the economic capability of the state, if the economy declines so too does state power. Thus, in times of intense power rivalry, relative economic performance or threats to the economic growth potential of the state may be perceived as being a national security issue, regardless of the wisdom of so doing (Buzan 1991:127). Stated differently then, the hydraulic mission of rapidly developing countries is about mobilising water resources and improving the 'security of supply' as a foundation for social and economic stability, which are also key elements of 'national security'. This has clear implications for water resource management in international river basins, particularly in water-scarce regions, where access to water has a direct impact on the economic growth potential of the state concerned. This is clearly relevant to the Okavango River basin.

Weak states – defined as those with a low degree of sociopolitical cohesion (Buzan 1991:97) – such as states that have been embroiled in endemic civil wars, will tend to find it difficult to sustain institutional expressions of the state. This leads Buzan (1991:102) to conclude that the weaker the state is (in terms of sociopolitical cohesion) the more ambiguous the concept of national security will become in relation to that state. Consequently, a very weak state can be defined more as a gap between

its neighbours, with little political substance underlying the facade of internationally recognised statehood (Buzan 1991:103). This has obvious implications for institutional development in an international river basin containing both strong states (those with a high degree of sociopolitical cohesion) and weak states (that have been hollowed out by civil war or have a low degree of sociopolitical cohesion). Significantly, national security is dependent upon international dynamics, and especially regional dynamics (Waever 1995:49). The proximity of insecurity in neighbouring states therefore exacerbates the conflict potential between riparians in an international river basin that straddles political borders.

Integrating these four concepts

It is necessary to establish a conceptual linkage between these four concepts. Table 1 shows the different outcomes in terms of threat perception for the two different forms of peace, shown as a function of the two forms of security.

Seen in this light, it is apparent that security can be approached either objectively (there is a real threat), or subjectively (there is a perceived threat), and there is no way of ensuring that these two approaches are aligned (Wolfers 1962:30 in Buzan et al 1998:30).

Institutional dynamics

Having established the linkage between some key concepts, institutional dynamics can be explored as they relate to river basin organisations (RBOs) such as OKACOM. Research currently under way (Turton 2002a) has shown that at least two distinct forms of institutional dynamic can be found in international RBOs in Southern Africa:

- zero-sum dynamics based on rivalry, perceptions of national insecurity and negative peace with a probable win-lose outcome; and
- plus-sum dynamics based on cooperation, perceptions of national security and positive peace with a probable win-win outcome.

Securitisation of shared water resources: Zero-sum hydropolitical dynamics

The most common form of hydropolitical dynamic found in developing regions, particularly those emerging from periods of protracted political conflict such as wars of liberation or civil wars, is one based on zero-sum outcomes. Such outcomes have an inherently high conflict potential because the gain of one party is seen to be the loss of another, manifesting as a win-lose series of interactions. As noted in table 1, threat perceptions are important, because it is those perceptions of risk that become the fundamental drivers of decision-making. If it is accepted that almost all decisions in government are made against a background of imperfect knowledge about the

Table 1

Integration of four key concepts showing the most likely threat perception to arise from each combination

	Negative peace	Positive peace
Security of supply	• Attempts to improve the security of supply by one riparian cascade into other parts of the basin as insecurity of supply for other riparians. • Tends to be a unilateral action.	• A basin-wide development plan improves the security of supply for all riparians in a coordinated and non-competitive manner. • Tends to be a negotiated action.
National security	• Insecurity in the region where the basin lies heightens the sense of national security threat from unilateral action by other riparian states. • Improvements to the security of supply by one riparian can therefore become a national security issue for another riparian under these conditions.	• Greater regional security translates into improved security perceptions within the basin. • Conflict potential is institutionalised. • Water resource management is less of a national security threat because the range of unilateral actions available to other riparians is reduced.
Threat perception	• Other riparians are potential competitors for scarce water resources, therefore a zero-sum outcome is probable.	• Other riparians are no longer competitors for scarce water resources, therefore a plus-sum outcome is probable.

intentions and capabilities of other potential opponents in the state system (Le Marquand 1977:22), then rationality suggests that a precautionary principle would be adopted. Under conditions of inherent national insecurity (negative peace), the precautionary principle dictates that the decision maker would assume the worst-case scenario and then formulate strategy accordingly. This, in turn, would be perceived by the opposition as a potential threat to their own national security, so they too would

be forced to adopt a precautionary approach in their own decision-making, because they also function with incomplete knowledge. This rapidly escalates into a spiral of insecurity as shown in figure 2, not unlike the dynamics of the arms race during the Cold War, with hydraulic infrastructure replacing weapons in the *realpolitik* of water resource management. As Buzan and others (1998:18) note:

> "[A] water shortage could become securitized at the global level, but the major battles will most likely be regional. Upstream and downstream powers and other potential beneficiaries from a particular river or lake will see each other as both threats and potential allies, which might play into other rivalries and constellations in the region and thus become tied into a more general regional security complex."

Under these conditions, national interest is the key driving force, with all states locked into rivalry, particularly with respect to the survival of the state as an entity. All actions that restrict the state in its unilateral quest for power will thus be perceived as threats to its own national interest and will consequently be interpreted as national security threats. Interestingly, in the context of realist theory, the notion of limited warfare plays an important role. For example, in the writing of Kissinger (1961:170), reference is made to limited warfare in which proxy forces square off against one another in different parts of the world, each representing one of the superpowers, which are unable to confront each other for fear of total annihilation through the deployment of nuclear weapons. It is precisely this type of endemic conflict that has engulfed Southern Africa, where proxy forces became engaged in limited local wars, as smaller theatres of the bigger Cold War. It is therefore impossible to escape the lasting results of realist political dynamics in Southern Africa, because the region was so deeply embroiled in the global rivalries of the Cold War.

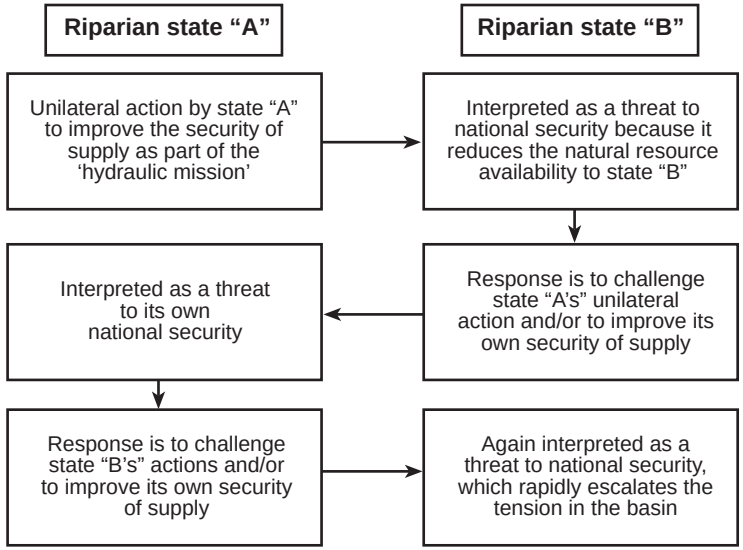
Under such conditions, the securitisation of water resource management is more or less an inevitable outcome. This means that water resource management, particularly in the context of international river basins, becomes closely linked over time to the national security perceptions of the states concerned, driven in part by suspicion, and resulting ultimately in stunted institutional growth as fears of the erosion of state sovereignty undermine possible cooperative efforts (Turton 2002b).

Desecuritisation of shared water resources: Plus-sum hydropolitical dynamics

Waever (1995:56) notes that security and insecurity are not in binary opposition, but are social constructs. By using the term 'security' in relation to something else, this suggests that a problematic situation exists in which some extraordinary measures need to be taken in response. Seen in this light, insecurity is a situation with a security problem but with no response. Consequently, the problematique of securitisation can be transcended, not by couching the problem in security terms, but rather by viewing

Figure 2

The escalation pattern of hydropolitical tensions based on the zero-sum dynamics of realism



it away from such terms. This implies the politicisation of the problem, rather than the securitisation of the problem, thereby allowing normal political processes of dialogue, negotiation and agreement to resolve the issue. Seen in this light, politicisation allows the issue to be dealt with in the open as a matter of free choice between the parties involved. In this context, security (or the securitisation of the issue) should be seen as being a failure to deal with the matter as normal politics (Buzan et al 1998:29). Desecuritisation of water resource management is thus a healthy manifestation, because it opens up the discourse and allows a wider range of roleplayers to become involved in the resolution of the core problem. This tends to foster institutional development and manifest as a win-win outcome, which is inherently more conducive to economic growth and hence positive peace.

How is this to be achieved? In a comprehensive analysis of various international river basins, it was found that a country could benefit from a lack of agreement with other riparian states in some cases. Under these circumstances, usually found in

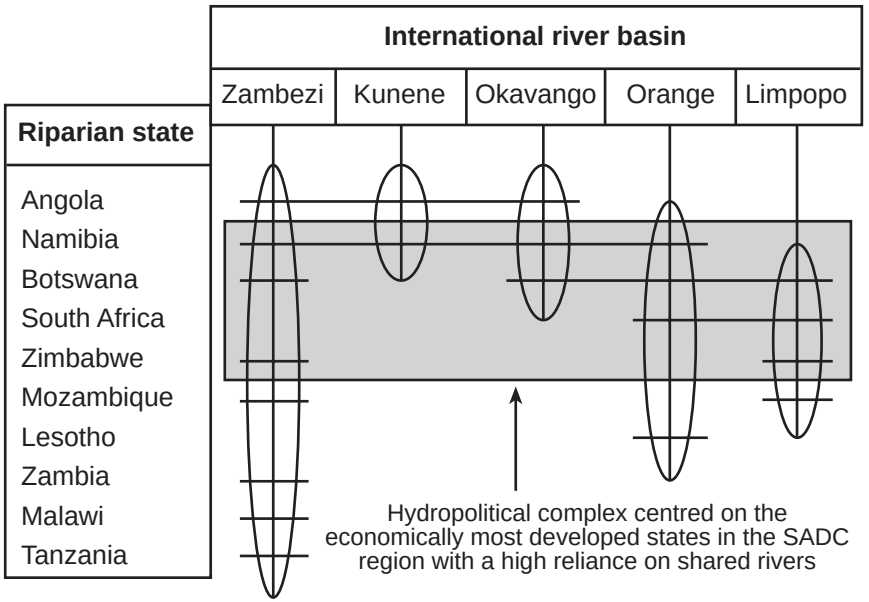
upstream riparians, there is little incentive for cooperation and a history of distrust and ill-will between the riparians can destroy the confidence needed for a joint programme (Le Marquand 1977:131). The conclusion to this study, however, was that mutual self-interest is the most common basis for cooperation (Le Marquand 1977:132).

If mutual self-interest is a key driver of cooperation, and desecuritisation is the key to the establishment of positive peace, it is necessary to understand the fundamental dynamics of this process. Returning to the quotation by Buzan and others (1998:18) noted earlier, the concept of a regional security complex was introduced. A security complex is defined as a set of units (states) of which the major processes of securitisation, desecuritisation, or both are so interlinked that their security problems cannot reasonably be analysed or resolved apart from one another (Buzan 1991:190; Buzan et al 1998:201; Buzan & Waever 2001:31). In terms of this conceptualisation, a region like SADC is locked into a security complex by virtue of a number of fundamental drivers not related to water resource management (see Buzan 1991:186-229). Riparians in water-scarce regions can also be part of a hydropolitical security complex. For example, Schulz (1995) has noted the existence of such a complex in the Tigris and Euphrates basin, while the author has identified an immature hydropolitical complex in SADC that is clustered around the Orange, Limpopo, Okavango, Kunene, Incomati and Maputo basins (Turton 2001; 2003). A hydropolitical security complex can therefore be defined as being a special form of regional security complex that exists when those states are part 'owners' and technically 'users' of shared rivers, and start to consider the rivers to be a major national security issue (Schulz 1995:97). Significantly, the fact that problems occurring within the basin can only be resolved in the context of cooperation within the same river basin, means that a hydropolitical complex exists, irrespective of the fact that water resource managers may deny the existence of such a complex (Turton 2002a). In this regard, the concept is an analytical tool, rather than an actor-defined condition (Buzan et al 1998:20). It therefore becomes instructive to develop an understanding of how states are linked with one another through shared river basins in water-scarce regions where most of the readily available water has been allocated to some form of economic activity or another. Figure 3 shows the linkages between the Okavango River basin riparian states and other countries (and international river basins) within SADC.

This means that the four most economically developed states in the SADC region – South Africa, Botswana, Namibia and Zimbabwe – which are also the most water-stressed, are locked into a relationship of potential competition (or cooperation) over the management of the shared river systems that form the foundation of their respective economic development potential, and hence national security interest. This can be seen as a distinct component of the regional political dynamics, likely to become a specific driver of either conflict or cooperation in the future, with marked peaks in activity during times of regional drought. The hydropolitical complex that is clustered around these shared river basins can therefore be seen as a distinct layer of political interaction within the emerging Southern African regional security complex

Figure 3

Linkage between the riparian states in the Okavango river basin and other riparians in adjacent international river basins



Note the linkage between the four most economically active countries.

(Turton 2001; 2003). Due to the fact that water resource management is not fully securitised yet, and is in fact being desecuritised in post-apartheid Southern Africa as evidenced by the spate of new regimes for the management of international river basins, this hypothetical hydropolitical complex is not being called a 'hydropolitical security complex'. This places Southern African shared rivers in a different category to those found in the Middle East, where the concept initially emerged.

Institutions and a regional hydropolitical complex

Institutions are key components in the process of the desecuritisation of water resource management and are thus an important interceding variable. It is therefore

necessary to understand more about their internal dynamics, particularly with respect to their capacity to transform the zero-sum outcomes of securitisation, into the potential plus-sum outcomes of politicisation (or desecuritisation) instead. As with the concept of 'national security', an institution is also difficult to define. One of the oldest definitions (and still one of the most useful) is that an institution is a set of formal and informal rules, including their enforcement arrangements (Schmoller 1900:61 in Furubotn & Richter 2000:6). A river basin organisation like OKACOM is thus an institution only if:

- it contains a set of formal or informal rules; and
- it also contains an enforcement arrangement in order to sanction non-compliance with those rules.

While the first aspect clearly exists in OKACOM in terms of article 3.6 of the agreement (Treaty 1994:3), there is no mention of any enforcement arrangement. This means that, technically, OKACOM is not a true institution, simply because no sanction for non-compliance exists in a formal sense. It is this aspect that can be considered as a major distinguishing feature of an RBO that is functioning under conditions of negative peace.

An organisation like OKACOM, however, can be described as a regime. In this regard, a regime is defined as a set of implicit or explicit principles, norms, rules and decision-making procedures around which actors' expectations converge in a given area of international relations (Krasner 1982:186; 1983:2). Regimes are designed to manage complexity, and complexity increases with the level of interconnectedness (Krasner 1983:12). In other words, a regime is similar to an institution, but it functions specifically in an international political environment, and it does not necessarily embrace any form of sanction for non-compliance. Regimes are therefore specific forms of institution. Significantly, this places water resource management into the realm of international relations because it impacts on the attainment of national political and economic objectives, rather than purely water resource management that happens to be practiced in a river basin shared by two or more riparian states. Krasner (1983:2-3) notes that a distinction must be made between regimes and agreements. In this regard, agreements are ad hoc and often 'one-shot' arrangements, whereas the purpose of regimes is to facilitate agreements. Jervis (1982:357; 1983:173) expands on this by noting that a regime implies that the norms and expectations not only facilitate cooperation, but also result in a form of cooperation that is more than merely the following of short-term self-interest. Regimes are like contracts that involve long-term objectives by seeking to structure relationships in a more stable way. The most important function of these arrangements is not to preclude further negotiations, but to establish stable mutual expectations about the pattern of behaviour that can be expected from other roleplayers, while a favourable negotiating climate is being established (Keohane 1983:146-147). Consequently, rules of international regimes are frequently changed, bent or even broken in order to meet the exigencies of the moment, but this action does not necessarily mean that regimes have no constructive

purpose. Importantly, rules within regimes are rarely enforced automatically, and they are not self-executing (Keohane 1983:147).

Seen in this light, OKACOM has grown from a former agreement (Treaty 1990) between Botswana and Namibia that established the Joint Permanent Water Commission (JPWC) for the purposes of advising on waters of common interest (article 1.2) – the Okavango, Chobe/Linyanti and possibly even the Orange rivers. OKACOM has a more specific focus than that of the JPWC, but is not necessarily more complex as an institution because it has no permanent secretariat, no internal funding mechanism and no formal sanction for non-compliance of agreed upon rules and procedures. In similar vein, OKACOM is not necessarily the final agreement on the issue of managing the Okavango River basin either. Research in the Orange River basin (Turton 2002a; 2003) has shown that the Lesotho Highlands Water Project (LHWP) has grown from earlier more simple agreements (Treaty 1986a; 1986b; 1999a; 1999b). The Orange-Senqu River Commission (ORASECOM) (Treaty 2000) that was established to manage the whole Orange River basin recognised these agreements (article 1.4), as well as the Cooperation Agreement Between South Africa and the Transitional Government of Namibia (Treaty 1987), the two separate agreements on the establishment of the Permanent Water Commission (PWC) (Treaty 1992a) and the Vioolsdrift and Noordoewer Joint Irrigation Scheme (Treaty 1992b). ORASECOM is probably the most complex river basin organisation in Southern Africa, because it involves so many riparians, and existing, often highly elaborate bilateral schemes, without necessarily having jurisdiction over these schemes. It is clear just how dynamic the process of regime creation is and, more importantly, the role that regimes play in reaching agreements and facilitating the convergence of diverse riparian interests over time.

It therefore becomes instructive to examine some of the core aspects of regimes as they relate to the management of international river basins like the Okavango. Krasner (1983:12) has shown that regimes are needed to manage complexity. In fact, the increase in complexity can become one of the fundamental stimuli for regime creation in the first place, particularly where the unilateral action of one actor can cause significant harm to another. Central to this is the generation of knowledge, which can be understood to be the sum of technical information and theories about such information that commands consensus at a given moment in historic time among interested actors (Haas 1980). Where RBOs are concerned, knowledge refers to the uncontested data that forms the basis of any given regime (Turton 2002a:20). Taking this as the point of departure, it becomes evident that there are at least five distinct, but equally important elements to this form of knowledge that need to be understood in the context of RBOs (Turton 2002a:193-194):

- Technical information lies at the base of knowledge, but data on its own does not constitute knowledge.
- This technical information must be processed and evaluated before it becomes knowledge, so there must be agreed upon scientific methodologies at work within the chosen institutional setting.

- Consensus needs to be generated on the validity of the initial data, as well as the methodologies used to evaluate this data if the resultant output is to become knowledge. Consensus-building is a social process with a strong political dimension.
- The resultant output of this process must result in changed perceptions about the core problem being confronted by the regime. If there is no change in perceptions about this core problem over time, then the knowledge is probably not legitimate simply because insufficient consensus has been reached on the initial data, the methodology used to evaluate the data, or the final result of the process.
- This new knowledge must become the basis for policy that guides the regime in the attainment of the institutional goal that arises from the changed perception of the core problem being confronted.

Seen in this light, the difference between information and knowledge is the process of legitimisation. Knowledge is institutionalised and is seen to be legitimate, whereas information is not necessarily so. Legitimate knowledge, when captured in an institutional setting, results in more than adaptation – it results in institutional learning as well. Adaptation becomes the response to the process of institutionalised learning, which in turn is the result of the social processes of consensus-building and legitimisation (Turton 2002a:194)

The primary function of regimes in the context of water resource management is to foster the convergence of ideas around the need to transform the potential zero-sum outcome of uncontrolled competition for water in international river basins, into plus-sum outcomes based on the reduction of uncertainty for all of the riparian states involved. This is the fundamental issue confronting OKACOM. If this is successfully achieved, and indications are that it is a likely probability because the political will exists, then regime creation will desecuritise the management of water resources in the Okavango River basin and contribute to the transition from a condition of negative peace to a more enduring condition of positive peace. The solution of the core problem therefore rests on three critical issues:

- the generation of a comprehensive and uncontested set of hydrological and related data that will form the foundation of all water management decisions in future, including the allocation of water between riparian states;
- the negotiation of a common set of rules and procedures that have been agreed upon by all riparian states and are thus uncontested, including allocative processes and mechanisms of compliance verification and sanction; and
- the agreement on a formal conflict mitigation structure as an integral institutional arrangement that is capable of dealing with the inherent conflict potential that is related to equitably sharing water between all riparian states in water-stressed river basins.

Seen in this light, the long-term survival of the regime is dependent upon the ability of the emerging institutional arrangement to generate sufficient uncontested

knowledge. This knowledge should result in the redefinition of the perception of the core problem away from water as an absolute scarcity and thus a limitation to the economic growth potential of the state (and therefore a national security issue), to water as a relative scarcity, capable of being managed by recourse to a wide range of coping strategies (Turton 2002a). The exact nature of such strategies is beyond the focus of this chapter.

If the generation of 'uncontested data' is an absolutely fundamental component of institutional development, it is helpful to dwell for a few moments on an analysis of this construct. There are two distinct elements to this notion. The first is 'data' and the second is the 'uncontested' nature of the data. Research in process suggests that there are two distinct types of 'ingenuity' – to use Homer-Dixon's concept (1994; 1995; 1996; 2000) – or two distinct forms of 'second-order resource' – to use Ohlsson's concept (1999) – that are relevant to each of these elements:

- Technical ingenuity, or the ability to solve problems through technical innovation, is necessary to generate data. This specific form of second-order resource is typically found in formal water management institutions (Turton 2002c:75), but it can also be in short supply, which is typically the case in countries that are emerging from long periods of debilitating conflict and/or poverty.
- Social ingenuity, or the ability to negotiate agreements, is necessary to build trust, legitimise the methodologies used to gather, process and interpret the data, and to adapt institutions as needed over time. This specific form of second-order resource is typically also in short supply in developing countries that are engaged in the early phases of their respective hydraulic missions. Under such conditions, social ingenuity is typically found in informal water management institutions (Turton 2002c:74), which are mostly incapable of developing technical solutions to complex problems such as those found in international river basins.

It is consequently the existence of second-order resources that determines the outcome of water regimes in semi-arid parts of the world. Seen in this light, the trajectory of RBO development in the SADC region has two likely alternatives as shown in figure 4. The one alternative, represented schematically on the left-hand side of this figure, is the securitisation dynamic. This can be regarded as being the *realpolitik* of water resource management. It will likely result in zero-sum outcomes and thus have an inherently high conflict potential, with stunted institutional development and limited regime creation, located in a broader setting of negative peace at best. The other alternative, represented schematically on the right-hand side of figure 4, is the desecuritisation dynamic. This can be regarded as being the functionalist or idealist approach to water resource management, that will likely result in plus-sum outcomes, and thus have a higher degree of predictability (due to the institutionalisation of the conflict potential) with more complex institutional arrangements emerging from various phases of regime development, located in a broader setting of positive peace.

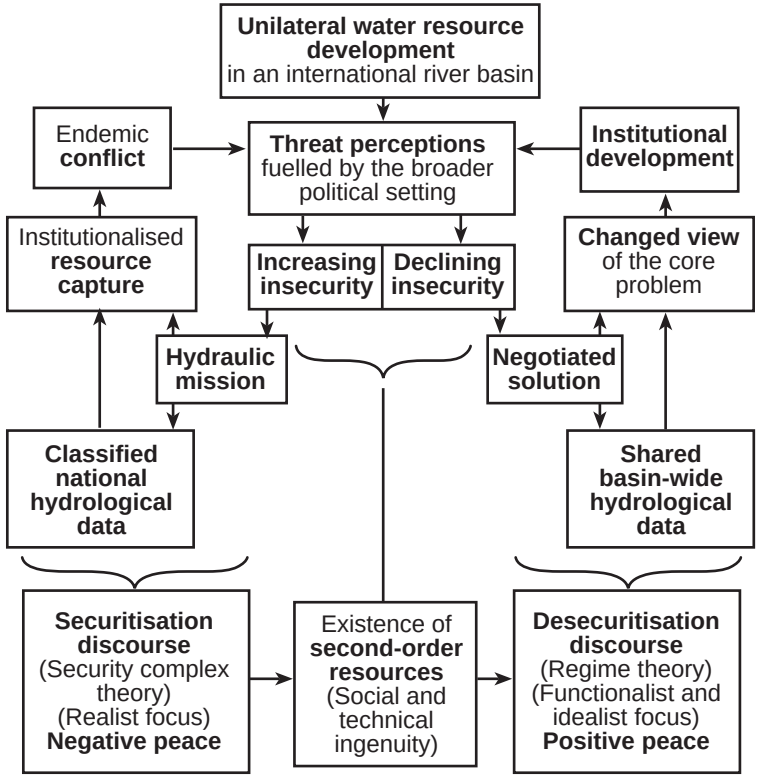
Conclusion

It is apparent that riparian states are locked into relations with their co-riparian neighbours, which means that political instability in one state impacts negatively on adjacent states in the context of international river basins. This is particularly true where strong states are in the same river basin as weak states, with their relative strength/weakness being defined as the degree of sociopolitical cohesion in a Buzanian sense. The conceptual distinction between 'negative peace' and 'positive peace' is thus highly relevant to Southern Africa. Countries that are engaged in aggressive economic development projects need to have a secure source of water supply, if that economic development is to be sustainable. The 'hydraulic mission' of developing countries, particularly in water-scarce regions, establishes a direct causal linkage between 'security of supply' and 'national security'. Given the fact that the management of international river basins is usually the domain of specialists, mostly engineers by training, this means that water resource management in transboundary river basins is actually more about international relations than about water resource management. In order to foster the transition from 'negative peace' to 'positive peace', institutions need to be developed. These are facilitated by means of regimes, which are a form of institution, but which lack the capacity to sanction non-compliance. Institutional failure can result in the securitisation of water resource management and the classification of national data, an undesirable state of affairs if enduring peace is to be achieved.

Central to the sustained development of river basin organisations in international river basins such as the Okavango is the need to develop an uncontested set of hydrological data. In this regard, there are two aspects of importance – the capacity to generate data, and the capacity to render this data uncontested – which have been linked to the existence of two distinct forms of second-order resource – 'technical ingenuity' (needed to generate the data in the first place), and 'social ingenuity' (needed to generate consensus on the accuracy and consequent acceptability of such data by all riparians). Seen in this light, RBOs need to be adaptable over time, with institutional learning being driven by the fundamental process of data generation and data legitimisation. There is no such thing as universally true data in hydropolitics, only data that is acceptable to all the riparian states involved. As such, second-order resources seem to be the key variable in determining the long-term outcome of RBOs such as OKACOM. It is in this regard that third-party actors can play a major role in regional peace and the generation of economic development by supporting efforts to generate data. Given the importance that has been attached to these issues by NEPAD and the AU, the role of RBOs as a functional arrangement in deepening the democratic tradition that is emerging in post-Cold War Africa, along with their role in redistributing wealth and prosperity between neighbouring countries, point to such institutions becoming major focal points in Southern Africa in the near future.

Figure 4

Linkage between the securitisation and desecuritisation discourse in water resource management



Source: Turton 2002a. Note the central role played by second-order resources in moving from negative peace to positive peace.

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CHAPTER 5

Cooperation in the Okavango river basin: The OKACOM perspective

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Abstract

The Okavango River basin is shared between Angola, Botswana and Namibia. As well as the water resources, people living in the basin derive numerous natural resources from the basin ecosystem. Lying in the middle of a predominantly semi-arid region, the Okavango provides opportunities for water abstractions for numerous uses. The three basin states, sharing a concern for the basin environment, decided to strive to manage developments in the basin in a sustainable manner. In this regard, the three states agreed to establish the Permanent Okavango River Basin Water Commission (OKACOM). This agreement was formally signed on 15 September 1994.

Introduction

Access to water is a prerequisite to achieve the socioeconomic objectives of the Southern African Development Community (SADC). The need for amicable collaboration between riparian watercourse states in the development of internationally shared river systems is well recognised in Southern Africa. This is clearly demonstrated by the entry into force in September 1998 of the SADC Protocol on Shared Watercourse Systems (SADC 1995). Botswana and Namibia signed and ratified the SADC protocol. The protocol calls for the establishment of river basin institutions to manage shared water resources. This is complementary to the framework provided by other instruments of international water law, such as the Helsinki Rules on the Uses of the Waters of International Rivers and the United Nations Convention on the Law of the Non-navigational Uses of International Watercourses (UN 1997). Angola, Botswana and Namibia all voted in favour of the adoption of the UN convention and Namibia is a signatory to the convention. Within this context, these three states that are all riparians to the perennial watercourses of the Okavango basin established the Permanent Okavango River Basin Water Commission (OKACOM).

Features of the Okavango River basin

The Okavango basin comprises perennial and ephemeral sub-catchments. The Cuando Cubango river, internationally known as the Okavango, is one of the three

main rivers in Southern Angola. The Cubango and Cuito rivers are in the perennial or active part of the catchment. They originate east of Huambo on the Bie plateau in southern Angola. Both rivers flow in a south-easterly direction towards the Okavango Delta in Botswana.

The river is surrounded by the basins of Cuando to the east, the Zambezi to the north-east, the Kwanza to the north and the Cunene to the west, as well as an undefined drainage area known as the Cuvelai basin.

The exact extent of the southern perimeter of the Okavango basin is not well defined, but the watercourse system drains about 725,000 km^2 in the central Southern African subcontinent. The basin covers four watercourse states: Angola, Botswana, Namibia and Zimbabwe (see table 1 and, for more information, see map 1).

The rainfall over the catchment is seasonal and summer rainfall conditions prevail. The perennial runoff entering the lower Okavango ends up as a swamp in the Okavango Delta. In the high flood season, the swamp covers an area of about 15,850 km^2. During years of good flows, outlets from the delta may carry water as far as the Ngami and Dow lakes in the Makgadikgadi salt pans. In exceptional cases, the water may spill into the Cuando system through the Magweqgana at the Selinda Spillway, thus becoming part of the Zambezi system.

The Cubango (called Kavango in Namibia) forms the border between Angola and Namibia over a distance of some 400 kilometres between Mbambi in the west and Andara in the east. At Andara, just downstream of the confluence of the Kavango and the Cuito, the river turns to the south across 50 kilometres of Namibian territory in the Caprivi Strip on its way to Botswana.

The mean annual rainfall in the headwaters of the Okavango in Angola is 1,200 mm, but decreases to 600 mm in the middle Okavango. Further southwards, the precipitation is between 300 and 400 mm in Namibia and Botswana, respectively. The Okavango yields about 9,863 million m^3 (rounded off to 10 km^3) of water per annum on average at Mohembo on the border between Botswana and Namibia, just upstream of the so-called Panhandle of the Okavango Delta.

Due to the topography of the catchment in Angola, there is good potential for hydropower generation and the soil is suitable for irrigation, especially on the plains along the river where it forms the border between Angola and Namibia.

The Omatako River catchment in Namibia is topographically linked to the perennial Okavango River, but due to the low mean annual rainfall of less than 400 mm in the headwaters, the river is ephemeral. Due to the sandy nature of the terrain, no runoff has actually reached the Okavango in living memory. There are also a number of other ephemeral watercourses that flow eastwards from Namibian territory across the border into Botswana in the direction of the Okavango Delta, but these watercourse systems all dissipate in the Kalahari Desert before reaching the delta. Therefore, all the runoff up to Mohembo is in effect derived from the Angolan part of the catchment.

Table 1

The Okavango basin

Watercourse state	Area (km^2)	Percentage of total area	Runoff contribution at Mohembo (km^3/a)
Angola	200,000	28	10
Botswana	340,000	46	0
Namibia	165,000	23	0
Zimbabwe	20,000	3	0
Total	**725,000**	**100**	**10**

Note: Figures rounded off.

The mean annual summer rainfall in the Nata River catchment in Zimbabwe (where it is known as the Amanzamnyama River) is 500 mm and therefore runoff in the river is ephemeral. It flows into the north-east reaches of the Makgadikgadi Pan in Botswana. The pan is topographically connected to the Okavango Delta via the Boteti River, but the runoff in the Nata reaches neither the Boteti nor the Okavango. The mean annual rainfall over the catchment in Botswana is 400 mm.

The Okavango is one of the most pristine river systems in Southern Africa, if not in the world. Although large portions of the catchment in Angola, Namibia, Botswana and Zimbabwe are suitable and are used for stock farming, the effects of land degradation or mining and industrial development have not been a significant threat to the watercourse system.

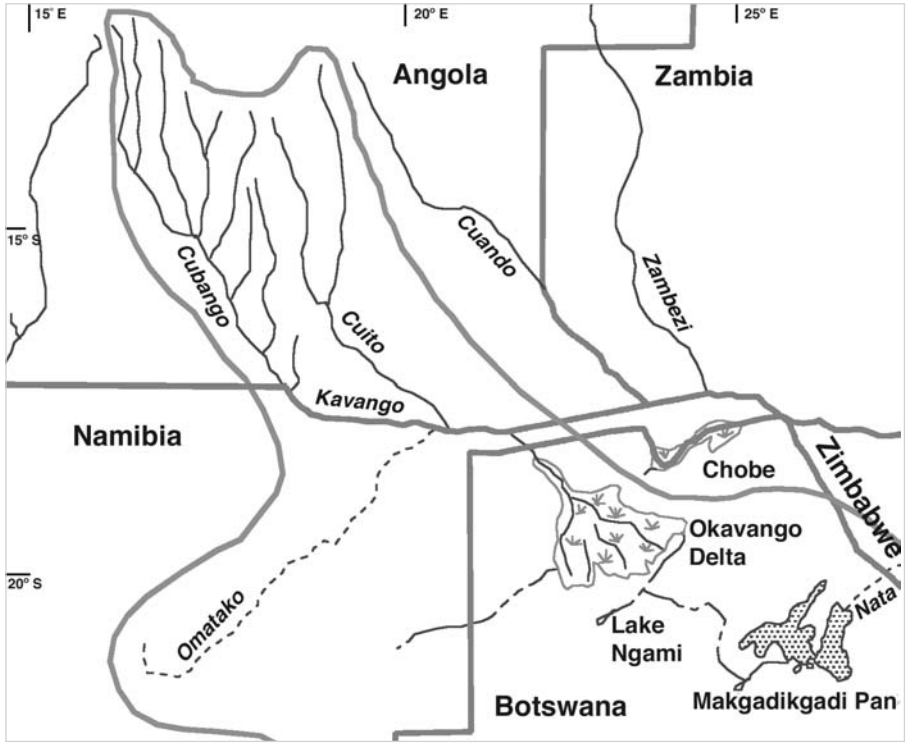
The catchment in Botswana is used for stock farming and large game parks have been created in the delta area. These parks are a major attraction for international tourism. The population centred around the delta also rely on the wetland resources and tourism for their existence.

National perspectives

The Okavango River basin traverses an area that is predominantly semi-arid. Therefore, the water carried by the river and the wetland resources it supports provide a livelihood for the residents of the basin. In all three basin states of the Okavango

Map 1

The Okavango River basin



River plans have been made on how best to utilise the water and the unique environment that the basin provides.

Angola

With the advent of peace, it is now possible to put in place programmes and projects focused on the displaced population in order to move them back to their areas of origin. This will ensure their place or engagement in upcoming agricultural projects. This priority is viewed as a global and strategic action to combat poverty and bring development in the short and long term to the country in general.

At this crucial stage, Angolan government programmes show that a great deal of financial resources are directed to actions focused on reconstruction, recovery and rehabilitation of all basic infrastructure such as roads, water and energy supply, as well as health and education services to improve the social conditions of the population wherever they are needed.

With Angola's existing potential, recovery can be rapidly made since the government has adopted an open door policy for joint ventures in most of the vital areas of the economy.

The upstream basin offers good conditions for the development of agricultural projects, with great potential for hydroelectric and agro-industrial projects that can be realised in the short and long term.

There are also other major government investment programmes in the pipeline (PIP 2002) that constitute a good source for employment in the region.

The ecotourism industry is another economic activity that cannot be neglected. A large part of the basin allows for the utilisation of different zones for the development of tourism projects similar to those already being implemented in the other basin states. In the long term, this will create conditions for the rehabilitation of wildlife, national parks and game reserves on the Angolan side. This will alleviate the great burden created by overpopulation of some species in the habitats of the two states.

It is important to note that, despite the good potential of Angola, it still has to achieve significant social recovery and reconstruction. This includes the rehabilitation of infrastructure, the promotion and revitalisation of productive activities, and the development of the capacity of local administrations to encourage the rural population to participate in community projects. These constraints need to be addressed so that the country can move forward.

Botswana

Botswana lies at the distal end of the Okavango River basin. All the water reaching the delta is derived from Angola, the upstream basin state. Being at the furthest end, the properties of the water that reaches the delta, both in terms of quantity and quality, depend very much on activities in the upstream states.

The presence of a vast body of water in a predominantly dry area has created a unique environment. From the natural environment and human settlements to a diverse animal and plant species, the Okavango Delta supports an ecosystem with entities that are highly dependent upon water.

While much of the surrounding area is influenced by the semi-arid nature of the Kalahari, the delta and its peripheries are characterised by lush vegetation drawing water from the perennially and seasonally flooded swamp.

A number of settlements have been established in and around the periphery of the delta all the way from Mohembo, close to the border with Namibia, down to the

villages along the banks of the Boteti River. These settlements rely on the system for their sustenance, and make use of the various resources that it supports. The largest of the settlements is the town of Maun, at the distal periphery of the delta.

The surface waters of the Okavango provide a ready source for livestock watering. From the early days, farmers have sustained their livestock from the waters of the delta, and grazed them on the grasses that grow in the seasonal swamp when the water recedes. As well as livestock, farmers also use seasonally flooded plains for crop production.

The mainly undisturbed wilderness environment and diverse wildlife are significant tourist attractions. Over the years, the tourism industry has consistently grown, and the delta has been a prime destination. The government of Botswana makes all possible efforts to keep the delta as a prime tourist attraction. In this regard, the government has opted for a low-volume/high-cost tourism policy.

In a thirsty land like Botswana, permanent water such as that found in the Okavango system represents a valuable source to meet various water needs. However, the remoteness of the delta from the major demand centres has ensured that it has remained relatively untouched. Apart from supply to settlements around the delta, no major abstractions have been effected.

The furthest location where water from the Okavango has been used is the Orapa diamond mine. However, apart from dredging a short reach in the Lower Boro during the early 1970s, no major engineering interventions have been undertaken. During good flows, which have not been experienced for a number of years now, water is able to reach the draw-off point for the mine naturally by flowing down the Boteti River.

Over the years, the delta has been viewed as a potential source to meet domestic, agricultural and other needs. In 1977, the United Nations Development Programme (UNDP) commissioned a study by the Food and Agriculture Organisation (FAO 1977) to investigate the Okavango Delta as a primary water resource for Botswana. This study looked at various aspects from engineering interventions, agricultural production, tourism, fisheries and others.

During the late 1980s, the government embarked on a project (Snowy Mountains Engineering Corporation 1987) to implement the recommendations of the UNDP/FAO report. The feasibility of the project was investigated, and detailed execution plans laid out. Engineering works that were recommended included dredging the Lower Boro to just inside the Buffalo fence, improving outflows from the delta, and a number of bunds to provide storage. However, before the project was implemented, environmental concerns were raised, and this led to the government suspending the project (IUCN 1992).

In carrying out activities in the delta, the government recognises the need to consult the different stakeholders. These range from citizens in the settlements around the delta, local and central government authorities, and different NGOs working in the delta.

The government of Botswana acceded to the Ramsar convention on 4 April 1997, and the Okavango Delta was listed as a Ramsar site of international importance. In accordance with article 3 of the convention, the country is required to promote the

conservation and wise use of the delta. In this regard, the country, under the leadership of the National Conservation Strategy Agency, has embarked on a management plan for the whole delta.

The plan was necessitated by the fact that existing land-use plans for different areas are often guided by somewhat conflicting guidelines. These had to be integrated into a single overall planning framework.

The long-term goal of the management plan is to provide an integrated resource management plan for the Okavango Delta that will ensure its long-term conservation and will provide benefits for the present and future well-being of the people, through the sustainable use of its natural resources.

Namibia

The Okavango wetland resources support the livelihood of about 140,000 people along the river and about 100,000 in the rest of the catchment in Namibia.

A preliminary study was done in 1969 on the development of a 40 megawatt (MW) hydropower station at the Popa Falls in the Caprivi Strip on Namibian territory (Department of Water Affairs, South-West Africa Branch 1969). In 1983, an assessment was made of the possibility to develop 30,000 hectares of land for irrigation on the Namibian side of the river (Department of Water Affairs 1984). At present, Namibia uses about 20 million m^3 of water per annum from the Okavango, mainly for domestic use and agricultural purposes.

Namibia has an extremely arid hydroclimate. The rivers in the interior of the country are therefore ephemeral in nature and the recharge to groundwater sources is limited. The potential of the surface runoff and the groundwater are respectively estimated at 200 and 300 million m^3 per annum or 500 million m^3 per annum in total. However, present estimates show that, in future, the managed water demand would exceed this figure by 2020. This means that Namibia will be looking to its perennial border rivers to augment the scarce water resources in the interior of the country.

Between 1970 and 1974, Namibia experienced growth rates of up to 7% per annum in the central area and an assessment was made of the water demand and supply situation. This led to the development of a proposed national water master plan (Department of Water Affairs, South-West Africa Branch 1974). The plan proposed, among others, the construction of the so-called Eastern National Water Carrier eventually to import water from the perennial Okavango River into the arid interior of central Namibia by 1986. It was decided to develop this project in five phases over time, depending on the actual increase in the estimated water demand, the yield performance of the internal water sources and the availability of capital funds for infrastructure development. The first phase of the project was the construction of the Von Bach dam, 70 kilometres to the north of Windhoek. The second phase of the project started in 1975 and two dams, the Swakoppoort and Omatako were completed and linked to the Von Bach dam. In view of the uncertainties leading up to the

independence of Namibia, economic growth could not be sustained and the need for the completion of the carrier was delayed beyond the original planned completion date. The third phase was the construction of a canal between the Omatako dam on the Omatako River and Grootfontein, about 250 km from Rundu on the Okavango River. This work was completed in 1987 and provided access to the karstified groundwater sources in the Otavi mountainland at Grootfontein. Only the fifth phase, the proposed Grootfontein-Rundu pipeline, remains to be completed (see map 2 for more information).

Although various economic and political factors reduced the growth in development and the corresponding water demand as anticipated in 1973, the demand was reduced even further and the yield of the various source components of the water carrier was increased through better water management practice.

Shortly after the independence of Namibia, it was decided to commence with a study to reassess the central area water demand and supply situation. The work was completed in 1993 and, according to the infrastructure development scenario presented, the link to the Okavango River had to be completed by as early as 2003 if the estimated yield of other water resources that could still be investigated in the interior of the country could not be mobilised as expected. However, it also became clear that even with the development of additional groundwater sources, the improved reuse of effluent, the integrated use of the existing water sources, the conjunctive use of surface and underground water, as well as better water demand management practice, the need to complete the proposed link to the Okavango to augment the internal water sources of central Namibia could only be delayed until 2009.

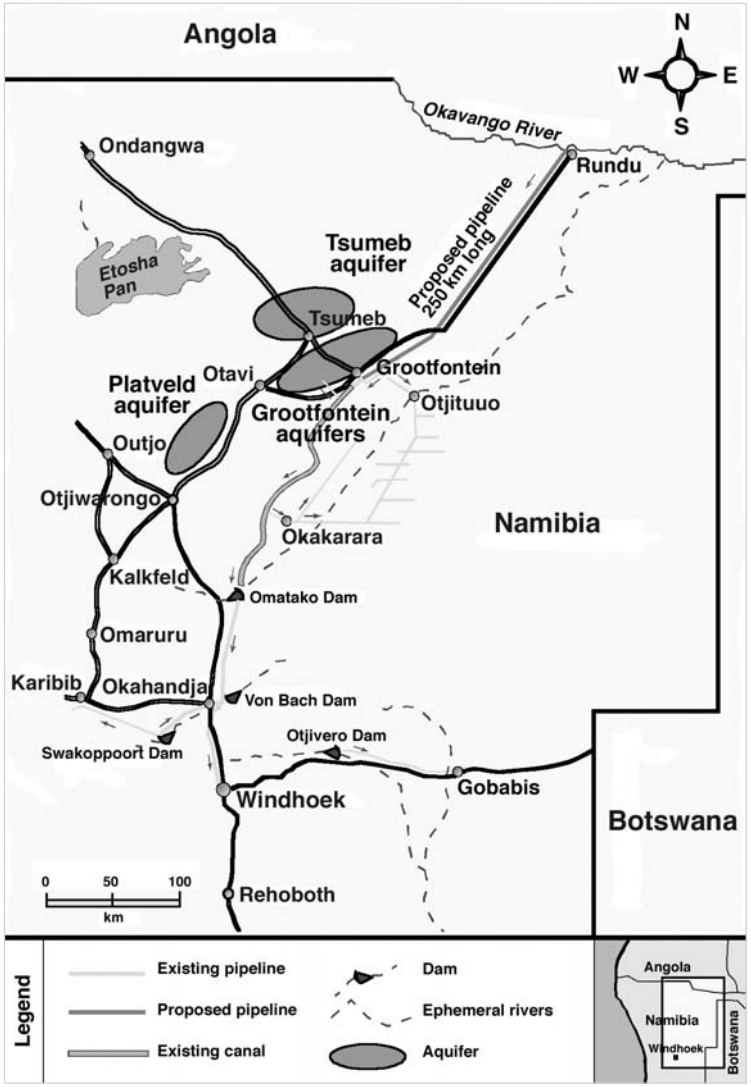
The possibility of utilising other water sources such as the supply of desalinated seawater into the carrier or to provide a link to the Orange River was ruled out as economically viable alternatives (Ministry of Agriculture, Water and Rural Development, Department of Water Affairs 1993). There are at present some 250,000 people outside the Okavango basin in the central area of Namibia who will need future access to water from the Okavango to sustain their socioeconomic activities (Ministry of Agriculture, Water and Rural Development, Department of Water Affairs 1997).

A major advantage of having the infrastructure in place to abstract water from the Okavango would be that Namibia could utilise the already developed surface water resources at higher yield, but a lower reliability. This link to a reliable water source will allow the utilisation of the accumulated surface water before it evaporates and will thus increase the environmental efficiency and yield of the dams. If any failure to supply would occur, then the availability of perennial water from the Okavango could provide the security of supply.

The 1993 study about the water supply to the central area of Namibia confirmed the results of the 1973 water master plan and the fact that Namibia would eventually have to obtain access to a reasonable and equitable share of the waters of the Okavango River to sustain further growth in the economy of the central area. It is therefore of critical importance to Namibia to know what the effect of development in

Map 2

The Eastern National Water Carrier



Angola would be on the flow in the Okavango at the proposed future abstraction point at Rundu.

Concerns about access to Okavango water

The prolonged war that started in Angola before 1974 ended recently and this considerably increased the potential for developments that would require water from the Okavango. It is now possible to achieve meaningful infrastructure development and to improve the socioeconomic conditions of an estimated 800,000 people living in the upper reaches of the Okavango catchment and on the plains in south-eastern Angola.

Feasibility studies that were done by the Portuguese authorities prior to 1974 indicated that there is potential for hydropower generation (350 MW) and the development of irrigation (54,000 ha) in the Angolan portion of the Okavango catchment, but very little recent information is available about the future development potential. The existing and future water requirements, as well as the impacts that possible future industrial, mining or irrigation activities might have on water abstraction, the quality of the water and the downstream environmental health of the Okavango are not clear. Angola is therefore seen as a potential sleeping giant that will come alive and that may have severe consequences for the future availability of water for Namibian abstraction on the Kavango where it forms the border between Angola and Namibia, or for hydropower generation at Divundu or on the Okavango Delta.

Although the Botswana government is sympathetic towards the legitimate and reasonable water requirements of Namibia, the international conservation community views Botswana as the custodian of the Okavango Delta and this may have an impact on the Namibian plans to utilise water from the Okavango. A large number of environmental NGOs are active in the delta. They may be, to a certain extent, in a position to bring pressure to bear on the Botswana government as far as developments in the Okavango are concerned.

The creation of OKACOM

Shortly after the independence of Namibia in 1990, the new Namibian government established a number of river basin institutions with other riparian states on the internationally shared border rivers of the country. The objectives of these commissions were to advise the respective governments about technical matters relating to the sustainable development, beneficial utilisation, integrated management and conservation of water resources of common interest among the watercourse states.

In September 1990, the governments of the People's Republic of Angola and the Republic of Namibia agreed to endorse and affirm the old agreements on the Cunene River between the colonial powers (Portugal and South Africa) and to re-establish the Permanent Joint Technical Commission (PJTC). In November 1990, the governments of the republics of Botswana and Namibia established the Joint Permanent Technical

Commission (JPTC) to deal with water resources of common interest. The watercourse states that are riparian to the active, perennial runoff in the Okavango basin are Angola, Botswana and Namibia and all three parties were represented on a bilateral basis in either the PJTC or the JPTC.

The need to utilise the waters of the Okavango to augment the water supplies in the central area of Namibia had already been identified long before independence, but the question of access to the water could not be taken up with the basin states because Namibia was not a sovereign state. The Namibian government therefore suggested to bring the commissioners of the PJTC and the JPTC together at a joint meeting in Windhoek to discuss the future development of the Okavango basin and the possibility to establish a tripartite water commission. This historic meeting took place in Windhoek in June 1991 and subsequently led to the establishment of the Permanent Okavango River Basin Water Commission (OKACOM) on 15 September 1994 in Windhoek between Angola, Botswana and Namibia.

At the first meeting of OKACOM, Namibia officially informed the other parties about the development of the proposed Eastern National Water Carrier and it became clear that the issue of co-ordinated development in the Okavango basin had to be addressed (Heyns 1999).

Initial activities of OKACOM

The first major achievement of OKACOM was to develop a proposal for a project to execute an environmental assessment of the Okavango basin and to develop an integrated water resource management strategy by June 1995 (OKACOM 1995). It was envisaged that the process to develop the strategy would provide comprehensive information about the state of the environment in the whole Okavango basin, and that an assessment of the prevailing situation would show the potential for the future development of the basin in each watercourse state. Such developments would require water from the Okavango watercourse system.

The envisaged management strategy would eventually enable the watercourse states to collect accurate data in order to provide a factual basis for informed discussions and sustainable decisions about the future utilisation of the water resources. This is viewed as one of the cornerstones of successful cooperation between the parties and would allow them to agree among themselves on the quantity of water required from the Okavango by each state to achieve its respective development objectives. Furthermore, the whole process would develop the required technical capacity and negotiating skills that are needed to reach consensus on the optimal solutions to achieve in an attempt to maximise the benefits of reaching the set objectives of each party.

In order to fund the proposed project, OKACOM approached the Global Environmental Facility (GEF) for support. The GEF agreed to make project development funds available to execute a transboundary diagnostic analysis in order

to identify the key areas of concern and the gaps in the knowledge of the biophysical, social and economic environment in the Okavango basin. OKACOM appointed a steering committee, the Okavango Basin Steering Committee (OBSC) to manage the project. A study manager was subsequently retained to organise and coordinate the activities of more than 20 consultants in various fields of expertise, representing all three basin states. In this process, the projects and programmes required for a strategic action plan to study the potential of the Okavango basin and to develop the proposed integrated management plan for the Okavango were determined.

The diagnostic analysis was completed and a project brief could be drafted for submission to the GEF for further consideration and agreement to release funds for the development and implementation of the proposed strategic action plan.

This could be seen as the first initiative in Southern Africa where so many individual consultants from three basin states of a shared river system worked together to achieve a common goal and is in itself a major achievement in integrated water resource management.

The present status of the GEF project is that the documents were approved by the GEF council and OKACOM. The start-up funds for the project will be released as soon as the document has been signed by all parties concerned.

OKACOM's functions

The integrated management of transboundary water resources is guided by three fundamental principles. These are the inherent sovereignty of each watercourse state, the obligation that one state should not cause significant harm to another state in the utilisation of water from a commonly shared resource, and the requirement that the water use must be equitable and reasonable.

However, these principles cannot be enforced, nor can any third party be called upon to resolve a conflict, unless all parties concerned have agreed to such an intervention. The foundation for the prevention of conflicts therefore lies primarily in the development of functional institutional mechanisms to facilitate a dialogue between the parties about their internationally shared watercourses.

OKACOM was established because the parties understood the importance of working together before a conflict situation would arise. This proactive initiative was not imposed on the basin states by any external agency and OKACOM actually mobilised much international support by having taken positive steps to manage the affairs in the Okavango basin in an amicable way.

The procedure to establish OKACOM was kept relatively simple by utilising existing basin institutions. The agreement on OKACOM is not an elaborate document, but succeeded in bringing the parties together around the table for meaningful discussions. OKACOM is not an expensive institution with a large staff complement and a big budget. The commission had eight meetings since 1995 and facilitated a number of constructive achievements that would otherwise not have been possible.

OKACOM is a relatively young institution that is still evolving to become a major driving force in the sustainable development of the Okavango basin. The commission will seek financial support to develop capacity and to implement projects to avoid conflicts between the parties. These objectives will certainly attract the support of the international donor community.

Conclusion

It is inevitable that Angola, Botswana and Namibia will use more water from the Okavango in future. While this may seem to be in conflict with environmental considerations, it is important that the mutual dependence of people and ecosystems in the Okavango basin should be accepted. There is therefore a need to maintain a balance between social, economic and environmental security in the basin.

OKACOM has already taken a number of steps to develop a process for the future implementation of an integrated water resource management strategy. The activities that have taken place so far – and will take place in future – are already building confidence, mutual understanding and trust between the parties through the exchange of information, joint planning and the development of a shared vision for the future (Heyns 1995).

These sentiments are the main driving forces behind the positive steps taken by the Okavango basin states to find a way to meet their future expectations.

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CHAPTER 6

Kant and should: Strategic thoughts about ‘wise use’ of the Okavango delta system

Larry A Swatuk

Abstract

The Okavango River basin presents an excellent example of the problematique that is the core issue of this book – state sovereignty and the associated national interest – and the way in which transboundary rivers challenge these fundamental concepts. This chapter deals with the discourse of politics and policy-making, suggesting a new language about a new regionalism that is fuelled by new thinking. The major purpose of the book is to interrogate the contradictions between sovereignty and national interest, on the one hand, and the need to transcend these very issues with respect to the management of transboundary natural resources, like rivers, on the other. In short, the chapter is about pushing paradigms and challenging conventional wisdoms in the hope that the core debate within OKACOM may change from water-sharing to benefit-sharing.

Introduction: Save the earth

> “The fact of diminishing nature and of human ubiquity is now obvious” (Yi fu-Tuan 1971).

> “We have accustomed ourselves to think of ever expanding productive capacity, of ever fresh spaces of the world to be filled with people, of ever new discoveries of kinds and sources of raw materials, of continuous technical progress operating indefinitely to solve problems of supply. We have lived so long in what we have regarded as an expanding world, that we reject in our contemporary theories of economics and of population the realities which contradict our views. Yet our modern expansion has been effected in large measure at the cost of an actual and permanent impoverishment of the world” (Sauer 1938).

> “Projects for change and progress need to be linked to the possibilities of society, national and international, as given. Fatalism in the face of the given is as unnecessary as speculation unhinged from practicality and real movement. We need, in Runciman’s judicious phrasing most pertinent to International Relations,

to distinguish the 'improbably possible' from the 'probably impossible.' This involves the double assertion – one intellectual, the other sociological: the intellectual revolves around a reassertion, chastened by history and critique alike, of the values associated with the Enlightenment; the sociological involves an assertion that, within the constraints of the contemporary world, and of that modernity which characterizes it, purposive action, linked to agency by individuals, movements and states alike, is possible" (Halliday 1999).

"In 1972, Hedley Bull wrote that 'the sources of facile optimism and narrow moralism never dry up, and the lessons of the 'realists' have to be learnt afresh by every new generation'… If the academic study of international relations can find little save period-piece interest in the ideas of the classical realists, that is more a comment upon the competence of scholarship today than upon any change in world conditions" (Gray 1999).

Rio +10 has come and gone. Many things have been said, many papers signed, many promises made. Yet, the fact remains: the state of the global environment has never been worse, while debates about causes and cures have never been more heated. According to Gardner (2002:4) of World Watch Institute, "global environmental problems, from climate change to species extinctions, deforestation, and water scarcity, have generally worsened since delegates met in Rio." The meeting in Johannesburg was supposed to be about agreement, timetables and implementation – about collective action taken toward solving this human-induced crisis. Instead, it was about turf wars, veiled threats, protecting vested interests, finger-pointing, back-peddling and no small degree of green-washing. It would serve well to reflect on these facts, for the global reflects the local and the local mirrors the global. Thus, in considering the peacemaking potential of the joint management of the Okavango Delta system as a Ramsar site, the myriad barriers to success thrown up by history, geography and contemporary (global, local and regional) sociopolitical economy should be acknowledged. To pretend that 'success' rests solely upon proper institutional forms and correct technical and scientific knowledge is fallacious. Clearly, these are important contributors to successful resource management. But they pale in comparison to the other factors highlighted.

In this chapter, both barriers and bridges to successful management of the Okavango Delta system are examined. A number of ideas are put forward of ways and means to achieve sustainable and wise use of the resources of the Okavango Delta. Before turning to these aspects, however, a brief background of Ramsar and related international conventions is presented in the context of liberal institutionalist and realist theories of politics. As suggested by the epigraphs above, while there can be no doubt that something must be done to stem environmental degradation, just what that something is varies directly with the prevailing world view.

'Managing' the situation: Ramsar and international conventions

Indicators of global environmental crisis are many and varied, but most involve some form of resource depletion – deforestation, desertification, soil erosion, species loss, habitat conversion – or the direct consequences of its use – global warming, acid rain, pollution. Among others, negotiations in Rio gave rise to several global conventions, for example, the Framework Convention on Climate Change (UNFCCC), the Convention to Combat Desertification (UNCCD), and the Convention on Biodiversity Preservation (UNCBD). It also created, among others, the Global Environmental Facility (GEF). Together, these conventions and institutions are intended to help in 'managing' the crisis – in the case of climate change, to set limits on use; in the case of both the biodiversity and desertification conventions, to reverse the loss.

The Ramsar Convention on Wetlands of International Importance, especially as waterfowl habitats preceded these perhaps more well-known conventions by more than 20 years. It is "the oldest of the four nature conservation treaties which include the World Heritage Convention, CITES and the Bonn Convention" (Njuguna 1992:9). Taking its name from the place – Ramsar in Iran – where the inaugural meeting was held in 1971, the Ramsar convention "provides the framework for international cooperation for the conservation of wetlands, the first and, so far, the only ecosystem type which has its own international treaty … The parties to the convention agree to include wetland conservation in their national planning and to promote their sound utilisation, especially as habitat for waterbird" (CEP Factsheet 17, no date). According to Njuguna (1992:9), the United Nations Educational, Scientific and Cultural Organisation (UNESCO) serves as the depository of the convention of which the "Secretariat, or Bureau, is an independent body administered by the International Union for the Conservation of Nature (IUCN) and the International Waterfowl and Wetlands Research Bureau (IWRB). The convention has its headquarters in Gland, Switzerland." Among countries in the Southern African Development Community (SADC), Botswana, Malawi, Namibia, South Africa and Zambia are parties to the convention.

Wetlands, particularly those more commonly defined – peatlands, bogs, fens and swamps – have had a particularly rough ride through history. Their conversion to other uses, and hence their destruction, extend in the European context at least as far back as the 11th century, with the negative environmental consequences of this being well-known almost from the beginning (Ponting 1991). According to Goude (1997:110-11):

"On a global basis the loss of wetland habitats (marshes, bogs, swamps, fens, mires, etc.) is a cause of considerable concern … In all, wetlands cover about 6 per cent of the earth's surface (not far short of the total under tropical rainforest), and so they are far from being trivial, even though they tend to occur in relatively small patches. However, they also account for about one-quarter of

> the earth's total net primary productivity, have a very diverse fauna and flora, and provide crucial wintering, breeding and refuge areas for wildlife. According to some sources, the world may have lost half of its wetlands since 1900, and the USA alone has lost 54 per cent of its original wetland area, primarily because of agricultural developments. There are, however, other threats, including drainage, dredging, filling, peat removal, pollution, and channelization."

Ramsar was the direct result of the collective desire of concerned individuals to see wetlands destruction stopped, indeed reversed, through the power of the sovereign state. It is logical that the state has been the primary vehicle through which Ramsar operates, for it has been at the hands of both public policy and public neglect that wetlands have suffered the most (Matiza 1994; Dugan 1992).

Ramsar's methods have changed over time, with an initial concern for locating wetlands of international importance within protected areas making way for more nuanced arguments in favour of 'wise use'. This is in keeping with most conservation-oriented organisations' shift toward sustainable utilisation, an idea and practice that will be discussed below. At the same time, Ramsar's definition of a wetland has broadened considerably, such that the traditional conception of a wetland (e.g. as bog or fen) is subsumed under the more comprehensive term wetland system. Compare the two definitions below as an example:

> "*Wetland*, geographic area with characteristics of both dry land and bodies of water. Wetlands typically occur in low-lying areas that receive fresh water at the edges of lakes, ponds, streams, and rivers, or salt water from tides in coastal areas protected from waves. In wetlands, the surface of the water, called the water table, is usually at, above, or just below the land surface for enough time to restrict the growth of plants to those that are adapted to wet conditions and promote the development of soils characteristic of a wet environment … Wetlands can be classified into three general categories: marshes, swamps, and peatlands. Within each of these categories, wetlands can vary widely. Because wetlands depend on water sources, their boundaries can change" (Microsoft Encarta Encyclopedia 2000).

> *Wetland*: "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine waters, the depth of which at low tide does not exceed six metres" and may include "riparian and coastal zones adjacent to the wetlands, or islands or bodies of marine water deeper than six metres at low tide lying within" (Ramsar convention quoted in Hollis et al 1988).

Whereas the former comprises the traditional notion of a wetland as a water-logged area limited in size (e.g. a fen), the latter encompasses not only the former but virtually all earth-bound elements of the water cycle. According to Blasco (1997):

> "[T]he resolution on Ramsar and water is of high significance, because for the first time the Conference of the Parties is addressing the question of 'the important hydrological functions of wetlands, including groundwater recharge, water quality improvement and flood alleviation, and the inextricable link between wetlands and water resources … Fresh, high quality water is already critically scarce in many places, and looks set to become scarce in many other locations. Water may well be the critical environment and development issue of the 21st Century."

Wetlands, it seems, are considerably wetter than initially thought. This is an important point returned to later in the context of sustainably managing the Okavango Delta.

The intention clearly is to locate traditional wetlands within an entire system of which the overall sustainability is subject to a wide variety of human and natural interventions. Again the logic is impeccable: what is the use of 'managing' a wetland of which the very existence may depend on far-removed agricultural, industrial and urban practices? To this end, Ramsar is seeking, among others, universal membership in the convention and designation of all wetlands – not simply those that parties to the convention consider as their 'flagships'.

Equally important for the conservation of traditionally defined wetlands is the way in which Ramsar has attempted to locate the convention itself within the wider ambit of the UNFCCC, UNCBD and UNCCD (Blasco 1997). This is part of a broader strategy to try and change people's ways of thinking about the environment or natural resources as somehow apart from their daily concerns, as somewhat akin to specialist interests – it is an attempt at what Phillips (1998) calls "mainstreaming wetlands". This is also 'wise use' of its own resources, given the fact that the Ramsar budget and permanent staff numbers pale in comparison to these global conventions. Articulating the many 'goods and services' wetlands provide to humanity has long been a means by which those interested in their conservation argue against habitat conversion (Matiza 1994; Phillips 1998; Hollis et al 1988). More recently, economic valuation of wetlands in the context of biological diversity and natural resources accounting has been another (Richardson 1998). Added to this are arguments for wetlands' central role as buffers in combating desertification, and as valuable carbon sinks in the struggle against global warming (Davidson 2000).

The Ramsar convention has also sought to align itself with powerful global NGOs, either with a mass membership base – Wetlands International, Worldwide Fund for Nature, Birdlife International – or with a mixed membership including a core of research scientists – IUCN. Most recently it has entered into a partnership with the private sector Danone Group through the Evian project to improve internet facilities for ten "developing and transition Contracting Parties" (Phillips 1998). To give form to these many activities, Ramsar formulated a strategic plan for the period 1997-2002. Adopted in 1996, the plan describes some 125 actions under the eight general objectives listed below:

- universal membership;
- wise use of wetlands;
- education, public awareness and communication;
- capacity-building and training;
- management of wetlands of international importance;
- designation of Ramsar sites;
- international cooperation; and
- strengthening the institutions of the convention.

How all these activities and interests play out in the context of the Okavango Delta is the subject of a further section in this chapter. At this point, however, it is important to locate these activities within a more theoretical framework so that the possibilities or improbabilities for success, either at global or local level, may become clear.

Clausewitz or Kant?

What can be made of all this activity? How likely is it to succeed, not only in preserving wetlands but, in the Southern African context, in building regional peace, for this is the sometimes explicitly stated goal of conservation organisations (De Villiers 1999; Swatuk 1997; 2001)? How these questions are answered depends to a great deal on whether an optimistic or pessimistic attitude about regional futures prevails. In Southern Africa today, there are parallel, opposed narratives in regular use to explain contemporary events and guide (policy) decisions. One reflects the classical realist assertions of Gray, the other the Kantian liberalism of Halliday shown in the epigraphs above. Each provides compelling evidence in support of its analyses. Kantian narratives argue that there are three dominant themes driving regional developments: the post-apartheid democratic moment; the socioeconomics of neo-liberal structural adjustment, now including regional (SADC) and continental (New Partnership for Africa's Development – NEPAD) integration components; and the post-Rio and Rio +10 emphasis on the collective management of natural resources. The manner in which these interlink and overlap forms the basis for the emergence of more positive and constructive inter, intra and transstate relations: a new language fuelling new thinking about a new regionalism (Swatuk & Black 1997; Swatuk 2000).

Supporters of this perspective usually emphasise the functional character of the new regionalism, with SADC, transnational, subnational and multilateral activity at the forefront of analysis. An emerging regional energy grid, a variety of protocols, improved communications and transportation networks, transnationally managed 'superparks', and new water laws are all said to be moving the region in the direction of cooperation and peace. The post-apartheid democratic moment, therefore, facilitates the collective pursuit of world order values in the region. These values of peace, economic growth and environmental sustainability are dependent upon increasing space for civil society to articulate its diverse needs and interests and

exercise its capabilities free from a domineering and overdeveloped state. They also require the more efficient allocation of often scarce resources by state makers in the region and the development of creative and effective partnerships between and among relevant stakeholders (state, corporate, (I)NGO and CBO-based).

To be sure, the Kantian argument continues, there are many obstacles along the road to regional peace and security. Like much of sub-Saharan Africa, the SADC region is characterised by weak, distorted and divided economies, war-battered societies, and too often unresponsive governments. Yet, unlike most of Africa, the SADC region enjoys the confidence and concern of the industrialised world as represented by the Organisation for Economic Co-operation and Development (OECD). As such, there seems to be much concentrated global effort toward making the African renaissance a reality, at least in this region. Importantly, the demise of UNITA rebel leader, Jonas Savimbi, is cause for hope regarding the prospects for peace and development both in Angola and in the Okavango River basin, in particular.

This perspective, in a nutshell, characterises all those active in conservation and development activities in the Okavango Delta – from local NGOs like the Kalahari Conservation Society, to international organisations like Conservation International, from bilateral and multilateral donors like GTZ, SIDA, the EU and GEF, to regional think-tanks like IUCN-ROSA, the Desert Research Foundation of Namibia (DRFN) and the Harry Oppenheimer Okavango Research Centre (HOORC).

However, for an increasing number of observers, it is the obstacles that mark the proper point of departure in regional analysis. State makers in Africa's Great Lakes region – the Democratic Republic of Congo, Uganda, Rwanda, Burundi – and Angola are without a doubt engaged in Machiavellian and Clausewitzian practices of 'statecraft'. Others – Zimbabwe, Zambia, Namibia, Botswana and South Africa – look on with varying degrees of interest. Levels of participation are partially determined by the immediacy of geopolitical events and the realities of cost and benefit analyses. Personalities and personal rule – the essence of Bismarck and Tallyrand, of classical realism, and so belittled in analyses of African politics over the last three decades – seem once again to be playing decisive roles in policy-making.

Even in those countries where bureaucratic structures of decision-making are more firmly entrenched – Botswana and South Africa – calculations are increasingly made on the basis of narrow 'national interests'. Ironically, states may be seen to be moving, simultaneously, in two directions: while they are busy building 'national fences' in a 'dangerous region', at the same time, departments of water affairs, tourism, trade and industry, among others, are actively seeking ways of tearing and keeping these national fences down (Swatuk & Black 1997).

The environment, quite literally, stands at the centre of these contradictions. Whereas the border areas between Namibia, Angola and Botswana have become sites of conflict, these countries share the Okavango River basin and are party to the Permanent Okavango River Basin Water Commission (OKACOM). Similarly, the Zambezi basin marks a zone of cooperation through the large, multilateral Zambezi

River Action Plan (ZACPLAN) – recently designated a NEPAD project – but also forms an area of crossborder conflict among the sovereign states of Angola, Zambia, the Democratic Republic of Congo and Zimbabwe (for general information on these and other Southern African river basins, see Chenje & Johnson 1996; Conley 1996; Pallett 1997; Turton 2003). Interestingly, in each case, conflict flows with the run of rivers. Headwater states are deep in conflict; those at mid-flow stand poised between Janus and Minerva; those at the mouth feel relatively helpless, as they contribute virtually nothing to the flow but accumulate everyone's effluent, and are most keen on multilateral agreement. Depending on whether Kant or Machiavelli is favoured, or cooperation or conflict is chosen, the environment either appears as the locus of opportunity for regional peace-building or as a fragmented series of resources for defence and capture.

To say that conflict and cooperation are characteristic of the region is stating the obvious. A pertinent question to ask, however, is which of these trends are likely to dominate regional relations during the first decade of the 21st century? And, as a corollary, can deliberate emphasis on cooperative tendencies in one issue area help to foster abatement of conflict in another? In other words, without losing sight of Gray's remarks, is it justified to act on Halliday's encouragement?

While most of the non-state actors seem more inclined toward Halliday, what state makers really think is less clear. Ramsar's activity, like most environmental organisations in the world today, mirrors the guardedly optimistic liberal institutionalist perspective on world affairs: while not losing sight of the myriad dangers let loose by a world of states jealously guarding sovereignty, they continue to beaver away at building creative coalitions and science-based arguments in the hope that formerly reluctant state makers will be trapped in an incontrovertible knowledge net. But many of those involved remain cynical. Ramsar was once described as a "toothless organisation" and a "gentleman's agreement without political clout" (Holberg, personal communication).

Managing the Okavango Delta or the 'delta system'?

It must be made clear from the outset that sustainable management of the delta itself is dependent upon sustainable management of the entire Okavango River basin – unsustainable inputs upstream (e.g. large-scale irrigated agricultural projects, large dams near the headwaters, many small farm dams along a repopulated middle river) will fundamentally alter the delta. According to Hollis and others (1988):

> "The components that support a wetland often originate well outside its boundary. Wise use of wetlands therefore often requires that appropriate conservation measures be taken beyond the boundary of the wetland. For example, ensuring a continuing supply of water of appropriate quality may require soil conservation measures in the headwaters, minimal upstream diversions of river-water, and the protection of water courses from industrial pollution."

This is not to undermine the very necessary national-level activity ongoing in Botswana of devising both a national inventory of wetlands and a management plan for the Okavango Delta itself. There are numerous resource use conflicts in place both in the core and buffer zones that must be addressed irrespective of upstream, transition zone activities (Peters 1994; Arntzen & Veenendaal 1986; Van der Heiden 1992; Hasler 2000a).

The 'core' area is defined as one of "the largest and most important inland wetlands in the world, covering over 15,000 square kilometres" (Monna 1999). The transition zone extends to the headwaters in Angola's Bie plateau. If the buffer zone is included, the area enlarges significantly:

> "Botswana submitted documents containing a description of a wetland known as 'The Okavango Delta System' … The Ramsar site is measured at approximately 68,640 square kilometres (6,684,000 ha) … The designated area includes the Okavango River, the entire Okavango Delta, Lake Ngami and parts of the Kwando and Linyati [sic] River systems that fall along the western boundary of the Chobe National Park" (Monna, 1999).

Botswana became a contracting party to the Ramsar convention in April 1997. Most observers feel that this act was taken based on narrow national interest: that upstream threats to the delta, in particular planned abstraction by Namibia and the potential for the same by a peaceful Angola forced policy makers in Botswana to try to locate regional water disputes within a framework of global interests. Similarly, whereas the government of Botswana was reluctant to designate the delta as a world heritage site in the past – fearing global backlash against its own development plans – it eventually became clear that in the context of 'wise use', it was better to become party to these conventions than to stand apart from them.

The 1987 Regina conference of the parties adopted the following definition of 'wise use': "The wise use of wetlands is their sustainable utilisation for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem." Sustainable utilisation is defined as "human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations" (Hollis et al 1988). This definition of wise use as sustainable utilisation is one of the most significant concessions made by conservation organisations in the last 20 years. It marks the culmination of a learning process whereby people and communities were conceptually reinserted into the landscape by organisations that still wish they were not there. Hence, core, buffer and transition areas appear. In the case of the Okavango Delta system, far from being a 'pristine wilderness', the entire 'system' is populated, with even the highly protected core providing 'food for the pot' for local communities resident there. In order to maintain the ecological character of the river, each of these zones require comprehensive management plans, sufficient human and capital resources, and the political will to see that policies are not only put in place but acted

upon. As the Okavango Delta is an international river basin, its management requires a very creative and determined approach to integrated water resource management.

Barriers to success

It is no small task to discuss the numerous barriers to success. Given space constraints, only a summary of these issues is provided. It is important to note that barriers to success are a difficult mix of structure and agency. As such, some may be more easily addressed and altered than others.

Perhaps the most powerful barrier to the sustainable management of the Okavango Delta system is humankind's treatment not only of wetlands but of nature throughout history. Some would say it marks not only the foundation of Enlightenment thinking but of industrial-based development (Swatuk 2001; Hunter 1992). As highlighted above, the world's wetlands are fast diminishing and have been doing so for perhaps a millennium. Drainage of wetlands has long been a strategy of human development, and human development has for several centuries regarded nature as an adversary to be overcome. In western renderings of 'development', those societies thought to reside most closely in harmony with nature – indigenous peoples – are regarded as 'backward'.

The impact of these practices on Southern Africa is particularly unfortunate, with the inherited colonial state forms organised specifically to exploit the natural environment through marginally linked enclave industrial activities in service of imperial or colonial industrial-based power (Swatuk & Vale 1999). In a neo-liberal age, underdevelopment may be an unfashionable concept, but it quite accurately captures the essence of the development problematique facing countries that are members of OKACOM (Amin et al 1987; Saul 2001; Wallerstein 1986). What does this mean for the sustainable management of the Okavango Delta system? In short, it means to swim against the entire tide of development history, philosophy and practice.

Compounding the difficulties arising from these philosophical and historical factors are recent regional experiences with liberation struggles and civil wars. While there is a flicker of hope of a peace dividend in Angola, the extent of physical and psychological damage cannot be overestimated. And while there are those who might suggest that, in certain contexts, war is better than peace for conservation, there are few who would wish to deny Angolans a peaceful and prosperous future (see Alvarez 2001; McNeely 2002). At the same time, there is a significant development deficit, not only in Angola, but throughout the SADC region. Part of the challenge for those interested in maintaining the Okavango system is to demonstrate to state makers, most of whom are imbued with 1950s-style notions of 'mega-project' development – for example, irrigated cash crop agriculture, power plants, producer-driven commodity chain production – that decentralised, community-based, participatory forms of 'development' are a better, more sustainable option (Hasler 2000b). Namibian plans for a gas-fired power station at the Orange River mouth Ramsar site, its stated intentions

to build a hydropower plant at Popa Falls – again, in the middle of the Namibian-proposed Southern Okavango Ramsar site – its long-planned usage of Okavango River water via the Eastern National Water Carrier project, and its mooted plans to establish large-scale irrigated agriculture in the Caprivi Strip, all suggest the opposite.

Namibia is being singled out only for example, however. Each of the riparians are determined to pursue national development plans, often holding jealously to their sovereign right to do so. Outside observers often attribute Angola's relatively inactive participation in OKACOM to a lack of capacity and a preoccupation with fighting UNITA. Yet, others closely involved with these basin commissions argue that inaction on OKACOM results more from Angolan unhappiness with Namibian developments in the Cunene River basin, and unwillingness to expose its plans for the Cubango beyond Savimbi (names withheld, personal communications). In addition, from the upstream point of view, Botswana's recent conversion to 'sustainable utilisation' options and arguments results not from any 'greening' of the government, but from a combination of money made through tourism (i.e. real cash benefits) and the failure to push through its own Southern Okavango Integrated Water Resources Management project (Hasler 2000a; IUCN 1992). While those interested in regional peace point to the positive World Court adjudication of the Namibia-Botswana dispute over Sedudu Island (see Swatuk 2002), it is clear that no real 'national interests' were negatively affected by the court's decision.

Botswana's unilateral announcement of the Okavango Delta system as a Ramsar site, though technically correct – its boundaries being entirely within Botswana's sovereign territory – left a bitter taste in the mouths of its OKACOM partners who felt that its action went against the collective spirit of the commission. As a consequence, it has taken some time to achieve cordial working relations. Yet, the fact remains – sovereign states keen on post-war reconstruction and overcoming the development deficit are unlikely to take kindly to outside interference in their development plans.

Most of the barriers to success discussed thus far may be regarded as structural – history, development philosophy, underdevelopment and national sovereignty. Agency, or the human capacity to overcome these, should not be ruled out. But human capacity comes in many forms, some of which work to reinforce structural pathologies, others to overcome them. This is most clearly expressed through institutions, for institutions stand at the interstices of structure and agency. For example, SADC government institutions, developed haphazardly over time or established to satisfy particular needs (like colonial interests), locate resource use decisions across numerous departments, ministries and agencies. Decision-making reflects the interests of strong personalities and influential departments and ministries. It also privileges policies oriented to retain the status quo, as all departments vie for their piece of the national budget.

At national level, departments or ministries of water development, mining, lands, housing and agriculture, to name several, are geared toward the exploitation of the resource, while national conservation agencies or ministries of tourism and the

environment are more interested in its conservation and wise use. Moreover, agencies or ministries of the environment tend to interact with their international counterparts and other NGOs sharing similar interests. The same may be said for ministries of finance, industry, mining and the like. As a result, while in theory serving 'the national interest', they in fact speak different languages and serve different interests. It should also be remembered that ministries of the environment and tourism are relative newcomers to government. For example, in Botswana, the National Conservation Strategy Coordinating Agency is now to become part of a newly formed Ministry of Tourism and the Environment. As global interests change, so local institutions adjust to reflect these interests. It does not mean, however, that they hold much power in national government circles. Power still lies with those ministries and departments developed on the back of colonial or imperial endeavours, for example, mining and agriculture. Beyond lip service at world summits, it is difficult to see how these institutions can make a meaningful contribution to the sustainable management of resources they have historically wasted and polluted. Ways must be found to build synergies across ministries and departments and undercut interministerial struggles over national resources. Without political power, the best management plans will fail. Worse still, with political power, bad management plans will be implemented.

The foregoing all point toward that fuzziest of variables, political will. It is no exaggeration to say that maintaining the health of the Okavango Delta is about as far away from Angolan government policy-making circles as an issue can get. It is also clear that the government of Namibia will use Okavango River waters as part of a national conjunctive use strategy. And, despite current appearances to the contrary, it is not clear that the government of Botswana will not make use of these waters as well – the Southern Okavango water project is shelved for the time being, but not abandoned. What is clear, however, is that the delta generates jobs, profits and supports multiple sorts of livelihoods for many people. Clearly, this is the basis for building political will.

One of the abiding dangers, however, is the strident approach to maintaining the waters of the delta taken by the (national and international) media and conservation organisations. Media sensationalism and the arrogant, know-it-all approaches taken by conservation organisations, like the International Rivers Network (IRN), do more damage than good. Communication is already a problem – between and among communities within the Okavango River basin, as well as between, among and within OKACOM member governments. It is imperative that channels of communication are kept open and flows of accurate, objective information – the purpose of this book – are nurtured.

Hopeful elements

While the barriers seem daunting, there are in fact many favourable bridges to sustainable resource management. Two favourable elements that often go unremarked are time and the robustness of the Okavango Delta system. In terms of the latter,

according to Wolski, the delta itself is less vulnerable than is often thought. On the one hand, it looks vulnerable due to the contrast with its surroundings. However, on the other hand, in Wolski's view, the delta is constantly changing: "It is subject to such big natural variability that it can sustain much more than we anticipate. This dampens the impact of variability because it is used to such variability" (Wolski, personal communication). Wolski also maintains that the system is so complex and the changes have been so gradual that it is virtually impossible to tell which are manmade and which natural. This is not to counsel complacency. It does suggest, however, that there is a good deal of time in which to articulate viable management plans, to sort out the necessary interstate modalities, and to build implementation capacity. Also contributing to the time factor is the relatively unpopulated character of the basin itself – a situation that will no doubt change as Angola consolidates peace. Whereas it may be true that once changes are initiated their impacts are quickly felt in arid areas, the widespread fears expressed about Angola as the 'sleeping giant' seem to be overstated at the present time.

Other favourable key elements are global interest, expertise and capital. This comes in a wide variety of forms: from bilateral support for the development of an Okavango River basin management plan (Swiss small grant programme), to an EU-supported, multidisciplinary and multi-university project focusing on achieving a balance between social and ecosystem needs in an international river basin; from the SIDA-sponsored project Every River Has Its People (ERHIP) that brings together six NGOs from Namibia and Botswana to study ways in which communities may be made active partners in the management of the Okavango system, to a Conservation International administered project investigating prospects for establishing a transboundary 'peace park' extending from the delta into the (presently moribund) Cuando-Cubango controlled hunting area (see De Villiers 1999). Ramsar is active in many of these and related activities, and there is a strong synergy between projects and groups, in part facilitated by the small scientific communities that exist in both Namibia and Botswana. While they may disagree on goals and methods – with the Namibian National Eastern Water Carrier being the prime case in point – they do nevertheless continue to liaise with one another and on occasion to work together.

Local interest is another key factor in support of conservation and wise use efforts. For example, ERHIP has its roots in the Okavango Liaison Group's efforts to strengthen dialogue between the governments of Namibia and Botswana regarding use of the waters of the Okavango River. The history of the Okavango Liaison Group (OLG) itself grows out of local Ngamiland action against the government of Botswana's Southern Okavango Integrated Water Development project. This long tradition of social activism is buttressed by the relatively democratic *kgotla* system of traditional government. Local communities lacking organisation have been helped by a wide variety of indigenous (Kalahari Conservation Society, Desert Research Foundation of Namibia) and international (Conservation International, International Rivers Network) NGOs with their own conservation-oriented interests overlapping with local community desires for access and (sustainable) use.

Lastly, there are a wide variety of regional interstate frameworks (SADC, OKACOM, Orange River Basin Commission, Limpopo River Basin Commission), with various protocols (e.g. on trade, tourism, shared watercourses) based upon global accords and conventions (e.g. Helsinki, UN Convention on the Non-Navigational Uses of International Watercourses, CITES). As stated earlier, the small base of scientists in the region ensures that many of the same faces meet time and again in different forums, thus sometimes building networks of trust (and, admittedly, sometimes animosity).

Thinking strategically: Achieving 'wise use'

Clearly, there is a great deal of interest and activity ongoing around the Okavango Delta itself and within the wider Okavango system. Two questions remain: Does all of this activity contribute to achieving the goals of ecosystem maintenance and wise use and to building regional peace? What has to be done to ensure that interrelated goals are achieved?

To attempt to answer the first question is to put the cart before the horse. Clearly, it is early days. Turning to the second question, and in light of the working assumption that all of this activity will contribute to regional peace and prosperity, there are a wide variety of strategies that may be undertaken.

First, knowledge is power: Countering extant ways of 'doing' politics and development can only be achieved by building a knowledge base that shows parochial politicians and destructive developmentalists the irrefutable benefits of ecosystem maintenance and wise use. It is unfortunate that those involved are forced to engage state makers with instrumental value arguments. Preserving nature should need no political, social or economic justification: there is intrinsic value in nature. But politicians are too often far from 'green', and too often privilege industries that are 'brown'. As public officials in Windhoek are quick to point out: asking questions about the sustainability of the city's two new garment industries, which will likely employ 8,000 to 10,000 people and inject an estimated N$25 million per annum into Windhoek's economy – Effluent quality? Water use efficiency? Why Windhoek and not Okahandja? – is to commit a treasonable act (personal communications, names withheld).

Set in regional terms, this is a distressing example. For the legacies of colonialism, imperialism and underdevelopment have created an extreme development deficit. State makers in Namibia, Angola and Botswana all came of age during the height of the modernisation period. Their understanding of development rests undeniably on the conquest of nature, where 'biodiversity loss' resulting from habitat conversion includes not merely 'nature' but certain cultural groups and cultural practices. So, water is power and power drives economies and economies create jobs. What hope is there for wetlands, even the wise use of wetlands, in the light of such thinking?

Policy-relevant social and physical scientific research must continuously be conducted so that policy makers see that there are realistic options and that these

options can translate into votes (see, for example, Pallett 1997; Heyns et al 1998; Turton 2000). One of the main reasons why community-based natural resource management as conceived by USAID in Botswana failed so dismally is because USAID failed to recognise the political implications of 'empowering people at the margins'. Upon departing from Botswana, one USAID official remarked: "the government simply is not interested" (personal communication, name withheld). But he was wrong: the government was very interested – that is why boreholes, drought relief, roads and clinics are the methods of choice: government is more interested in maintaining itself in power than in empowering people to think for themselves, to realise that there are choices. A population with choice, particularly in an ethnically divided society, is a potential political problem.

Recognising this, smart partnerships should be cultivated within and beyond states. There are often key individuals in certain ministries who wield much power and influence. Kader Asmal in South Africa is the obvious example: as minister of Water Affairs and Forestry, Asmal was able to achieve a great deal of good in a short period of time. In Botswana, Ian Khama may play a similar role. It is an unfortunate truth that cultivating a relationship between Khama and, for example, the IUCN's Jeff McNeely may do more good for conservation than all the science in the world.

Networks and sympathetic constituencies must be built at local, national, regional and global level. In doing so, the idea of 'wetlands' must be relocated beyond departments or ministries of the environment and should be placed squarely where the power lies: in the ministries of industry, trade, finance, mining and fisheries, for example. Economic valuation arguments based on transboundary peace parks and global tourism are a necessary beginning as these build links between a variety of ministries in all basin countries and present possibilities for shared positive economic outcomes. At the same time, work within existing frameworks should continue – SADC, OKACOM, the Revised Protocol on Shared Watercourses – without reinventing the wheel. The small scientific base in the region means that synergies can be built at the regional level that might not otherwise be possible in more complex political economies. An interesting angle to this is the potential role South Africa may play as impartial 'third party'. The scientific community in South Africa is far more developed than in the rest of the region and so constitutes a ready resource to be tapped. However, there is also the legacy of the 'regional hegemon', again playing itself out in economic and political terms and so there may be some resistance to this idea. Also, given worrying trends toward privatisation and so-called public-private partnerships, South African involvement in the region in the form of 'consultancies' may be regarded negatively as a form of neo-liberal pollution.

A practical contribution that could be made to existing frameworks is the establishment of a library or some other form of depository where all the research ongoing in the Okavango River basin could be stored and made available to the public. The HOORC may be able to play such a role. But the location should not be

restricted to a single country: the research centre may be more broadly defined to include branches in Angola, Botswana and Namibia – given lingering distrust and personality differences, this may be a more viable solution. At the same time, the regional library could be staffed by university students of SADC states – either registered in a SADC university or in a university elsewhere in the world – and valuable collation and analysis of the collected research could lead to a variety of postgraduate degrees. This research could be facilitated by scholarships provided by those international groups active in the basin and the SADC region.

It is important to play to existing strengths. This means recognising that, although the fact or form of states and their tendency to operate on the grounds of narrow self-interest may not be changed, environmental awareness can be built at grassroots level – that is, among the children of the region who will ultimately constitute the state makers of the future. The power of environmental education programmes must not be underestimated.

Penultimately, those interested in conservation and wise use of wetlands broadly defined must think practically not patronisingly. There is an unfortunate tendency among certain international NGOs and donor agencies to treat local people as though they are ignorant savages – it is the recreation of 19th century thinking about racial hierarchies, of which the basis for truth today is 'the lab coat'. Local people's interests must be respected, otherwise a constructive dialogue will never emerge. A practical approach, therefore, would be a scholarship fund to train people in natural resource management, economic valuation of natural resources, among others – not to chase consultancy fees and act as global know-it-alls. Another practical approach would be to provide formal positions for local community representatives either in OKACOM itself, or in an adjunct forum specifically created to filter popular opinion, knowledge, needs and desires upward to state level.

Concluding remarks

Lastly, the facts of state power, of 'national interests', and of sovereignty cannot be ignored. Indeed, taken together they constitute the fundamental problematique for successful management of the Okavango Delta system. While many academics working in the social sciences use post-positivist, constructivist methods to interrogate the world around them, those operating in the area of (the political economy of) natural resource management would do well to engage in a two-level game. On one level, it is useful to recognise that states are social constructions, that they are time-bound historical artefacts, not timeless physical phenomena. Regarding them as such provides insight into capacities for changing the system, perhaps toward different, more inclusive and sustainable forms of social organisation, grouped, for example, around resources like river basins. However, at another level, it must be acknowledged that those who inhabit states act as though they are timeless entities, taking their intellectual cues not from Kant but from

Clausewitz and Machiavelli. There are those who argue that states counselling interdependence and multilateralism only do so because they are weak in a world of the strong. As a downstream state, Botswana is playing the multilateral card. By doing so it is hoping eventually to tie its upstream neighbours into a regime of sustainable river basin management. Botswana, in playing the 'environmental good guy', is understandably pursuing narrowly defined national interest in the form of delta health for tourism and economic development. Namibia is more ambivalent about this. While it too is a contracting party to Ramsar, it has recently shelved plans to place the Lower Okavango River wetland on the list of wetlands of international importance. However, through OKACOM it remains willing to talk and to listen – very important activities indeed. But its stated intentions remain: to use the waters of the Okavango as part of a conjunctive use strategy that will ensure steady supplies of water and national development. Angola – not a Ramsar member – remains the unknown entity, but a post-Savimbi Angola would conceivably behave much like present-day Namibia. As an Angolan state maker, the first question to ask of Botswana is probably why Angola should forego the use of the water of the Cubango and allow Botswana to reap all the economic and social benefits. What is in it for Angola?

History shows that upstream states and regions within states have always taken the lion's share of the water. The Colorado River, dammed and diverted time and time again, no longer flow into the sea. The quality and quantity of water in Southern Africa's rivers that flow through Mozambique pose both serious challenges to integrated water resource management in the region and grave warnings for those interested in maintaining the health of the Okavango Delta. The delta presents a very difficult position, for the waters end in an ecologically and socially vibrant physical space in the heart of another country. If Angola decides – officially through government, or informally through the actions of many (possibly a more likely outcome) – to abstract a volume of water from the river that will forever alter the delta, what is there to stop the country from doing so? This marks an instance of the abiding tension between Machiavelli and Kant in the region and in the world: there seems little that can be done to stop them from doing so. Can shared membership in global conventions serve as the basis for sustainable use? Perhaps, but as long as state representatives to these conventions are located in relatively powerless conservation agencies or marginal environmental ministries, it is unlikely that sustainable use will move from theory to practice.

Building webs of knowledge and interest must continue, and those concerned should continue to think practically, to lobby vehemently and to listen carefully. In this way, perhaps what is improbably possible – like integrated water resource use – may one day seem common-sensical, like the fact of states themselves. In the words of Hollis and others (1988): "When wetland destruction becomes a socially unacceptable activity, we shall know that the message about the wise use of wetlands has finally been heard."

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CHAPTER 7

The Okavango Delta Management Plan project: The need for environmental partnerships

Ruud Jansen and Masego Madzwamuse

Abstract

The government of Botswana plans to undertake an integrated management planning exercise for the Okavango Delta in order to pursue, in accordance with national policy, the wise use of natural resources for the benefit of all stakeholders in the delta, to fulfil its obligations under the Ramsar convention, and to contribute to regional integrated water resource management in the Okavango River basin. This chapter seeks to highlight the principles underlying the planning process, their operational exponents, and the need to place the Okavango Delta within the wider river basin ecosystem. It is argued that the latter is of particular relevance to the perspective of national and regional decision makers who will need to work in partnership to sustain the goods and services of this unique Ramsar site, which is the world's largest.

Introduction

> "The Okavango Delta is more than beautiful; it provides a major source of income for the country, the delta communities and indeed the individual residents. It is hard to imagine Botswana without the Okavango Delta; indeed for many people Botswana *is* the Okavango Delta. We have the responsibility as the government and the people of Botswana, together with our development partners, to make sure that this amazing resource is utilised in a sustainable and responsible manner" (Botswana minister Jacob Nkate, WSSD, September 2002).

Policy framework: Botswana's National Wetlands Policy

The Botswana National Wetlands Policy and Strategy provide the policy framework for wetland management planning in the country (NCSA 2000). The policy is people-oriented and stresses that the public have a role as major players, and should be involved in the management and monitoring of wetlands through the use of local knowledge and institutions. Participation by the public will improve conflict resolution and encourage active support. The emphasis placed on public support for the policy derives partially from the national principle of democracy and good

governance, as well as from the reality that the responsible institutions in government will be more effective in implementing the policy when receiving full public support.

The development of a national policy on wetlands started in 1994 with a conference on wetlands management. Key recommendations included the need to form a wetlands coordinating committee and for the government to formulate a national policy on wetlands. An initial list of wetlands policy issues was generated at a wetlands conference in Maun in 1997 and, soon thereafter, the National Conservation Strategy Agency (NCSA) proceeded with detailed identification of issues. These issues were reviewed at the National Consultative Workshop in 1998. A year of consultations followed with publications being widely distributed and community-level consultations undertaken throughout the country. The results of these consultations contributed directly to the preparation of the National Wetlands Policy and Strategy, which was published in draft form in 1999.

The policy describes wetlands as areas where water sits on the surface of the soil for periods of time, affecting the area's ecological characteristics. The definition of wetlands used throughout the policy is "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt." The policy argues that the major factors leading to the degradation and loss of habitat and biodiversity in Botswana's wetlands are:

- changes in land use due to urbanisation, canalisation of rivers and channels, settlement within wetlands, extensive *molapo* farming, clearing of the riparian vegetation for arable lands, establishment of veterinary cordon fences and uncontrolled fire;
- changes in water quality and availability through diversion of water for other activities (such as dams, irrigable agriculture) and unsustainable groundwater abstraction;
- pollution originating from fuels and lubricants, mismanagement of chemicals, particularly pesticides, dumping in river courses and sewage disposal;
- invasive species as manifested by the spread of, for example, Salvinia molesta, which threatens the wetlands of northern Botswana;
- sedimentation of wetlands due to upstream habitat loss and destruction, siltation, overgrazing within river catchments and erosion of arable land;
- uncontrolled exploitation of wetland resources through commercial exploitation of communal resources (such as sand extraction), overgrazing and commercialisation of livestock production, lack of regulations particularly for fisheries and the limited enforcement of existing natural resource-related legislation;
- alienation of communities living in or near wetlands due to reduced (rights of) access and resource use and lack of empowerment of communities;
- regional threats such as upstream water abstraction, pollution and conflicting land uses; and
- global threats such as global warming and its potential impact on climatic processes, with subsequent local effects on wetlands.

There is therefore clearly a pressing need to conserve wetlands by reducing the present rates of degradation, promoting rehabilitation and protecting these resources from future challenges.

The implementation of the wetlands policy is guided by the following principles:

- Decisions are to be based on a comprehensive understanding and appreciation of the functions and values of wetlands (including indigenous knowledge).
- The concepts of wise use, sustainable development and equity are fundamental to the policy and strategy.
- Wetland conservation and management are to be multisectoral and integrated.
- All appropriate spheres of government and the general public are to participate actively in an ongoing, transparent and gender sensitive decision-making process.
- Communities living in or having traditional links to wetlands shall be directly involved in wetland management.
- Public awareness and support are crucial to effective wetland management.
- Research into wetland processes, dynamics and management is to be maintained and findings are to be widely disseminated.
- Botswana's regional and international environmental obligations are to be observed.
- Human health and safety concerns shall not be compromised.

The strategy on wetlands management, an integral part of the policy, reads as follows: "Adopt an ecosystem approach to utilisation, conservation and management of wetlands. Plan and implement ecologically sustainable wetland conservation including the development and implementation of management plans for wetlands of national and international importance."

Concerning wetlands of national and international priority, the wetlands policy is very clear: "management plans will be drafted for all designated Ramsar sites and wetlands identified as nationally important." This, therefore, puts the Okavango Delta Management Plan project at the centre of the country's policy on wetlands.

The Okavango Delta

The government of Botswana ratified the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar 1971), popularly known as the Ramsar convention, and became a contracting party on 4 April 1997. The Okavango Delta system was listed as a wetland of international importance according to article 2 of the convention and, as stated in article 3, its conservation and wise use should be promoted.

Although the site lies between coordinates 18°15'S, 021°45'E and 20°45'S, 023°53'E, and is the largest declared Ramsar site (see map 1), the delta is part of a river system, which originates in Angola and passes through Namibia. Article 5 of the

convention specifies that contracting parties shall consult one another about implementing obligations arising from the convention, especially in the case of transboundary wetlands where a wetland extends over the territories of more than one contracting party and/or where the system is shared by contracting parties (Ramsar Bureau 1997).

Environmental status

The Okavango Delta – an inland delta – forms the core of the largest wetland of international importance protected as a Ramsar site. The site, which also includes the Cuando/Linyanti river system, is located entirely within Ngamiland district in a semi-arid region and experiences large variations in flooding of permanent, seasonal and intermittently flooded areas. Annual inflow ranges from 7,000 to 15,000 million m^3 and variations in flow have a profound effect on ecological processes such as sedimentation and water distribution. Approximately 3% of the flow reaches downstream towards the Makgadikgadi Pans.

The system is important for terrestrial and water bird species with 650 bird species identified. Two resident species, the Wattled Crane (*Burgeranus carunculatus*) and the Slaty Egret (*Egretta vinaceiqula*), are globally threatened. The delta contains high densities of large mammal species particularly elephant. It is also the habitat of one of the largest remaining populations of the African wild dog (*Lycaon pictus*) and is a stronghold for the Sitatunga antelope (*Tragelaphus spekii*) and the Nile crocodile (*Crocodilus niloticus*). There is a high floral diversity with 208 aquatic and semi-aquatic species, 675 herbs and grasses and 195 woody species. One endemic has been identified, the ground orchid (*Habenaria pasmithii*). A number of other plant species has been identified as rare or endangered in the ecological zoning study carried out in 1990.

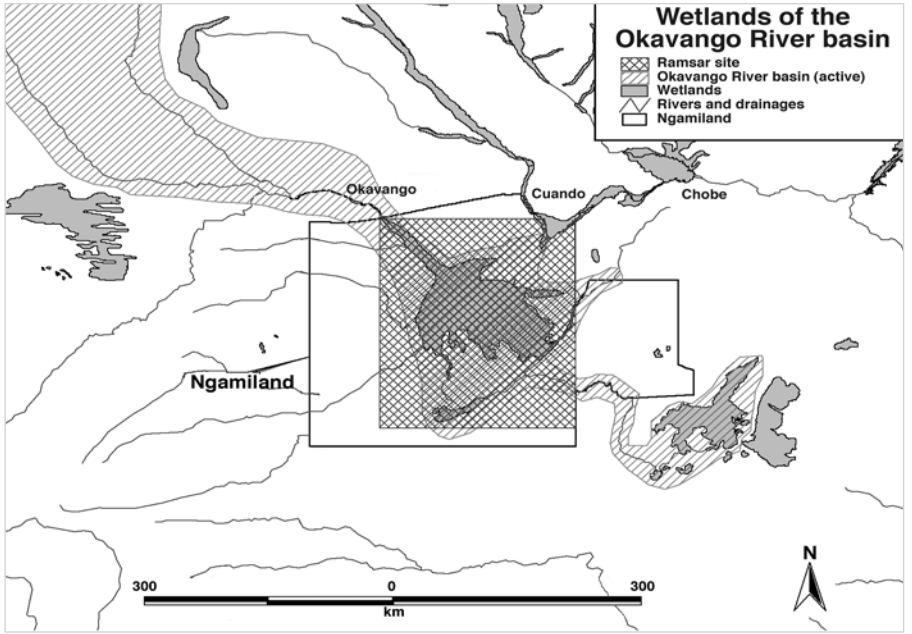
Approximately 7% of the area falls within the Moremi Game Reserve and is protected under the 1992 National Parks Act. A further 65% is protected under the same Act as a wildlife management area and activities are controlled through regulations (WMA 2000), which allow for both consumptive and non-consumptive use of wildlife. The rest of the area (28%) is zoned for agricultural and residential development.

Land and natural resource use

In an arid country like Botswana water is very precious and thus the delta and its abundant water, vegetation and wildlife resources have always attracted people. Signs of human habitation in the delta and its periphery have been found dating back to about 100,000 years. However, natural factors like the changes in the flow pattern, outbreaks of epidemic diseases and the spread of tsetse fly have affected the settlement and land-use pattern of the Okavango swamps. Many ethnic groups, like the BaYei, the BaTawana, the HaMbukushu, the OvaHerero and the River San, with

Map 1

Location of the Okavango Delta system Ramsar site



different perceptions of land and natural resource utilisation, are presently living mainly along the fringes of the Okavango Delta.

Large numbers of Ngamiland's population still depend directly on the utilisation of natural resources in the delta for subsistence. Fishing, hunting, livestock grazing, floodplain cultivation, the collection of raw materials for building and fuel, and the production of handicrafts are important factors in the local economy. Arable agriculture is practised in Ngamiland mainly at a subsistence level, as soils and climate are generally not well suited for crop production. On the fringes of the Okavango Delta, small-scale flood recession farming is found locally. Grazing resources are generally good in the dry land areas. However, the availability of water and the occurrence of tsetse fly close to the delta restrict the development of the livestock sector. The Okavango Delta itself is a livestock-free zone. Due to the outbreak of a cattle lung disease, 320,000 cattle had to be culled in Ngamiland in 1996. Currently, livestock numbers in the planning area have increased again to well

over 100,000. The outstanding natural beauty and abundant wildlife resources form the basis of a fast-growing tourism industry, which is offering alternative employment opportunities to people in the rural communities of Ngamiland district.

Transboundary issues in land and natural resource use, such as planned water management interventions in the river basin, the movement of wildlife populations between Botswana and its neighbours, and shared problems like the distribution of tsetse fly necessitate the inclusion of surrounding countries in the planning process (Ashton & Neal 2002).

Challenges facing the Okavango Delta

The Okavango Delta forms the tail end of the river basin and, as such, most upstream developments in Botswana, as well as those in the upstream catchment area and basin in Namibia and Angola have a potential effect on the character and functioning of the delta downstream.

Plans for large-scale water off-take and watershed development

In the past, many plans have been made to extract water from the Okavango in order to support development projects in Botswana and neighbouring countries. Even though most of these projects did not materialise, plans for water management interventions form a constant threat, as there is not enough climatic and hydrological information to predict the impact of hydrological changes on the delta's ecology and socioeconomic functioning. Furthermore, the overall economic value of an intact delta ecosystem has never been considered in the planning and decision-making processes.

Land and resource use conflicts

The increasing demands of the fast-growing Ngamiland district population (3.9% per annum), the changes in economic structure and the tremendous expansion of the tourism sector have augmented the pressure on the natural resources of the Okavango Delta and the sustainable level of water off-take is often disputed. As an example, the increased water demand of the district capital, Maun, cannot be met during years of low floods, leading to a serious water crisis. The consequences of human-induced environmental changes like pollution, alteration in the flow regime and destruction of habitat for rare and endangered species are not monitored and not fully understood. Data on the magnitude of the actual resource off-take, and the sustainability and reproduction level of the natural resources is not available. For planning of the sustainable use of the natural resources of the Okavango Delta, the establishment of carrying capacity guidelines, the setting up of user restrictions and the establishment of zoning recommendations are crucial. Through the improvement of the rural roads

network, even the remote areas of Ngamiland have become more easily accessible and more vulnerable to exploitation. Traditional land rights are often not defined and documented and consequently are not protected. Land-use conflicts among different user groups are prevalent and need to be addressed.

In the last decade, community-based natural resource management has been adopted in Botswana as a new conservation and development strategy. Several community-based organisations (CBOs) around the Okavango Delta have been given the responsibility to utilise and manage the wildlife and other natural resources in their respective areas. Various constraints have been identified by the different stakeholder groups, which are hampering the effective implementation of the community-based strategy. The lack of capacity to implement the new strategy, the lack of mutual understanding between stakeholders and the unclear definition of the roles and functions of newly established institutions are but some of the examples (see also Rozemeijer 2002). As not all of the communities in Ngamiland have been empowered and are benefiting from the community-based strategy, unequal opportunities have been created resulting in political friction and a lack of commitment to the approach by non-beneficiaries.

To control the spread of tsetse fly and an outbreak of *nagana* (*Trypanosomiasis*) in the district, an integrated tsetse eradication programme is being implemented. This includes aerial spraying of almost the entire delta and the introduction of sterile male flies. The possible negative side-effects of this control measure have led to some controversy between environmentalists, tourism operators, the local population and government institutions. The Harry Oppenheimer Okavango Research Centre (HOORC) is implementing a biodiversity monitoring programme to study the impact of the eradication campaign. Disease control programmes with broad ecological, social and political implications need to be considered in long-term planning.

The Okavango Delta Management Plan project

The overall goal of the Okavango Delta Management Plan is "to integrate resource management for the Okavango Delta that will ensure its long-term conservation and that will provide benefits for the present and future well being of people, through sustainable use of its natural resources" (NCSA 2002). The objective of the exercise is hence to develop a comprehensive, integrated management plan for conservation and sustainable use of the Okavango Delta and surrounding areas (see map 1 for the management plan area as defined by the Ramsar site coordinates).

The various components of the management plan will seek to:

- provide a long-term vision of the development options and management scenarios for the Okavango Delta;
- serve as an integrated, dynamic management plan, which provides the overarching framework and contextual guidelines for individual area and sector plans;
- determine levels of use in order to ensure sustainability and protection of the natural resources of the Ramsar site;

- set up the institutional framework required for the management of the Ramsar site;
- determine research and monitoring requirements and standards;
- provide data and information requirements and feed development options into the basin management planning exercise of the Permanent Okavango River Basin Water Commission (OKACOM); and
- build capacity among implementing institutions and in communities.

From a basin-wide perspective, the environmental aspects of this management planning exercise are based on the Ramsar guidelines, as well as the use of the ecosystem approach in the development of the project and through the planning process.

The development of the Okavango Delta Management Plan is expected to provide input into the overall management of the Okavango River basin through OKACOM. The link between the management planning exercise and activities undertaken under the auspices of OKACOM is of great significance to the government of Botswana as it shows its regional commitment to transboundary cooperation, as well as integrated river basin and natural resource management (see box 1).

The two most crucial environmental issues, which will be addressed by the management planning exercise, are discussed below.

Water resources management

The annual rhythm of water flows is the key factor determining the quality of life in the delta in terms of biodiversity, as well as of human livelihood. In an area like the north-west of Botswana, situated at the edge of the Kalahari Desert where water is scarce, demands on water resources from the different stakeholders are potentially high and often of a conflicting nature. Water may be used only once, or be fed back into the system in a polluted state.

Crucial in this will be the understanding of the area's hydrology, both for surface and groundwater. This understanding is of vital importance in order to be able to predict any changes in the delta and its impact on interests represented in the delta that might be caused by developments in the river basin. Without the understanding of the hydrology and of its importance for the different interests at stake, the formulation of a management plan becomes an academic exercise of very limited use.

Land and resource use planning

Extensive land-use planning exists for the Okavango Delta. Ngamiland is divided into planning zones and controlled hunting areas for which principal land uses have

been identified. In protected and wildlife management areas detailed physical planning exists. Furthermore, there are various sectoral development plans. However, the land-use plan produced in 1991, covering the Okavango and Cuando wildlife management areas (Van der Heiden 1991), was drawn up without sufficient stakeholder participation and consequently seems to lack adequate implementation support and commitment from local institutions. The individual area and sector plans need to be examined, analysed and, if necessary, harmonised. All existing plans are static and do not follow an integrated ecosystem management approach. As they do not include a constant monitoring component, they cannot be regularly adjusted to the dynamics of the delta ecosystem.

The ecosystem approach

The ecosystem approach seeks to organise human use of ecosystems in order to strike a balance between benefiting from the natural resources available from an ecosystem's components and processes, while maintaining an ecosystem's ability to provide these at a sustainable level.

Hence, the ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way (see box 2 for the ecosystem principles adopted by the Convention on Biological Diversity in Nairobi, 2000). It requires adaptive management to deal with the complex and dynamic nature of ecosystems, as well as with the absence of complete knowledge or understanding of their functioning. This adaptive approach should be able to respond to uncertainties, and contains elements of 'learning-by-doing', and/or research feedback. The approach does not preclude other management and conservation approaches, but carries the potential to integrate all these approaches and other methodologies to deal with complex situations (CBD 2000; Maltby et al 1999).

Ecosystem management seeks to meet human requirements for the use of natural resources, while maintaining the biological richness and ecological processes necessary to sustain the composition, structure and function of the habitats or ecosystems concerned (Pirot & Meynell 1998). Pirot and others (2000) further placed ecosystem management within the context of the sustainable use of natural resources to balanced human needs, and summarised the principles of the ecosystem approach as follows:

- maintaining ecosystem function and integrity;
- recognising ecosystem boundaries and transboundary issues;
- maintaining biodiversity;
- recognising that people are part of the ecosystem;
- recognising the need for knowledge-based adaptive management;
- recognising the need for multisector collaboration; and
- making ecosystem-based management a mainstream development approach.

The ecosystem approach and its application form a crucial aspect of the Okavango Delta management planning exercise, more so because the approach is multidisciplinary, recognises transboundary natural resource management and looks at interlinking ecosystems. This forms an important backdrop to the implementation of the Ramsar convention, the SADC Revised Protocol on Shared Watercourses (SADC 2001), and the increased SADC regionalism and international cooperation on integrated water resource management.

Planning approach and principles of the Okavango Delta Management Plan project

The National Conservation Strategy Agency (NCSA), as the Botswana government coordinating agency for the National Wetlands Policy and Strategy and the focal point for the Ramsar convention, is responsible for the development of the management plan. The overall planning approach is guided by Botswana's National Wetlands Policy and Strategy, the ecosystem approach, and the Ramsar convention guidelines on wetland and river basin management.

The main guiding principle of the management plan is the creation and strengthening of ownership. Institutions and actors mandated to implement the Okavango Delta Management Plan should be associated with the planning process, so that the final product will be 'their' plan. In order to operationalise the approach and this guiding principle, a number of key elements are of importance.

Creating and strengthening responsibility and accountability in existing institutions involved in managing the delta and its resources

The project will assist institutions to participate in the planning process, consolidate existing responsibilities, and implement the plan by making provisions for capacity-building. Components will be identified in such a way that they ensure appropriate integrated planning at national and district levels, while ensuring vertical cohesion through the different line departments where components may be housed.

Active stakeholder participation in the main stages of the planning process

Participation includes, among others:

- the use of traditional knowledge;
- association with the decision-making process;
- transparency in the planning process and stakeholder access to information;
- recognition of and respect for traditional resource user rights; and
- benefits to stakeholders responsible for managing the resources.

Association of international stakeholders with the planning process

Regional and international environmental obligations will be integrated. The Okavango Delta Management Plan will also be integrated into the existing OKACOM process.

Integrated planning process

A dynamic and phased approach (living plan) will be used. A first version of the management plan (framework management plan) will be produced after one year, and will be based on existing knowledge, taking cognisance of existing land-use and sector management plans. The framework management plan will be subjected to an evaluation and review with the participation of stakeholders, assisted by national and international expertise. Identified shortcomings in the framework management plan will be addressed during the second year, so that a draft management plan can go through a similar review process at the end of the second year. The final management plan will be available after three to four years. This plan would then require periodic updating.

Prioritising the issues to be dealt with in the planning process will enhance ownership and acceptance of the plan. In each key area of management, one or two 'burning' issues (a so-called 'hotspot' approach) will be selected at a very early stage in consultation with stakeholders (see box 2), for immediate attention and solution during the planning process itself. Integration and cooperation will be pursued among stakeholders and the solutions will form an integral part of the Okavango Delta Management Plan.

Capacity-building and learning will be enhanced in the participating institutions through hands-on training during the planning process and specialised technical training as identified during the inception phase.

Planning based on the ecosystem approach

This aims to adapt to the constant changes in the ecosystem and to maintain the integrity of the Okavango Delta within the Okavango basin. The approach, as explained above, brings together social, economic and environmental aspects. The project will take valuable guidance from the Ramsar convention's implementation and planning manuals.

Planning principles

The guiding planning principles underlying the Okavango Delta Management Plan are:

- creation and strengthening of responsibility and accountability in existing institutions with a mandate to manage the delta and its resources;
- active stakeholder participation in the main stages of planning and implementation utilising traditional knowledge;
- a dynamic, integrative action-oriented planning process based on the ecosystem approach and addressing pertinent issues as the plan is being prepared;
- cognisance of the existing relevant land-use and management plans;
- recognition of and respect for traditional resource user rights;
- acknowledgement of international interest in the delta; and
- accent on training and capacity-building.

The principle of responsibility and accountability takes shape through the devolution and decentralisation of mandates to institutions that are currently involved in managing aspects of the delta ecosystem and its functions. The main responsibility for the formulation and implementation of each project component within the framework of the management plan will lie with one of the existing agencies. The following ten components and lead agencies have been identified:

- *Policy, planning and strategy (including communication)* – National Conservation Strategy Agency (NCSA) on national level, District Development Committee and Okavango Wetland Management Committee on district level, and *communication* in collaboration with the Tribal Administration
- *Research, data management and training* – Harry Oppenheimer Okavango Research Centre (HOORC)
- *Hydrology and water resources* – Department of Water Affairs (DWA)
- *Wildlife management* – Department of Wildlife and National Parks (DWNP)
- *Sustainable tourism* – Department of Tourism (DoT)
- *Fisheries and animal health* – Department of Animal Health and Production (DAHP)
- *Vegetation resources* – Department of Crop Production and Forestry (DCPF), in association with the Agricultural Resources Board (ARB)
- *Physical planning* – Department of Town and Regional Planning (DTRP)
- *Land-use planning and land management* – Tawana Land Board (TLB) and District Land Use Planning Unit (DLUPU)
- *Local authority services' provision* – North West District Council (NWDC)

In order to achieve the immediate objectives of each component, these lead agencies will have to ensure that effective interaction takes place with other government agencies, as well as with civil society. Figure 1 gives an overview of the components, the implementing agencies, an identification of their main tasks within the planning process, and the coordination at their respective levels.

The principle of active stakeholder participation is reflected in the elaborate consultation process that preceded the finalisation of the project proposal. Also, a

project like the formulation of a plan for the integrated and sustainable management of the Okavango Delta demands the collaboration of a large number of stakeholders, from government and civil society, to local and international institutions. This can only be achieved successfully when communication is properly addressed. For this reason, communication is a subcomponent of the role played by the NCSA, but with its own objectives, outputs and activities (see figure 1).

According to the ecosystem approach, the role of people as an ecosystem component, and their interactions with other components of the system (Pirot et al 2000) make human action the focus of ecosystem management, as people make the social and political choices about exploitation of the ecosystem. Other reasons for including people, particularly at local community level, are:

- They have a particular interest in the management process, being dependent upon the services the ecosystem provides.
- They often have considerable relevant knowledge of the ecosystem and of the ways in which it can be managed (indigenous knowledge systems).
- In some cases, the cultural, ethical and spiritual values of local communities have evolved on the basis of a long-standing interaction within an ecosystem, so their interest goes beyond simply deriving material benefits from the system.
- In many cases, they have developed traditional use or tenure systems that can be adapted to the aims and objectives of an ecosystem management programme.

Apart from positive reasons, people are often the greatest threat to ecosystem functions and integrity and without their cooperation ecosystem management efforts will run a high risk of failure. The people in the delta will have to view this planning exercise as beneficial for their livelihood strategies rather than a threat.

Participation must occur at an early stage in the planning exercise and not only at the stage when the plan is being finalised. The project includes a stakeholder forum, which will review progress and ensure participation (see figure 1).

The approach of addressing pertinent issues, as the project gets under way, is a principal matter, as the project should not be disconnected from implementation and become a desktop planning exercise. The rationale is hence for a close connection with the specific issues of the various stakeholders and the piloting of solution-seeking activities that will keep the planning momentum going, provide a technical input into the planning approach, and involve stakeholders actively in the design and implementation of actions that pursue conflict resolution (see earlier remarks on the planning and hotspot approach).

The Okavango Delta has not been managed in a complete vacuum. Various land-use plans exist dealing with different areas and prepared at different scales and levels of detail. However, gaps exist that have to be addressed, while at an overall delta-wide level, general land-use planning and utilisation principles need to be determined that will guide the overall development of the delta. For this to take place

without too much distress, existing plans need to form the basis of the overall planning exercise. This is also an exponent of the adaptive plan or 'living plan' strategy.

The premise of the principle of the acknowledgement of international interest in the delta is based on the fact that the Okavango Delta is listed as a Ramsar site and the management plan is developed according to the guidelines of the Ramsar convention. The government of Botswana is undertaking an integrated management planning exercise for the Okavango Delta to fulfil its obligations under the Ramsar convention (article 4), to pursue the wise use of natural resources for the benefit of all Okavango stakeholders, and to contribute to regional integrated water resource management in the Okavango River basin as mandated to OKACOM. This is in line with the Ramsar guidelines, which call for an integration of wetland site management within broad-scale environmental management planning, including river basin and coastal zone management.

Operations of the Okavango Delta Management Plan project

As mentioned above, the NCSA is the lead government agency. At the operational level, the project will be overseen by a project steering committee, which will hold biannual meetings while the Okavango Wetland Management Committee will function at field level (see figure 1). The latter committee will be established for the Okavango Delta according to the wetland organisational structure proposed in the National Wetland Policy and Strategy. It will coordinate planning at district level and report to the NCSA through the District Development Committee. All major stakeholders will be represented.

Each responsible agency will establish task forces for major activities to be carried out within the framework of the project. The responsible agency will decide on the terms of reference and composition of each task force. However, the intention is that each task force will have representatives of major implementing partners, as well as community and private sector representatives where appropriate and feasible. The main aim of the task forces is to secure cross-sectoral coordination, project integration and stakeholder involvement. A task force will be abolished once the expected outputs have been achieved.

The implementing partners of the project should regularly discuss and be informed about ongoing project activities through a stakeholder forum. The forum would be composed of representatives of the existing institutions in the district involved in planning, decision-making, research and extension, as well as political leaders and representatives. The stakeholder groups could be strengthened by representatives of interest groups utilising the natural resources of the Ramsar site (local communities and the private sector), and by representatives of groups supporting the communities in reaching sustainable levels of resource utilisation

Figure 1

Project organisation including the responsibilities of and linkages between agencies

Implementing agency	Main outputs/responsibility
National Conservation Strategy Agency (national level)	National coordination Project monitoring Linkages to steering committee Linkages to OKACOM Linkages to convention bureaux
National Conservation Strategy Agency (district level project secretariat) – with Tribal Administration (communication)	Project management Coordination between components Communication/information Training support Consulting support Monitoring, evaluations and reporting Physical and economic planning through district planning offices
Department of Water Affairs (in association with DMS)	Hydrology and water resources Integrated hydrological model Climate changes scenarios
Department of Animal Health and Production	Disease control policies Data on fishery resources
Department of Wildlife and National Parks	Biodiversity data and analysis Habitat and wildlife management CBNRM implementation
Department of Tourism	Carrying capacity for tourism Community involvement in tourism
Department of Town and Regional Planning	Settlement strategies Infrastructure development and environmental impact
Department of Crop Production and Forestry (in association with ARB)	Access to agricultural land and forests Biodiversity data and analysis Carrying capacity for livestock
Tawana Land Board (in association with DLUPU)	Land-use zoning, land management, monitoring and compliance CBNRM implementation
North West District Council (in association with DSWM)	District tourism plan Waste management strategy
Harry Oppenheimer Okavango Research Centre	Data management and library Ecosystem research Participatory land-use planning Training support

Coordination
OKACOM
Project Steering Committee
Okavango Wetland Management Committee
Stakeholder forum
Major outputs/ components **TASK FORCES**

(NGOs). The media should also be invited to attend. The main role of the stakeholder groups is to ensure active local participation, give advice and guidance to the planning team working on the Okavango Delta Management Plan and to feed back findings, suggestions and results into the existing institutions and local discussion forums.

Permanent project staff will include a project coordinator, a chief technical advisor and a project facilitator. The latter is a support function to the NCSA in Gaborone. Additional support staff will also be hired.

Conclusion

The Okavango Delta Management Plan project aims to plan comprehensively for the delta on the basis of a long-term vision, as well as the ecological and development needs and aspirations of the various stakeholders. However, as the delta is part of a much larger river basin and ecosystem, regional partnerships in planning and implementation will be crucial for the future status of the delta and the river basin in its entirety.

During its meeting in July 2002 in Windhoek, Namibia, OKACOM endorsed the Okavango Delta Management Plan project and was encouraged to conceive similar exercises in Namibia and Angola in preparation for robust regional cooperation on the basis of an integrated management plan for the entire river basin. Developing a management plan for the river basin is not a linear process, which starts at the regional level and trickles down to the national and subnational planning framework. Indeed, there is widespread acceptance of the notion that the various management and development planning initiatives in the riparian countries will contribute to the overall river basin planning exercise.

However, at a regional scale, issues such as national sovereignty, local needs, comparative advantages, securitisation, food security, rural development, industrial development, protected areas management and tourism, ecological reserves and trading water (whether real or 'virtual') all have to be taken into account and reconciled when developing a river basin management plan from an integrated water resource management perspective. A recent report argued that the trade-off and the uncertainties in the Okavango basin are acute (ODI/Arcadis/Euroconsult 2002). However, this situation will gradually change with the end of civil strife in Angola.

Linking this back to the Ramsar convention (and the expected joining of Angola, currently the only Okavango riparian state that is not yet a member), and to SADC and other international agreements, it is clear that regional and international cooperation is not only a necessity (Henwood & Funke 2002), but also provides ample opportunity (Affeltranger 2002) for development cooperation of mutual benefit among riparian states. In this regard, the peace dividend in Angola could indeed pay substantial interest.

Box 1

Issues identified during stakeholder consultations: Okavango Delta Management Plan design and appraisal phase

Environmental issues

- Lack of understanding of long-term climatic changes and their impact on the delta results in failure to consider these important aspects in management planning.
- Lack of inclusion of health data as an indicator into management planning prevents rapid management interventions.
- Concerns that high rates of human-induced fire have an impact on the ecology.
- Deteriorating environmental quality through increased sound pollution, visual pollution and access tracks undermine the base of the tourism industry.
- Absence of an efficient monitoring system leads to inability to assess impact of interventions.
- Absence of standardised survey techniques leads to incompatible information for management purposes.
- Uncoordinated research activities and limited use of indigenous data lead to research results that are unsystematic and less useful from an ecosystem perspective.
- Increase in elephant populations is changing woodland structure.
- Lack of documentation on endangered or rare plant and animal species and their locations makes it difficult to include this information in management planning.
- Limited information (and public awareness) on invasive plant and animal species increases the risk of their introduction and spread.
- Lack of recognition of the delta's function as a reservoir for globally endangered species such as wild dog and cheetah results in these aspects not being included in management planning.
- The border cordon fences, erected for national security, result in reduced wildlife movements and loss of crossborder community-based management opportunities.
- Groundwater pollution from cattle lung disease (CBPP) burial pits will result in high mitigation costs.
- Past flow manipulation of main river channels has had long-term impacts on the ecology.

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- Increase in human population and wealth has resulted in increased sewerage and solid waste with a subsequent impact on the ecology and management practice.

Policy and overall issues

- Inability to influence changes in upstream land and water use activities threatens the integration of the Okavango Delta and has an overriding impact on delta land-use planning.
- Water off-take (irrigation and domestic use) influences downstream users and ecology (e.g. groundwater recharge, integrity of the Makgadikgadi National Park). It also weakens Botswana's position concerning OKACOM.
- Ramsar boundary lacks ecological and socioeconomic integrity.
- Problems in the implementation of the community-based management approach, relating to roles and responsibilities, lead to conflicts and confusion among stakeholders (roles and duties of Technical Committee undefined).
- Conflict arises between existing development policies (Agriculture and Disease Control Policy and Strategy) and the implementation of the proposed community-based management approach.
- Laws and contracts on natural resource management (lease agreements, fire control, veld product harvesting, regulation on livestock densities) are not monitored and enforced.
- Changes in tourism policy from low-volume/high-cost to high-density/mixed-cost tourism will put increased pressure on the delta ecosystem.

Management issues

- International environmental obligations have not been included in present management planning (failure in compliance).
- Regional agreements do not specify quantities of water abstraction, which drives international conflicts and impacts on delta ecology and economy.
- Non-holistic ecosystem planning approach results in numerous individual, unrelated management plans for particular areas.
- Land Board delays allocations due to increased demand, lack of clear management plans in place and lack of guidelines.
- Management conflicts occur due to some control hunting area boundaries not being demarcated.

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- Lack of updated demographic data for planning purposes hampers progress.
- Development and carrying capacity guidelines absent in areas other than wildlife management areas lead to unplanned developments.
- Natural resources (apart from wildlife) are not actively managed by communities unless allocated to them (lack of user rights).
- Static planning conflicts with dynamics of the delta ecosystem (no constant monitoring and adaptive management that would be required by the ecosystem approach).
- Lack of stakeholder participation in the existing 1991 Land Use and Development Plan leads to a lack of support and commitment to implementation.

Land use

General

- Planned blanket aerial spraying with endosulphane (deltamethrin) for tsetse control will cause loss of biodiversity and have an impact on the tourism industry.
- Unsustainable agricultural practices are resulting in the degradation of resources e.g. slash and burn and shifting agriculture, overstocking, erosion of *molapo* soils.
- Conflicts arise between increasing elephant, hippopotamus and crocodile populations, and people and related land use.
- Conflicts occur between different farming activities such as crop farming and livestock rearing.
- Disease control fences affect wildlife movements.
- Present disease control strategy does not optimise land-use potential.
- Poaching and predator control leads to loss of biodiversity.
- Increased use of fish resources results in conflicts between user groups.

Tourism

- Rapid expansion of tourism industry has resulted in increased pressure on natural resources.
- Increased motorboat traffic results in increased pollution and dangers of collision.

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- Increase in service settlements for the tourism industry has resulted in greater support service requirements (e.g. health facilities and schools).
- Absence of an efficient monitoring system to assess tourist satisfaction does not allow for feedback to planning.

Veld products

- Overexploitation of mokola palm and dye plants by basket makers results in their unsustainable use and commercialisation of these natural materials.
- Citizen hunting is restricted through community-based management and commercial tourism activities leading to a loss in income opportunities.
- Limited information on natural resource use, distribution of resources, sustainable use, user groups, rights and obligations (both quantitative and spatial) results in these issues not influencing planning decisions.
- Absence of a forestry resource inventory of commercially exploitable timber results in the resource not being used.

Hydrology

- Gaps in knowledge on water quality limit monitoring of impacts and implementation of mitigations.
- Lack of information on the impact of hydrological changes on biodiversity, community structure and ecosystem productivity results in a failure to predict impacts of management interventions.
- Hydrological modelling lacks spatially well-distributed data (e.g. evapotranspiration; ground and surface water flow; meteorological data) needed to predict ecological and social impacts of off-take.

Capacity-building

- Services required by communities involved in community-based management efforts are not well identified and the service support not coordinated.
- Insufficient government extension services for tourism and natural resource management (lack of transport and personnel) lead to a vacuum filled by uncoordinated activities of NGOs and private community support organisations leading to misunderstandings in the communities.

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Traditional rights

- Confusion exists about traditional rights (no comprehensive definition, no protection from abuse, little documentation and mapping).
- As traditional rights are not documented or protected, land grabbing occurs.
- Local commercial users enjoy traditional user rights to exploit resources leading to conflicts over user rights.

Community-based natural resource management

- Creation of unequal opportunities through community-based natural resource management results in political friction and a lack of commitment to the policy by non-beneficiaries.
- Inappropriate mechanisms for implementation of joint venture agreements cause conflicts between the partners.
- Inherent instability of tourism industry in communally managed areas (short-term leases) leads to high turnover rates and a lack of commitment to sustainable management.
- Unrealistic expectations of CBOs towards private sector lead to conflicts between partners.
- Lack of coordination between stakeholders causes misunderstanding, conflicts, instability and distrust between NGOs and government, NGOs and the private sector, and between CBOs.
- Insufficient capacity-building available for communities to enable them to participate effectively in management planning (lack of community mobilisation).
- Community trusts not allowed to participate in setting wildlife quotas.
- Communities lack expertise and funds to enter tourism industry.
- Problems arise in joint management where communities with different ethnic identities are grouped together.
- Tender process for community managed areas is not transparent. Lack of legally binding rules leads to unfair competition practises between safari operators.
- Poor community trust board performance leads to dissatisfaction among community members.
- Problems with administration, reinvestment and redistribution of revenue by trust boards lead to distrust.
- Distrust between trust boards and communities results from a lack of information flow.

Box 2

Ecosystem principles as adopted by the 5th conference of parties to the Convention on Biological Diversity (CBD), Nairobi, Kenya, 15-16 May 2000

Principle 1: The objectives of management of land, water and living resources are a matter of societal choice.

Different sectors of society view ecosystems in terms of their own economic, cultural and societal needs. Indigenous peoples and other local communities living on the land are important stakeholders and their rights and interests should be recognised. Both cultural and biological diversity are central components of the ecosystem approach, and management should take this into account. Societal choices should be expressed as clearly as possible. Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way.

Principle 2: Management should be decentralised to the lowest appropriate level.

Decentralised systems may lead to greater efficiency, effectiveness and equity. Management should involve all stakeholders and balance local interests with the wider public interest. The closer management is to the ecosystem, the greater the responsibility, ownership, accountability, participation, and use of local knowledge.

Principle 3: Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.

Management interventions in ecosystems often have unknown or unpredictable effects on other ecosystems; therefore, possible impacts need careful consideration and analysis. This may require new arrangements or ways of organisation for institutions involved in decision-making to make, if necessary, appropriate compromises.

Principle 4: Recognising potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should:

Reduce those market distortions that adversely affect biological diversity;
Align incentives to promote biodiversity conservation and sustainable use;
Internalise costs and benefits in the given ecosystem to the extent feasible.

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The greatest threat to biological diversity lies in its replacement by alternative systems of land use. This often arises through market distortions, which undervalue natural systems and populations and provide perverse incentives and subsidies to favour the conversion of land to less diverse systems.

Often those who benefit from conservation do not pay the costs associated with conservation and, similarly, those who generate environmental costs (e.g. pollution) escape responsibility. Alignment of incentives allows those who control the resource to benefit and ensures that those who generate environmental costs will pay.

Principle 5: Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.

Ecosystem functioning and resilience depend on a dynamic relationship within species, among species and between species and their abiotic environment, as well as the physical and chemical interactions within the environment. The conservation and, where appropriate, restoration of these interactions and processes are of greater significance for the long-term maintenance of biological diversity than simply protection of species.

Principle 6: Ecosystems must be managed within the limits of their functioning.

In considering the likelihood or ease of attaining the management objectives, attention should be given to the environmental conditions that limit natural productivity, ecosystem structure, functioning and diversity. The limits to ecosystem functioning may be affected to different degrees by temporary, unpredictable or artificially maintained conditions and, accordingly, management should be appropriately cautious.

Principle 7: The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.

The approach should be bounded by spatial and temporal scales that are appropriate to the objectives. Boundaries for management will be defined operationally by users, managers, scientists and indigenous and local peoples. Connectivity between areas should be promoted where necessary. The ecosystem approach is based upon the hierarchical nature of biological diversity characterised by the interaction and integration of genes, species and ecosystems.

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Principle 8: Recognising the varying temporal scales and lag-effects that characterise ecosystem processes, objectives for ecosystem management should be set for the long term.

Ecosystem processes are characterised by varying temporal scales and lag-effects. This inherently conflicts with the tendency of humans to favour short-term gains and immediate benefits over future ones.

Principle 9: Management must recognise that change is inevitable.

Ecosystems change, including species composition and population abundance. Hence, management should adapt to the changes. Apart from their inherent dynamics of change, ecosystems are beset by a complex of uncertainties and potential 'surprises' in the human, biological and environmental realms. Traditional disturbance regimes may be important for ecosystem structure and functioning, and may need to be maintained or restored. The ecosystem approach must utilise adaptive management in order to anticipate and cater for such changes and events and should be cautious in making any decision that may foreclose options, but, at the same time, consider mitigating actions to cope with long-term changes such as climate change

Principle 10: The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.

Biological diversity is critical both for its intrinsic value and because of the key role it plays in providing the ecosystem and other services upon which we all ultimately depend. There has been a tendency in the past to manage components of biological diversity either as protected or non-protected. There is a need for a shift to more flexible situations, where conservation and use are seen in context and the full range of measures is applied in a continuum from strictly protected to human-made ecosystems.

Principle 11: The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.

Information from all sources is critical to arriving at effective ecosystem management strategies. A much better knowledge of ecosystem functions and the impact of human use is desirable. All relevant information from any concerned area should be shared with all stakeholders and actors, taking into account, inter

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alia, any decision to be taken under article 8(j) of the Convention on Biological Diversity. Assumptions behind proposed management decisions should be made explicit and checked against available knowledge and views of stakeholders.

Principle 12: The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

Most problems of biological diversity management are complex, with many interactions, side-effects and implications, and therefore should involve the necessary expertise and stakeholders at the local, national, regional and international level, as appropriate.

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CHAPTER 8

The dynamics of river basin cooperation: The Nile and Okavango basins

Alan Nicol

Abstract

This chapter examines the Nile and Okavango basins in a comparative manner. Central issues raised include the aspect of scale, not only in terms of actual numbers, but also in terms of political complexity. The teleology of water scarcity and conflict is refuted, with the discourse of cooperation providing the main backdrop to the chapter. Because cooperation is about changing paradigms from water-sharing to benefit-sharing, the case is made that transboundary rivers challenge sovereignty and independent national development priorities – the main theme of this book. Two significant common aspects in both the Nile and the Okavango are the attempts to 'enhance' yield by manipulating wetlands through dredging, and the issues raised by post-conflict reconstruction. Both basins contain wetlands of major proportions, which make them interesting case studies when considering river basins comparatively.

Introduction

The issue of water and conflict is the focus of frequent media reports, usually written by ill-informed journalists keen to cover column inches. The publication of such reports is often proportional to concerns over water scarcity in various regions of the world, with the Middle East and Southern Africa in the spotlight. Some reports even portray impending 'water wars', quoting out-of-context statements made by politicians and technocrats who mostly have vested national interests. The statement made in 1995 by a prominent water sector professional that the next world war would be over water is a case in point (Serageldin 1995). In fact, the history of conflicts or disputes over water is somewhat threadbare—instances of cooperation and agreement far outstrip those of dispute and conflict (for a comprehensive listing of agreements and treaties see <www.transboundarywaters.orst.edu/>).

Nevertheless, at a more local level, there is 'background noise' caused by resource conflict in many arid and semi-arid parts of Africa and Asia. This is usually conflict spawned by the daily need to access water for livelihood security within complex and often competing resource-use environments. In some cases, the conflicts have serious local repercussions leading to displacement and loss of livelihoods. It is also at a level

where fewer checks and balances exist to the development of conflict and its proliferation as compared to 'higher' levels (regional, in particular), and certainly at a level where there is less scrutiny from the wider international community.

While this chapter contends that conflict over water – whether violent or not – is a rarity at shared basin level, this should not be an excuse for complacency in the face of complex and often rapidly increasing demands for access to water by co-riparian states. Furthermore, in reaching cooperation and agreement at basin level, benefits can be made available to local users through decisions that address water development for sustainable livelihoods and poverty reduction. At this level of impact, 'water for peace' arrangements can help to catalyse development benefits of key importance to local people, including those who are engaged in local-level conflict over resources.

The two basins examined in this chapter both represent such opportunities. Each is frequently under the media spotlight and has recently been (or continues to be) 'conflict-laden', in the sense that there remain significant areas of violent conflict within the basin, though not necessarily involving water or other natural resources. Although some observers do anticipate wider conflict over competing demands for water in these basins, both basins have provided examples of effective development cooperation – some of which are in their early stages – and not of conflict. Questions remain, however, about the nature of these cooperation and development processes that raise wider issues of development surrounding the distribution of socioeconomic benefits and the means by which to share such benefits at both international and national levels.

Comparing the two river basins

Similarities

In many ways – including area, population, number of riparian states, volumes of available water – the two basins diverge widely in characteristics (see table 1). In other ways, there are important similarities that make a comparison useful.

Politically speaking, both basins have emerged from prolonged periods of political stasis. In the case of the Nile, the Cold War effectively dictated a pattern of relations between states and, on a broader level, the nature and direction of interstate and intrastate conflict (Makinda 1992). Soviet influence in the region included support to Ethiopia's military, which helped to prolong the internal conflict in this country, and ensured hostility with Egypt as the latter swung towards the United States during the 1970s. These structures and processes of international relations effectively hindered the development of collaborative efforts around the Nile by blocking the thawing of bilateral relations between Ethiopia and Egypt. Regime change in Ethiopia in 1991 and the establishment of a more western-oriented government helped to generate the necessary rapprochement that immediately opened up the 'policy space' necessary to exploit greater Nile basin cooperation.

In the Okavango basin, the end of apartheid in South Africa served a similar purpose (Turton 2003), causing a ripple effect throughout the region and opening up new levels of discourse between states, including those sharing international river basins in Southern Africa. It also added impetus to the Southern African Development Community (SADC), enabling it to evolve a more developmental and inclusive role in Southern Africa, as well as creating opportunities for new agreements and regional treaties.

Although the basin states flanking these two rivers differ significantly, some similarities can be found in the economic sphere. In both cases, widely divergent economies share a common resource, adding great complexity to the apportionment of water in both basins (particularly the legal, social and economic basis on which this is to be achieved), the benefits derived from the use of this water, and the processes and structures necessary to share benefits.

In the case of the Nile, the economic polarity in the basin is clearly evident in the huge difference between Egypt as the major water recipient and Ethiopia as the major supplier. Egypt receives some 55,500 Mm^3 (under the 1959 Nile Waters Treaty with Sudan), while Ethiopia contributes 52,000 Mm^3 from the Blue Nile alone, with other significant tributaries to the Nile system from Ethiopia including the Omo-Gibe (18,000 Mm^3), Baro-Akobo (12,000 Mm^3) and the Tekeze (8,000 Mm^3), yet remaining effectively excluded from any legally agreed apportionment. Whereas Egypt is ranked as a middle-income economy with a gross national product (GNP) per capita of US $1,530 in 2001, Ethiopia's equivalent was US $100 in the same year (World Bank 2002). In the Okavango, the difference between Angola (with a GNP per capita of US $500 in 2001) and Botswana (with US $3,630 per capita in the same year) (World Bank 2002) is even more noticeable (see table 2). There are therefore serious issues as a result of such differences that have to be dealt with in institutional development, the creation of effective management processes and, ultimately, in the sharing of water and benefits.

The key fact is that, although cooperation is aimed at supranational level, the real issues relating to development have to be examined and understood at national and subnational level. Clear linkages between basin-level cooperation and local-level development have to be a priority in both basins. In the development of cooperative arrangements, the end goal is far too often subsumed by the means necessary to achieve this goal, and the cooperative arrangements themselves are subsequently regarded as the key 'success'.

Finally, both basins have real or latent conflicts involving – though not specific to – issues of resources, nationhood, self-determination and ethnicity. While less complex in the case of the Okavango, there is an interesting parallel between the two basins in the key position taken by upstream states. Although Ethiopia is far more heterogeneous than Angola and its recent conflicts on a larger scale (particularly the border war with Eritrea in the late 1990s), conflict resolution and effective peacebuilding are key priorities in both states. The success of peacebuilding in effect

Table 1

Comparison between the Nile and Okavango rivers

River	Length (km)	Size (km^2)	Basin population	Average annual discharge (Mm^3)	Riparian countries
Nile*	6,671	3,349,000	160,000,000	84,000	10
Okavango**	1,100	429,394	215,000	9,863	3

Sources:
* All data from Nile Basin Initiative materials.
** ODI/Arcadis 2001 and Green Cross International at <www.gci.ch/GreenCrossPrograms/waterres/pdf/WFP_Okavango.pdf>.

Table 2

Comparison between (selected) eastern Nile and Okavango riparian countries (2001)

Country	Population (million)	Population growth (%)	Gross domestic product (billion US $)	Gross national product per capita (US $)	Surface area (million km^2)
Egypt	65.2	1.9	97.5	1,530	1.0
Sudan	31.7	1.9	12.6	330	2.5
Ethiopia	65.8	2.3	6.4	100	1.1
Angola	13.5	2.8	9.5	500	1.2
Namibia	1.8	2.0	3.2	1,960	0.8
Botswana	1.6	0.8	5.1	3,630	0.6

Source: World Bank 2002.

creates greater downstream challenges as renewed national development opportunities raise questions about future demand for water and patterns of resource use in important upstream tributaries.

Differences

One obvious difference of significance between the two basins is scale – the Nile basin is more than five times the size and length of the Okavango basin. The former comprises ten states spanning three major regions of the continent, while the latter encompasses three states in one region (though Angola arguably has significant links to Central and West Africa). The population of the Nile basin is more than 20 times that of the Okavango, and figures for the total populations of the riparian states widen this difference even further. This ensures, at a minimum, that the financial issues with regard to basin-wide development are of a far greater magnitude in the Nile basin. Complexity caused by scale also has important repercussions for the type and extent of institutional development necessary to address development challenges – put simply, the larger the basin, the greater the probability that higher transaction costs will be involved.

The institutional challenges posed by issues of scale in the Nile basin are also matched by the political complexity of the position of states such as Egypt, with a government tied into wider decision-making systems related to global concerns such as the Israeli-Palestinian conflict. At an even wider scale, it could be argued that, after the Twin Towers attack in September 2001, a state such as Sudan has a changed – perhaps strengthened – regional position because of its involvement in the US response to these events. The issue of oil in southern Sudan is one such a key area. An end to the conflict in southern Sudan will open up oilfield exploitation to US companies, currently barred under anti-terrorist legislation predating the events of September 2001. During 2002, a shift could be perceived in the strategic weight of Sudan at the expense of Egypt's traditional hegemony within the basin – and the region. In short, changing geopolitics has a greater immediate impact on Nile basin states than on states in the Okavango basin.

Economically, the differences are largely related to the economic basis of states. In most of the Nile basin, this is rooted in the agricultural focus of economies. In Egypt, agriculture accounted for just 16.9% of GDP in 2001, against 50% for services and 33.2% for manufacturing. In contrast, Ethiopia's agricultural sector accounted for 52.3% of its economy in the same year, with industry at 11.1% and services 36.5% (World Development Indicators 2002).

In the Okavango basin, economies are far less reliant on agriculture, with Namibia having the highest agricultural contribution at 11.3% in 2001, followed by Angola with 8% and Botswana with 2.4% (World Development Indicators 2002). The demands for water derive mainly from growing industrial activities, population centres outside the basin, as well as from the environment. While this last demand on the resource is of particular importance to the Okavango, environmental flows are far

lower down the list of concerns of Nile states, although environmental degradation in the highlands of Ethiopia remains serious. The implications of economic differences between states and between the two basins are particularly important for understanding how benefits accrue from water usage – to which sectors and to which states – and how the sharing of benefits can best result in complementarities that address future concerns such as environmental degradation. This is a tall order institutionally and suggests the need for the effective facilitation of institutional development, particularly at the early stages of cooperation.

This leads to the final question of ongoing conflict, where both similarities and differences exist between the two basins. While the immediate concerns to build peace in countries recently emerging from protracted civil war are similar, the achievement of peaceful resolutions in the two major parallel conflicts differs significantly. In the case of the Nile, the recent outcome of the Machakos agreement is a higher degree of optimism that a peace agreement can finally be reached in Sudan, but the possible consequence of a referendum on the future of the south raises the possibility of a new Nile basin state. This possibility is of immediate concern to Egypt, not least because of the impact this would have on the existing 1959 Nile Waters Agreement (see Howell & Allan 1994). Continued conflict, on the other hand, hinders the possible development of potential supply-side structures – most notably the Jonglei Canal project, which would augment Egypt's summer flows in future. In Angola, in contrast, the attainment of peace after decades of war would imply a rapidly increasing demand for water in the upstream catchment. This will likely, though not necessarily, lead to greater abstraction and reduced downstream flows. In both these instances, key water management issues accompany wider conflict resolution questions.

Finally, the scale of interstate conflict in the Nile basin in recent years has been far greater than in Southern Africa. This suggests greater political prizes in using the Nile basin process to achieve integration and political convergence between states. At a minimum, the Eritrean-Ethiopian border war cost the lives of well over 100,000 people in two years and had enormous political and economic consequences for the two countries. Bringing the two states closer through joint work on shared tributaries of the Nile, in the context of current initiatives, is one possible step forward.

In conclusion, there are clear parallels in issues and outcomes for cooperative development of both the Nile and Okavango basins. However, the process required – its cost, extent, timescale and requirements for external facilitation – will be noticeably different. Upstream-downstream issues of need, abundance and the means to share benefits from cooperative usage are mediated by hugely variant sets of social, political and geographic factors. How these factors are understood and exemplified in the types of institutional arrangements that accompany and facilitate cooperation will determine, in the end, whether successful outcomes are achievable or not.

The next section examines some of the critical issues facing the two river basins and concludes with a discussion of the principal joint water development concerns of the two basins.

Box 1

Relationship between major Nile basin states: Egypt, Sudan and Ethiopia

Key riparian position (until 1998)

Egypt

- Under the 1959 Nile Waters Agreement entitled to 55,500 Mm^3 per annum.
- Until the mid-1990s was 'deaf' to Ethiopia's intentions to develop the Nile waters.
- Publicly has regarded the 1959 Nile Waters Agreement as defining its 'minimum entitlement'.
- Recognises Sudan's entitlement to 18,500 Mm^3, and has opposed reduction to 'historic' entitlements. No other riparians besides Egypt and Sudan have signed the Nile Waters Agreement.
- Prepared to develop schemes jointly including the Jonglei in Sudan.
- Government agencies concerned with water and land reclamation strongly protect the notion that they have options for substantial increased use of water and propose a 25% increase in area under irrigation. These schemes are far beyond what is possible with known water resources and existing institutions (see Toshka, below), but play to the international legal and relationship imperatives of projecting vigorous water demand.

Sudan

- Sudan's position is largely dominated by Egypt. The Nile Waters Agreement included provisions on monitoring by Egyptian engineers of Sudanese usage.
- Developing irrigated agriculture since early 20th century. Had the 1960s and 1970s trends in development been sustained, would be utilising its full entitlement by now. In the 1980s, the pace of agricultural development declined and some land came out of production.
- Sudan watches Egyptian use carefully, including the diversion to Sinai. Many Sudanese were particularly excited when Egypt spoke of transferring water across Sinai to Israel in late 1979, though this was never put into practice.
- The Jonglei scheme (facilitated by the Nile Waters Agreement) was developed in the early 1980s. Its original intention was to reduce evaporation losses from the White Nile as it moved through the Sudd, thus increasing water supply to the north (and Egypt). However, the decision to construct the scheme – made

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in 1974 by the northern government – failed to take into account its impact on southerners and was a partial catalyst for the resurgent civil war. The scheme was abandoned halfway.

Ethiopia

- Ethiopia has noted with alarm plans by Egypt to move water outside the natural Nile.
- It has not been able to develop its immense hydropower potential nor to address the more difficult water-for-agriculture issues.
- Gradual utilisation through construction of small dams in the highlands is increasing, but these projects are subject to severe problems resulting from environmental degradation.
- Upstream riparians – including Ethiopia – regard the renegotiation of the 1959 agreement as an essential preliminary to any future agreements on the Nile.
- Ethiopia has been attempting to gain recognition of its rights to develop water for power and agriculture. In 1997, for the first time, the Egyptian government stated that the two governments – as the major suppliers and users of the resources – should discuss issues bilaterally. This led to an exchange of diplomatic notes and formed the basis for the emerging Nile Basin Initiative (see below).

Source: Allan & Nicol 1998.

What are the critical development issues?

The Nile

Given the dimensions of the development challenges facing both basins there are, not surprisingly, major development issues of overlap and trade-offs facing basin planners. This section broadly divides the issues into demand and supply factors, before examining some of the questions around process that impact on the capacity to identify trade-offs (as important as the benefits themselves), and the ways in which negative trade-offs can be turned into 'win-win' scenarios. The concept of a 'trade-off' is vital in understanding how governments will perceive different development options and sell these to citizens. An appreciation of the hierarchy of trade-offs in social, economic, political and environmental spheres is likely to be an intrinsic part of building consensus between and within basin states.

The first major demand-side issue in the Nile basin is that of agricultural uses of water by all basin states. This varies substantially between states, but is constant in terms of development concerns of riparians – either in Egypt's case, in its virtual total reliance on the Nile for irrigated agriculture, or in Ethiopia's case, on its precarious reliance on peasant rainfed farming for most of its economic output. Sudan is somewhere between the two, with both significant economic returns from irrigated agriculture, at the same time as extensive farming through rainfed agriculture in the east and west of the country. The basic issue surrounding agriculture is one of food security, or food self-sufficiency, and the various forms of discourse on this issue that surround the Nile.

A critical analytical distinction must be made between 'food security' and 'food self-sufficiency'. Security is attainable without self-sufficiency if the trade-off of perceived 'national security' can be achieved. Reliance on 'own production' in the face of rising demand but unreliable rainfall regimes suggests that, in fact, security might be more logically sought in purchasing food from other more reliable production areas through world markets (see Allan 2001). The periodic droughts in the Horn of Africa and in Southern Africa are a case in point and can have enormous impacts on downstream flows. These hold great 'emblematic' significance for both the major user and supplier of Nile waters (for more on the notion of 'emblematic events', see Allan 2001). For Egypt, although the irrigated agricultural sector is extremely significant in social terms – it employs approximately 40% of its labour force – it is of less significance economically than other sectors, including oil, gas, remittances and tourism.

In contrast, although the potential for greater irrigation development exists, the economic logic behind developing expensive irrigation in Ethiopia has yet to emerge. It is certainly not the answer to most of the country's food security problems. As Rahmato (1999) notes, much of the land used for irrigation would already have been under rainfed cultivation (or pastoral range land), and significant opportunity costs to irrigation expansion are therefore likely. An optimistic scenario suggests that irrigation would in any case only contribute about 10% to food needs in the next 20 years. Improving the rainfed sector in the Ethiopian highlands is the key issue, with the problem of land-holding size and the capacity of households and communities to grow buffer stocks to help tide them through poor years of rainfall being central to this improvement.

This leads to the second major demand-side use: water for hydropower development and, more generally, power development in the Nile basin. At present, the major generating structure on the Nile is the High Aswan Dam in Egypt. Built in response to Egypt's perennial water insecurity – at least in terms of variable annual flows – it served to capture an entire year's flood and thus conserve water that would otherwise have flown directly to the Mediterranean Sea. This has been greatly successful, particularly in the very lean years of the middle to late 1980s when the level of the reservoir fell so low that the turbines themselves were about to be turned off (levels were recorded daily

on the front page of one of Egypt's most popular newspapers, *Al-Ahram*). However, as an electricity-generating structure, the High Aswan Dam increasingly loses its importance as Egypt exploits alternative – particularly thermal – energy options. To the annoyance of some upstream states, the reservoir continues to lose – certainly when it is very full – probably in excess of 10,000 Mm^3 of water a year through evaporation and seepage. While this was anticipated under the apportionment of the 1959 Nile Waters Agreement, it remains an understandable bone of contention upstream.

Losses on this scale are enormous (virtually the equivalent of the annual flow of the Okavango River), considering the lack of entitlement under the agreement of any upstream state to Nile water. Earlier hydrological plans for the river, devised by the British, envisaged storage upstream at higher altitudes where losses due to evaporation would have been far lower (similar to the Lesotho Highlands Water Project), thus resulting in net gains for the system. These plans were echoed in the Blue Nile waters study carried out by the United States Bureau of Reclamation in response to the High Aswan Dam development in the late 1950s and early 1960s (see USBR 1964). However, upstream storage that left water control beyond its borders remained politically impossible for Egypt, at least until the end of the Cold War.

Hydropower development is now inextricably linked to wider debates on dams and development (World Commission on Dams 2000). This has reduced the likelihood of further large dam construction in both basins unless it satisfies a stringent set of criteria. Dams within the Nile basin remain contentious. The Sudanese government is pressing ahead with the construction of the Merowe Dam on the Nile north of Khartoum for hydropower development, rather than raising the height of the existing Roseires Dam on the Blue Nile. There are significant upstream-downstream issues, even between the two treatised states, due to Sudan's existing underutilisation of its water share. There is some suggestion that Egypt prefers the Merowe to the Roseires project, because the former would be almost exclusively for hydropower development, while the latter would also allow far greater gravity-fed irrigation of existing irrigation schemes in the country (personal communication with Sudanese opposition member, 2002). This would represent a greater loss from the system and reduce some of the excess flows to Egypt that now serve the Western Desert via the Toshka canal. (The canal is a huge project with construction costs alone for the main canal about US $1.4 billion. The total scheme is anticipated to cost up to US $60 billion in the next 20 years. The idea is to lift (by pumping) about 5,500 Mm^3 of water from Lake Nasser into a network of canals into the Western Desert in order to reclaim 540,000 acres of desert. Egypt expects six million people to relocate from the Old Valley. The concept for the agricultural development is high-tech, high-value produce for European markets. There are many claims that the project has not been sufficiently assessed, that it is a huge drain on government resources and that it has contributed to the current economic problems in the country.)

For all three 'eastern' Nile states, there are also significant ecosystem issues at stake. Ecosystem (mis)management has had a great impact on river regulation and

flow, exacerbating the heavy silt load brought down from the Ethiopian highlands by intensive agriculture and poor catchment protection. Some of this siltation, particularly of storage facilities in Sudan, has probably contributed to the recent catastrophic floods in Sudan (the Nile reached some of its highest levels in decades in 1998 and 2001). For the Ethiopians, meanwhile, the rainfall regime, particularly the *keremt* rains from August to October, contributes to the rapid decline in soil fertility and severe soil erosion in many parts of the Blue Nile basin.

The effect on ecosystems of changes in management is significant at many levels. The High Aswan Dam caused significant environmental effects in the Egyptian delta in the decades after construction, increasing saltwater intrusion, coastal degradation and channel scouring, as well as initially reducing the important sardine catch along the coast, all directly or indirectly caused by reduced silt load. In Sudan, the partial completion of the Jonglei canal – while not having major ecological impact thus far – has had a social impact by hampering the movement of humans and cattle. Its completion would have major consequences for the Sudd area, one of the largest and most significant wetland ecosystems in the world (normally about 13,000 km^2 in size, compared to the Okavango Delta's 8,000 km^2, but capable of expanding to twice its normal size in years of exceptional White Nile flows). The Sudd is a huge area of swamp in southern Sudan through which the White Nile meanders at slow speed and with high evaporation loss. Reducing this loss through speeding up the passage of water through the Sudd via the Jonglei Canal was the key aim of the project. Any savings would be divided equally between Sudan and Egypt. The Sudd covered almost 30,000 km^2 in the early 1960s.

On the supply side, key issues relate to variations in flow and the kinds of efforts undertaken by all riparian states to manage flows and regulate discharge for irrigation and hydropower purposes. The High Aswan Dam is by far the largest structure, although the Toshka diversion and the Al-Salam canal are further examples of major engineering works on the Nile in Egypt. In Sudan, there are key dams at Roseires and Damazin, and now defunct storage facilities at Jebel Aulia built under British Condominium largely to serve the Egyptian need for summer flows (when the Blue Nile flood had reached its lowest point). In Ethiopia, there are dams on some tributaries of the Blue Nile, but the only one of any major significance is at Fincha. Most irrigated development has had to be developed outside of the basin in order to attract investment and is largely found in the Awash Valley (Nicol 2001). The huge silt load in Ethiopia renders many small and medium-sized dams rapidly obsolete, but also affects the maintenance and management of hydropower units.

Storage is also a critical issue in the Nile Equatorial Lakes states, most notably in Kenya and Uganda. The Owens Falls Dam in Uganda produces significant hydropower output, and the country is also developing a further, controversial Bujagali Falls project. The demand for power from rapidly growing urban areas is the main rationale behind the latter. In all cases, the management of these large structures is increasingly viewed in terms of their environmental and social impact.

This raises the critical issue of weighing up trade-offs between different development options and the weights to be attached to the various social and economic outcomes. In the case of the Nile, environmental factors at both national and basin levels are increasingly influencing decision-making. Not only is environmental and biodiversity protection far more globally significant than in the past, but the connections between environmental degradation and development costs are more readily made. In fact, the greater weight being given to environmental factors has catalysed cooperative development along the Nile through providing 'win-win' opportunities visible to all major basin states.

Nevertheless, difficult national issues arise about 'fixing' the flows of benefits to states against the potential negative trade-offs. While national-level elite may perceive a benefit stream at national level – possibly from the sale of hydropower to neighbouring states or environmental flows helping to secure tourism revenues – civil society may have a different view of and access to such benefits. Fundamentally, the question is how such benefits are to be distributed within riparian states. It is in these regional, national and local linkages – particularly at the lowest level of impact – that the net benefits of greater cooperation will arise and, effectively, where successes will be judged. This raises many of the thornier development issues such as the distribution of wealth, state intervention, subsidisation, compensation and other forms of benefit distribution. These demand that, at a minimum, the arrangement entered into goes far beyond the traditional confines of water management institutions.

The Nile Basin Initiative provides a good example of a successful process of this nature that, thus far, has increased awareness of development needs and sought creative approaches to problem-solving. The initiative is examined in the next section.

The Okavango

The key development issues in the Okavango basin are somewhat different to those in the Nile basin. On the demand side, the agricultural use of water is far less significant and abstractions correspondingly lower. This could change if Angola begins to develop its irrigation potential on key watershed tributaries. The food security question is addressed through imports, particularly from neighbouring South Africa. Within the basin itself, important communities – predominantly low-income, mixed agriculture and pastoral – are found along the river and depend on its resources.

Industrial and urban domestic use, however, is of far greater significance nationally to each riparian, not least because the flow regime of the Okavango River is more sensitive to such abstractions than the Nile. The growing demands placed on the river by Namibia and Botswana are therefore important and, in the case of the former, originate in parts of the country external to the basin itself. In Botswana, the growth of population centres in and around the delta adds to problems of resource degradation – and demand on resources, including the high abstraction of groundwater.

The issue lies particularly in the key 'downstream' land-locked delta, which is an area of globally significant biodiversity. This is perhaps the most sensitive area of the basin in terms of trade-offs between co-riparian development trajectories. Not only is the ecological integrity of the delta a major international issue, but tourism development of the resource is an issue of critical national economic importance for the Botswana government. For Namibia, the need is mainly for industrial and municipal water, particularly in the central part of the country that lies beyond the boundaries of the basin. The different needs clearly have an impact as "disparate levels of dependence upon the basin's natural resource base in each country create barriers to harmonised development of the basin as a whole" (GEF 2000).

In general, the complexities of national development in the three major riparian countries complicate the demands placed on the resource, while exacerbating the dangers of resource degradation caused by increasing soil loss – in Namibia through overgrazing, and in upstream Angola through unplanned development.

Key concerns: Water and development

The underlying dynamics of cooperation in shared river basins such as the Nile and Okavango are located in the need to balance trade-offs between the distribution of the resource, demands for it, and the benefits that can accrue from its use. This is the case as governments move towards cooperative development processes. The move from political contestation to realisation of benefits and trade-offs in their apportionment is not easy. Trade-offs are related to a number of variables – including political structure, governance processes, decision-making contexts and social and economic environments – which ensure that national political economies and their different domestic constituencies are important. One of the most difficult challenges in achieving cooperation and development involves the construction of new systems of sharing that can articulate the benefits to be shared in terms of national interest, while addressing ways of maximising the benefits to be shared between states. There is a need to look both outwardly towards neighbouring states and inwardly towards internal interest groups and political constituencies, whether these are economic, ethnic, political or environmental.

One of the key features of this challenge is to understand the capacity to adapt to change (Turton & Ohlsson 1999), both in the distribution of the resource and the surrounding social and economic decision-making environment. There are perhaps two important facets of 'adaptive capacity' that need to be emphasised. The first is what may be called 'static' adaptive capacity, or the existing capacity to adapt to changes in resource availability. The second is 'dynamic' adaptive capacity, or the ability to increase capacity to adapt in response to significant changes in water availability. The latter has more to do with the wider decision-making environments and the 'reflexiveness' of social and political structures, which include elements of a 'smart economy' such as training, education, awareness, communication, and others.

It is not necessarily short-hand for more 'open' economies, though trade liberalisation as an option to help ensure food security can clearly help to enhance the capacity to adapt to changes in water availability by readjusting flows to agriculture.

Both these conceptions of adaptive capacity should be explicitly woven into the benefit-sharing approach. Understanding the dynamics of cooperation in terms of benefits from the basin as a whole and the sharing of these benefits, reduces the emphasis on upstream-downstream issues and, in many ways, reduces the relevance of international legal instruments based on particular water-sharing formulae.

Such an approach also introduces normative social development issues that are harder to define. These focus on equitable and sustainable development at basin level, which challenges traditional norms and processes associated with water-sharing arrangements. Benefit-sharing also raises particular questions about global-local linkages. If protection of an international wetland resource under the Ramsar convention provides a constraint to the utilisation of resources for socioeconomic development, the question arises how the trade-offs are to be understood in terms of opportunity cost to particular national development opportunities, and perhaps even compensated for under particular benefit-sharing approaches.

An important starting point is to distinguish development (mis)perceptions from realities, including those about issues of water for agriculture and water for the environment. Once there is a clearer agreement on the development realities of using water, the politically feasible trade-off options can be identified. This emphasis on process issues is examined in the next section. At its root is the need to build consensus around agreed facts and realities – the mjor purpose of this book – to achieve national development trajectories that can be accommodated within a water-sharing environment.

What drives cooperation

The drivers of cooperation are sometimes related to circumstance, as mentioned at the outset, or are the outcomes of external influences. This section analyses some of the dynamics of cooperation in both basins. It is important to point out that the cooperative timeframe in both basins is relatively recent, with the exception of bilateral arrangements such as the Nile Waters Agreement. Approximately a decade has elapsed in each case between early efforts and current institutional structures and process dynamics. Before success can be measured in future socioeconomic benefits, further decades will inevitably come and go. Commitment has to be long-term because immediate benefits are unlikely when the issue is really one of fundamental economic and social change.

The Nile

One of the key contextual drivers remains political feasibility. In the case of the Nile, the post-Cold War development of states helped to facilitate new approaches to

cooperation. In response, the Nile Council of Water Ministers (NileCOM) was inaugurated in the early 1990s. Part of the precursor to these initiatives was the Nile River Basin Action Plan developed in 1995, which recommended the spending of approximately US $100 million on several preliminary basin studies.

The World Bank's response was the major impetus behind the Nile Basin Initiative. Instead of sticking to Operational Directive 7.70 that prevents it from lending to one riparian if any other riparian objects to the proposed project, an approach was adopted based on the principle of subsidiarity. This enabled the 'division' of the basin into two key areas – the Eastern Nile and the Nile Equatorial Lakes – and subsequently provided the major impetus to continued cooperation through a reduction in transaction costs and increased linkage of benefits to riparian countries.

Future development scenarios based on growing demand for the resource also revealed major problems ahead for Egypt's use of the water, largely because of the rapid increase in population rates. In effect, therefore, a combination of national development contexts and external political feasibility helped to open up space for joint dialogue. This was reinforced at technical level by the establishment of the Nile 2002 series of conferences in the early 1990s, which brought specialists from all backgrounds, including government, together initially for largely technical, but increasingly also for socioeconomic and legal discussion of the basin context.

Assisting in both processes was another important dynamic – the facilitation of major donor agencies, in particular the World Bank and bilateral agencies such as the Canadian International Development Administration (CIDA). It was out of this initial early facilitation, and the convening of the Nile 2002 series in countries basin-wide, including in Ethiopia in 1997, that the Nile Basin Initiative developed. An important step in the development of cooperation has subsequently been the building of confidence and stakeholder involvement through study tours by parliamentary representatives and others, and through the joint commitment to a broad vision of what the process should look like and seek to achieve. This process of moving from the general to the particular enables barriers to political feasibility to be overcome in a progressive manner. One of the key catalysts in this process is attempts to help riparian states to understand the mutual advantages derived from cooperation.

The positive approach to this form of interstate cooperation is balanced by sceptical views that regard perceived state gain and advantage in the longer term as the main motivation. The more powerful states are happy to achieve short-term (negative) trade-offs in return for longer term advantage – including little real change in the sharing of water. In addition, there are long-term problems of dynamic adaptive capacity. This refers to the greater educational, technical and social capacity of some states to gain from the complexity of benefit-sharing arrangements, not least being an ability to field larger numbers of technical experts to identify the key trade-offs and costs involved in future decisions within the Nile Basin Initiative (NBI).

The Nile Basin Initiative developed in 1998, after it was recognised by all riparians (though Eritrea was to join only later as an observer) that "cooperative

development holds the greatest prospects of bringing mutual benefits to the region" (NBI 2001). The transition mechanisms officially launched in February 1999 comprised the Council of Ministers of Water Affairs of the Nile Basin (Nile-COM), a technical advisory committee (Nile-TAC), and a secretariat (Nile-SEC). At the meeting of Nile-COM in February 1999 the governments adopted a shared vision "[t]o achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources" (NBI 2001). To achieve this vision, a strategic action programme was drawn up combining a shared vision programme and subsidiary action programmes. The action programmes comprised development projects at sub-basin level, which sought to translate visions into "concrete activities and seek to realise transboundary development opportunities" (NBI 2001). The two subsidiary programmes focus on the Eastern Nile (Egypt, Sudan and Ethiopia) and the Nile Equatorial Lakes (NELSAP) including the six countries in the southern portion of the basin – Burundi, the Democratic Republic of Congo, Kenya, Rwanda, Tanzania and Uganda – as well as Sudan and Egypt. The latter's inclusion is a signal that the strategic interests of Egypt also extend to this portion of the basin.

The initial external partners – the World Bank, the United Nations Development Programme (UNDP) and CIDA – have more recently been complemented by other donors, including the Scandinavian countries and the United Kingdom, through the International Consortium for Cooperation on the Nile (ICCON). The shared vision programme includes sub-programmes on environmental action, power trade, water for agriculture, water resource planning and management, confidence-building, stakeholder involvement, applied training, socioeconomic development and benefit-sharing.

The Okavango

While the Okavango is one of the least 'developed' rivers in Africa, there is increasing pressure to develop the basin's resources. In partial reaction to the pressure, but also as a reflection of the changing political context in the region, the OKACOM agreement was made in 1994. In 1995, OKACOM declared a commitment to the implementation of an environmental assessment and integrated management plan for the whole basin, supported by the Global Environmental Facility (GEF). Under OKACOM, all transboundary water issues would be discussed through interministerial representation, including issues of prior notification and other matters.

Barriers to transboundary management remain, illustrated in part in the lack of coordination between national policies and institutional arrangements. While the GEF argues that the primacy of national interests results in the imposition of transboundary externalities, the costs of cooperation are high, not least due to enduring communications barriers and poor understanding between the countries. As a recent report clearly showed (ODI/Arcadis 2001), the trade-offs and uncertainties in the basin are acute. The basin represents the only water flowing in Namibia and Botswana as all

other perennial rivers are on the borders of both states (see map 1 on p 10). While conflict in Angola has virtually stopped any development from taking place, the end of hostilities means this will soon change. The two countries with the highest demands on the resource lie downstream but contribute almost nothing to the streamflow – akin to the situation of Sudan and Egypt with respect to Ethiopia. The challenges facing cooperative institutions in the Okavango are therefore significant. Future cooperation will also have to contend with the Ramsar status of the delta ecosystem and the constraints this will place on Botswana's development of its aquatic resources.

Future prospects: Cooperation and development?

Processes of river basin management take time both to establish and to function, not least because of the challenge to understand the complexities of development. Processes of cooperation are only as effective as the institutions through which they are managed, which are in turn only as effective as the data they have at their disposal and their knowledge, skills and other human capacities to utilise this data.These are all critically important second-order resources that are in short supply across the whole basin (see Turton & Ohlsson 1999). Getting the process 'right' in terms of effecting meaningful development of shared water requires a process-oriented view.

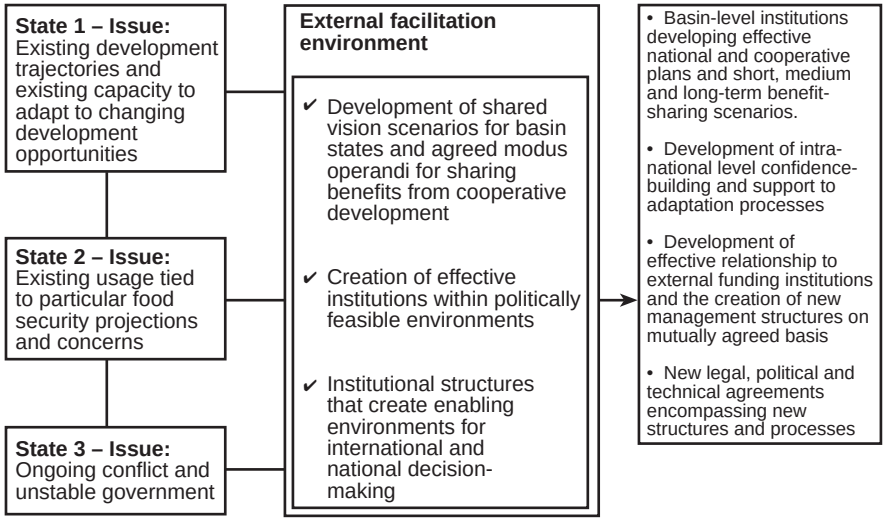
Increasingly, there is an understanding that governments cannot 'go it alone' in this process, both in terms of understanding the challenges of basin development and in understanding the impacts on human and natural environments. The inclusion of civil society in a process such as the Nile Basin Initiative recognises this fact, and the importance of including society in decision-making processes. The local impact, mediated through national processes, has to be a key driver of decision-making on benefit-sharing and cooperation (see figure 1).

The challenge is no longer about resource capture, agreed shares of water, supply-led development and apportionment, monitoring, early warning and other factors. In the case of the Okavango, in particular, there is an acute need to shift from an era of supply management to policy responses that focus on addressing future demand scenarios, particularly as Angola comes 'on-stream' in its demands on the resource. Not only are the demands on the resource and the impact on the resource base now going to be far greater, but the global institutional development context has changed with the need to bring basin management into wider poverty reduction approaches strongly emerging at present.

The need for facilitated shared water development is therefore great and it is apparent that an internationally coordinated approach is required that would exchange experiences, demonstrate best practice and assist in technical and financial development, as well as helping (crucially) to achieve what is politically feasible. A recent study conducted by the Overseas Development Institute (ODI) and Arcadis Euroconsult (2001) on behalf of the Swedish Foreign Ministry, recommended that an International Shared Waters Facility should be established based on a 'partnership

Figure 1

Building linkages between cooperation and development processes



model'. It should draw on the established roles of actors such as the World Bank, the UNDP and GEF, while maintaining close liaison with related international initiatives such as the Global Water Partnership. Its charter would highlight the importance of transboundary water management as an international public good and would promote the principle of subsidiarity in the provisioning of such a good. As well as serving as an international source of arbitration for riparians, the facility could help to develop modalities between financing institutions in order to facilitate funding arrangements for new and existing initiatives, and would support institutional development in water resources management within regional multilateral organisations.

In this regard, the mainstreaming of poverty reduction targets within basin development processes is an opportunity that cannot be missed. In the Nile basin countries alone, there are an estimated 300 million people, a large percentage of the continent's overall population. Bringing the approaches of cooperative river basin development in line with national poverty reduction strategy development and broader programming and planning in areas such as health, education, employment and the environment is therefore a development imperative.

Addressing the institutional challenges within a basin such as the Nile is only just beginning to be realised. But without the connection between basin management and wider development goals, cooperation may proceed apace, but it will exist in a development vacuum. Currently, the Nile Basin Initiative is setting up a benefit-sharing programme that will assist in linking all the other programmes and provide the key process by which to achieve social development objectives. Important lessons are likely to emerge for other basins, including the Okavango.

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CHAPTER 9

Ephemeral and endoreic river systems: Relevance and management challenges

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Abstract

Ephemeral and endoreic rivers are located in arid, semi-arid and dry sub-humid drylands of the earth. Climate variability, strongly correlated with aridity, is a major factor influencing ecological, economic and social sustainability of ephemeral and endoreic rivers (Molles et al 1992). Ephemeral rivers, with temporary surface flow that varies between seasons and years, nevertheless support ecological systems that have been used by people and wildlife for millennia. Endoreic rivers, which may be perennial or ephemeral, are also a focus of use and development in otherwise arid landscapes.

Growth in human populations and changing lifestyle expectations of people living in arid environments have led to greater pressure on ephemeral and endoreic rivers globally, while at the same time attracting more tourism, based on biodiversity and scenery. Commonly, policy guidelines are missing and information to aid management is incomplete, as these rivers tend to occur in remote areas. Nevertheless, examples of mismanagement and non-sustainable use of ephemeral and endoreic systems are legion, and provide salutary lessons to those responsible for management of the Okavango River and its water resources. Potential exists for policy and management options, both traditional and innovative, to ensure continuing supply of water and associated benefits to human and biotic riparian communities and their inland neighbours.

The major management challenge for the Okavango River and similar ecosystems is to balance rights, expectations, responsibilities and opportunities of local people, many beset by poverty in a harsh, arid landscape, with requirements of the ecosystem to maintain these desired services and with expectations and aspirations of the global community. The latter recognise the potential value and opportunities represented by the unique but diminishing assets supported by these dryland ecosystems, but are not required to sustain their own livelihoods from them.

Introduction

Growing human populations worldwide and concomitant increases in use of natural resources have led to increased recognition of the importance of biodiversity, climate change and the threat of increased desertification among

the global community (WECD 1977; UNCBD 1992; UNFCCC 1992; UNCCD 1996).

The Okavango River is a perennial endoreic river with some ephemeral tributaries supporting a unique ecosystem with diverse opportunities for use and development for a variety of local, regional and global communities. For a number of reasons, the three Okavango basin states – Angola, Namibia and Botswana – have not extensively used the landscape or waters of the river or delta for development, although many divergent ideas and plans have been mooted over the past century. To date, the middle reaches of this ecosystem and the delta have been put to limited use by local populations for livestock grazing and harvest of natural products, and for a growing, lucrative tourism industry. As a consequence, it remains one of few, relatively untouched perennial endoreic rivers in the world's drylands that supports a varied and diverse biota in a relatively pristine and spectacular landscape.

Experience from elsewhere in the world has shown that endoreic rivers, occurring as they do in drylands, are in a relatively fragile state of hydrological and ecological balance, easily and often subject to degradation. The Aral Sea in central Asia supported a thriving fishing industry that has been entirely destroyed by use of its source rivers for irrigated cotton farming. Even if the entire inflow was to be restored to its original volume, neither the water body nor fishery could be restored to their former levels (Goldman 1994). Climate change is also affecting water bodies, and Lake Chad, located in the Sahel, has diminished in size by over half its surface area during the last century, apparently due to natural causes. Peace and potential development in Angola, source of the Okavango River, and use of water from its middle reaches to support the burgeoning and urbanising population of arid Namibia, could produce a similar effect to that of the Aral Sea. If combined with predicted increased aridity in the area due to climate change, the future of a perennial Okavango delta could be in jeopardy. This would negatively affect ecosystem services provided to the local population (among others, clean water) and their direct use of natural resources (such as fish and wood), as well as globally important biodiversity in the area and income generated from tourism.

Namibia is one of the Okavango basin states with a significant percentage of its population dependent upon water from ephemeral rivers. About 20% of the country's surface area and 20% of the population depend on 12 westward-flowing ephemeral rivers (Jacobson et al 1995). Another 50% of the people live along the endoreic, ephemeral wetlands of the Cuvelai system in north-central Namibia, while another 20% depend on other ephemeral systems and groundwater. Only 10% of Namibia's population uses perennial river water to support their livelihoods. These proportions emphasise the importance of ensuring development and use of very localised, fragile but important ecosystems in a socially, economically and environmentally sustainable manner. In Botswana, the Okavango Delta supports a population of approximately 30,000 (2% of the national population) while the

remainder depend mainly on groundwater and a few surface impoundments on ephemeral rivers.

Ephemeral and endoreic rivers

In an ephemeral river, water flows sporadically and for short periods following heavy rain or snow melting in its catchment during spring. Water may flow for hours or even days, but rarely longer. Jacobson (1997) defines an ephemeral river as one in which measurable discharge occurs for less than 10% of the year. Over time, a particular river can change from perennial (where water flow is continuous) to ephemeral, or vice versa, depending upon climatic and environmental circumstances. Another important feature of an ephemeral river is that, although the river channel's surface may remain dry for most of the year, there is usually a significant volume of water stored beneath the channel (Jacobson et al 1995).

An endoreic, or closed water system, ends its journey inland rather than flowing into the ocean. Most endoreic systems terminate as a lake or a sea or, as in the Okavango River system, as a delta. Both ephemeral and perennial systems can be endoreic, and paleohydrological evidence from around the world often shows that a system has changed from exoreic (flowing to the sea) to endoreic due to geological, climatic or environmental factors.

Location

Ephemeral rivers are located throughout the drylands (see map 1). These areas are centred along the tropics, north and south of the equator, where over a billion people in 110 countries try to make a living on more than 30% of the earth's surface (Turnbull 2002). In Africa alone, 35% of these drylands are degraded with over 70 million hectares strongly degraded according to figures provided by the United Nations Environment Programme (UNEP). Twenty African countries have more than 90% of their productive lands in vulnerable drylands, an illustration of the human dimensions of the issue (Turnbull 2002). Very few perennial rivers cross these drylands, with the Nile being one example, and none have their origins there. Ephemeral rivers, as a consequence of their variability, have a higher per capita importance than their volume of water would indicate.

Endoreic rivers are also located mostly in dryland areas of the world between the northern and southern margins of desert zones in both the northern and southern hemispheres. Most endoreic rivers are located far inland from the sea. They tend to have their origins in better watered areas and their endpoints in the drylands. As is the case with dryland ephemeral rivers, endoreic rivers often serve as a focus of activity for people and wildlife and for agricultural and urban development. Endoreic rivers also often have a higher per capita importance than their volume of water would indicate, despite sometimes containing water of lower quality than exoreic water bodies.

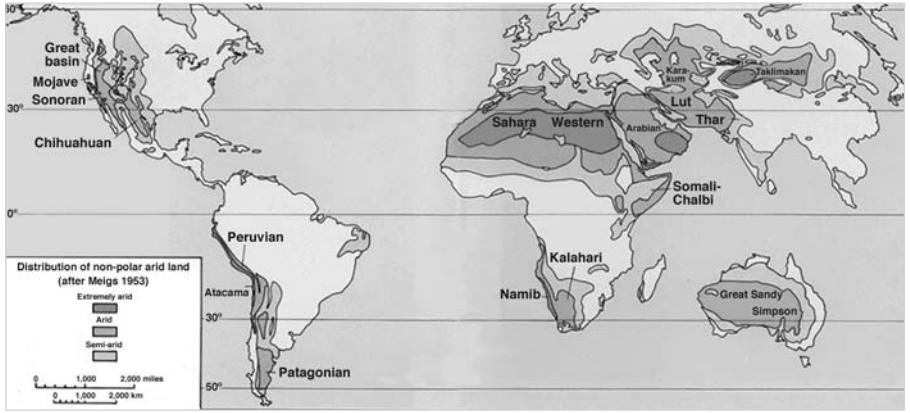
Relevance for the Okavango River

The Okavango River is a perennial, endoreic river with ephemeral tributaries (see map 2). With ongoing and expected increased development in the Okavango River catchment, the possibility exists that main river flow could become more variable within and between years resulting in only intermittent flow. This trend could be exacerbated by predicted regional climate change. Some perennial tributaries, particularly those flowing through sandy substrates, could also become ephemeral as aridity increases. Although figures vary, greater variability and lesser volumes of rainfall are expected in Southern Africa (Tarr 1999) as a result of climate change. Examining and understanding characteristics of ephemeral rivers, including their social, ecosystem and economic aspects on both a local and global basis, are thus of significance to those contemplating either conservation, or development and increased diversion of Okavango River water.

The Colorado River is an example of a perennial, exoreic river, flowing from high rainfall areas into an arid region, which has been converted into an endoreic system with little or no flow in its delta, due entirely to anthropogenic development. Much of this development occurred in the guise of progress during the first half of the 20th century. Regulations and agreements between the United States and Mexico and

Map 1

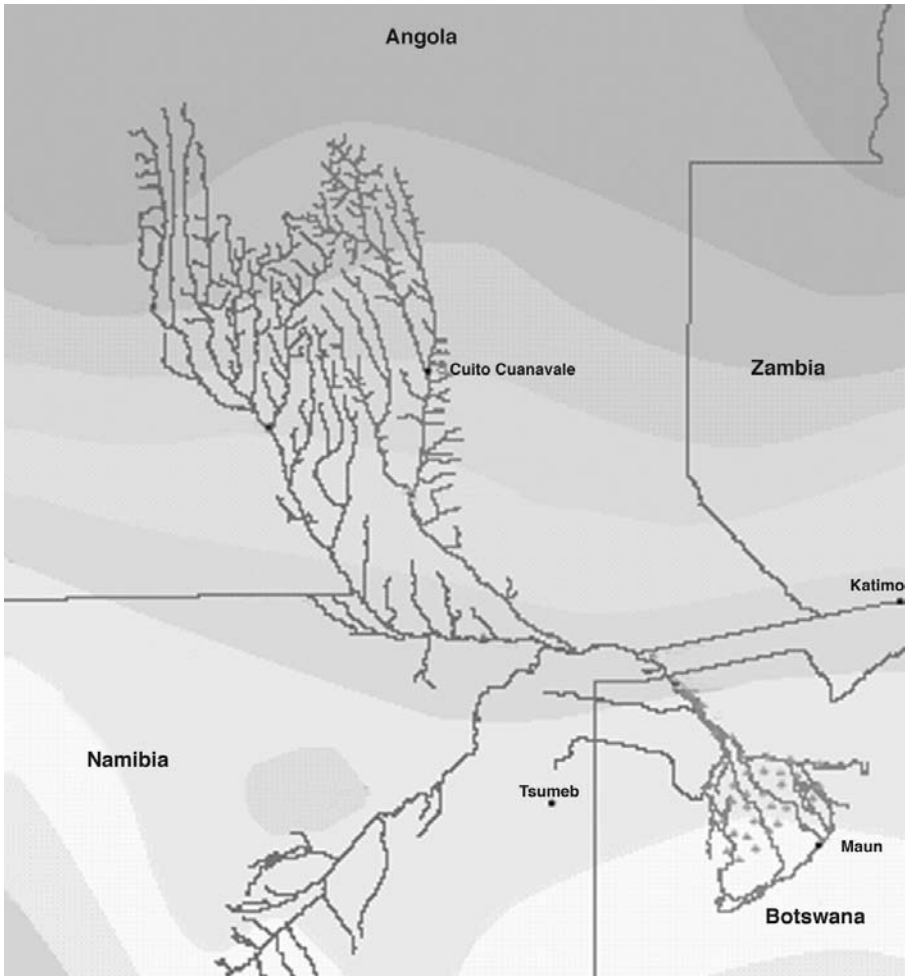
Arid and semi-arid areas of the world



Source: <ag.arizona.edu/OALS/IALC/About/aridlands_map.html>.

Map 2

Okavango River system



Source: el Obeid & Mendelsohn 2001.

among US states contribute to continued exploitation of this river, thus entrenching its endoreic nature.

Geographical characteristics of ephemeral and endoreic rivers

Ephemeral rivers, large and small, are predominantly found in the world's drylands. These rivers may be ephemeral in their lower reaches with some perennial flow in their upper reaches or where a rocky substrate forces groundwater to the surface in localised areas. Many ephemeral rivers are also endoreic, that is, they do not flow into the sea even during the highest rainfall. This may be the result of insufficient water in their upper courses, for example, in ephemeral rivers associated with mountains of the Sahara, the Tibesti or Agghar. Alternatively, this may be the result of sand dunes or other obstacles blocking their course, for example, the ephemeral Tsauchab River flowing into Sossus Vlei in Namibia. Other ephemeral rivers flow into the sea during high flows, or could, if developments had not diverted their surface flows. In Namibia, 10 of the 12 major westward-flowing ephemeral rivers flow into the sea on occasion, and the southward-flowing ephemeral Fish joins the perennial Orange that empties into the southern Atlantic Ocean. Namibia's perennial rivers also have ephemeral, endoreic tributaries that, although considered part of the basin, rarely flow. These include the Nossob, a tributary of the Orange, and the Omatako connected to the Okavango.

The geology through which ephemeral rivers flow also has an effect on their regimes and classification. The Nossob, for example, flows through the sandy Kalahari while the Fish River flows through hard rock areas along most of its length. Changing geomorphological conditions may also influence river classification as ephemeral and endoreic or as ephemeral and exoreic. In Namibia, the ephemeral Hunkab River of the northern Namib was considered endoreic, damming up against the Skeleton Coast dunes. In 1995, a large, localised downpour in its headwaters caused the river to cut through the dunes to the sea for several days (Jacobson et al 1995). This event uncovered evidence that surface flow to the sea had happened previously. Within a few years, any sign of dune disturbance was obliterated.

Aridity and its associated rainfall variability are key factors determining ephemerality of rivers, as is the very high rate of evaporation. In the western ephemeral catchments of Namibia, evaporation is more than six times greater than mean annual rainfall in the inland headwaters and more than 100 times greater in the arid west (Jacobson et al 1995). Evaporation leads to rapid loss of rainwater from the system. Where surface water is present at springs and wetlands, high evaporation frequently results in very saline soils. Because of limited water flow, salts build up and the only types of vegetation that can survive around these springs and wetlands are salt tolerant species. The efficiency of dams in drylands is also seriously affected by the high rate of evaporation.

Drought, the result of variable rainfall in arid environments, is another factor correlated to ephemerality of rivers in drylands. Although drought is a normal

occurrence in drylands, people are usually unprepared for it when it occurs. Periods of drought often result in increased pressure on surface and subsurface water.

Endoreic systems form as a result of interruption of surface water flow that arises from a balance between inputs (precipitation and surface flows) and outputs (evaporation and seepage). Because inflowing water subsequently flows into dry watercourses or is evaporated, minerals and other inflow erosion products concentrate within these water bodies. With a continuing mineral input, some endoreic water bodies typically become more saline than those that flow into the oceans. As evaporation plus seepage are the major water outflow pathways, endoreic water bodies also tend to be more sensitive to pollution than those that flow into the oceans (UNEP 2000).

Endoreic water bodies include some of the world's largest lakes. The Aral Sea, a large terminal lake, presents the most disrupted endoreic system in the world (Goldman 1994). Its two major inflow rivers, the Amu Darya and Syr Darya, previously maintained the lake within acceptable boundaries of water quantity and quality for many beneficial water uses. A thriving commercial fishery employed over 60,000 residents in the catchment before the two rivers were more or less completely diverted to irrigate cotton in desert areas of Kazakhstan and Uzbekistan during the mid-20th century. This diversion led to the reduction of the Aral Sea to two-thirds of its original size and the threefold increase in salinity from evaporation. Remaining inflow is loaded with agricultural and industrial pollutants. The catchment is now beset with excessive fertiliser and pesticide use, as well as salinised soils causing serious health risks to local residents. It has furthermore led to extinction of 24 fish species and other aquatic species, ruin of the fishing industry and unemployment. Of particular significance is the fact that devastation of this ecosystem took place within the timeframe of a single human generation. It provides an example of unsustainable socioeconomic development of a catchment with the serious, unplanned environmental, economic, ecosystem, human health and social consequences that arise.

Mono Lake in eastern California is an endoreic ecosystem that was partially destroyed when its catchment water was diverted directly from the Sierra Nevada mountain runoff to Los Angeles. Reversal of this diversion is slowly allowing natural restoration of this remarkably scenic saline lake. The endoreic Oanab River in Namibia was thought to dissipate into the Kalahari sands after a flood until a dam was built across its lower reaches. Now, as the nearby artesian aquifer level decreases, possible connection with the Oanab River comes into question. Endoreic systems in arid environments still hold surprises for those wishing to develop their water resources.

Environmental characteristics of ephemeral and endoreic rivers

Ephemeral rivers have long been of importance to people and wildlife living nearby, representing linear oases or riparian corridors through otherwise dry landscapes (Jacobson et al 1995). Today they represent focal points of human development and natural biodiversity in drylands.

Ephemeral rivers are not only important for their water resources, but also for the vegetation and other biota that they support. Structure, productivity and spatial distribution of biotic communities are strongly affected by flow patterns. Altering flow negatively affects this fragile balance and reduces overall productivity. Soils in most ephemeral rivers are relatively poor and thin and have little potential for irrigated agricultural production. These same soils, however, support dense stands of trees and other woody vegetation, which provide essential fodder for livestock and wildlife. In evaluating potential benefits of any development, various factors must be considered such as poor drainage, high salinisation potential and particularly the great volumes of water required for irrigation (Jacobson et al 1995; Jacobson et al 2000).

Flooding is an important element in the structure and maintenance of ephemeral river ecosystems. Jacobson (1994) vividly describes a flood in the Kuiseb River:

> "The leading edge of the flood was nearly a meter high and looked more like lava than water as it rolled rapidly down the channel. The water was loaded with sediments and organic material, including seeds, sticks, logs, grasses and animals of various shapes and sizes. The water itself contained high amounts of nutrients and dissolved organic carbon. All of this material was carried downstream and deposited within the desert reach of the Kuiseb River."

Floods in ephemeral rivers are usually produced by heavy downpours that leave little time for water to infiltrate the soil (Jacobson et al 1995). The rate of water flow, or discharge depends upon the volume and pattern of rainfall in the catchment and where it is measured (see, for example, figure 1). Discharge increases until the combined effect of evaporation and infiltration causes a decrease in water level. Infiltration, the seepage of water into the channel bed, is the main factor contributing to downstream decline in discharge. Infiltration and evaporation are so great that discharge often stops before the flood reaches the river end. Large flood variations, coupled with a limited record of past floods, provide a serious barrier in understanding the resource base in ephemeral rivers, as well as to their sustainable management.

Presence of fish in ephemeral rivers usually depends on presence of perennial water somewhere along the river's course. This is one of few ecological systems where it is sustainable to remove all fish. They die as the river dries up and regenerate from perennial river sections.

Terminal water bodies of perennial or ephemeral endoreic river systems are varied. In the Kalahari basin, the Okavango River forms a perennial delta of varying size controlled by tectonic movements in the area. In the Cuvelai basin of north-central Namibia, the extensive, saline Etosha Pan receives water only occasionally, the last big inflow dating back to 1971 (Berry et al 1973). Sensitivity to salinity and pollution are characteristics of all endoreic systems, although some are already so saline – the Etosha Pan, Mono Lake – that increasing salinity is not currently a

relevant factor. Fish are an important economic asset in some endoreic systems, but salinity or other factors preclude them from others. Waters of the Okavango Delta are not as saline as might be expected given that evapotranspiration accounts for about 96% of water loss. Transpiration dominates over evaporation especially in the permanent swamps, and resulting saline water seeps away in groundwater flow. This coupled with bacteria in peat swamps, which absorb salts, prevent formation of saline surface water (McCarthy 1992). How the system would react to increasing levels of pollutants remains to be seen.

Economic, social and environmental benefits

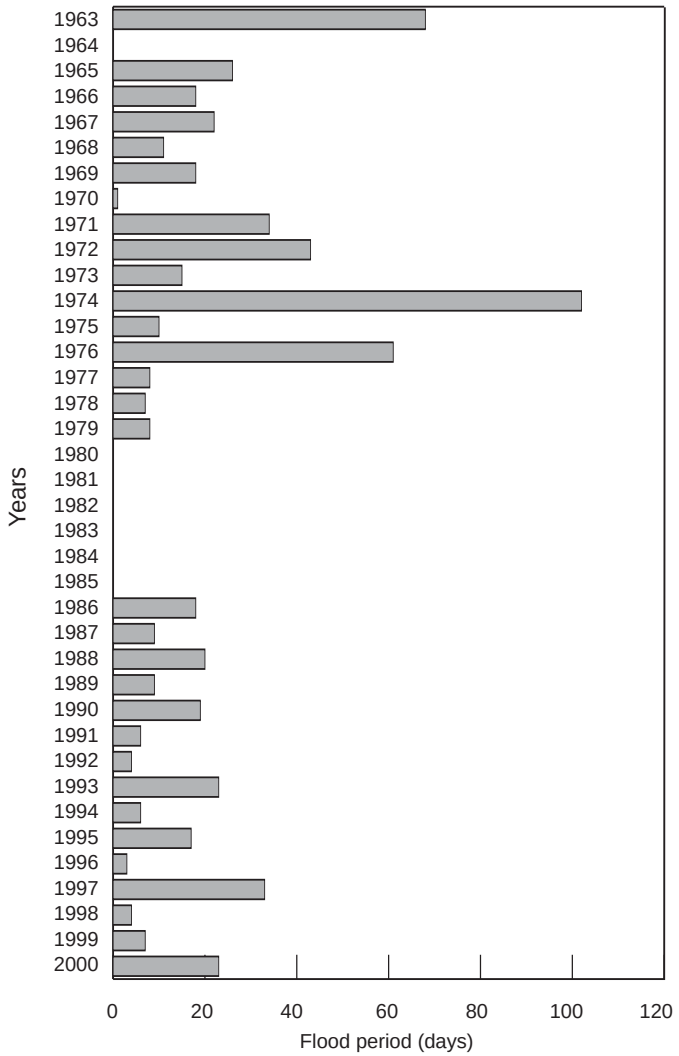
Perennial and ephemeral rivers have different users along their courses that share benefits and cause differential impacts. Perennial rivers usually originate as small streams that swell as water enters the system from numerous tributaries. Many large cities in temperate regions are located along the lower reaches and near the mouths of large perennial rivers. Ephemeral rivers, on the other hand, often have more water in their upper reaches, present for a longer time, than in the lower river course. Urban and large-scale agricultural developments dependent upon ephemeral rivers either use surface water captured in artificial dams, or groundwater stored in ephemeral aquifers. Sharing of water between upstream and downstream users therefore differs fundamentally between perennial and ephemeral rivers. Moreover, a greater proportion of water available in ephemeral rivers is consumed per capita than in perennial rivers. In the ephemeral Swakop River in central Namibia, the proportion of surface water impounded in its upper reaches has reached 100%, with consequent impact on productivity downstream, and is still insufficient to support Namibia's capital, Windhoek.

Sharing benefits between upstream and downstream users in endoreic systems is similar to that of ephemeral river systems because of the general landscape aridity and all that portends. As with ephemeral rivers, a great proportion of all water can be removed from endoreic systems short of their natural endpoints because of lack of inflow from surrounding arid landscapes.

Endoreic systems, whether perennial or ephemeral, contribute to groundwater recharge and support riparian ecosystems. Variable flood regimes are responsible for induction of germination and establishment of woody vegetation, and serve to recharge wetlands. Because of their function as linear oases or riparian corridors in drylands, they become a focus for urban centres, agriculture, irrigation, tourism and other human activities. Water may be directly abstracted from perennial endoreic rivers for domestic use or agriculture including irrigation. Impoundments may enhance human management and use of endoreic systems but, as with other arid zone water systems, there is a fine balance between benefit in the form of additional water and loss of alternative benefits, also dependent upon water, from the system.

Figure 1

Flow variability in the ephemeral Kuiseb River



Source: DRFN

Sharing upstream/downstream benefits and impacts

The Kuiseb River presents a good example of how water from an ephemeral river is shared among users. Over 100 commercial farms share the upper 63% of the catchment area (Jacobson et al 1995), each excavating from one to 20 farm dams, many of which have silted up in recent years (Angula et al 2001). Groundwater in the river's middle reaches supports wildlife of the Namib-Naukluft Park and Topnaar communal farmers. Meanwhile, the alluvial aquifer of the lower Kuiseb, which depends on recharge from occasional flooding, sustains the harbour and fishing town of Walvis Bay. In the recent past, the lower Kuiseb aquifer also supported the resort town of Swakopmund and Rossing uranium mine. As population of the coastal towns increases, along with increased fishing and harbour activities, greater use is made of the alluvial aquifer. At the same time, plans for a major dam in the middle reaches of the Kuiseb to support a new uranium mine are being pursued, which would reduce or eliminate recharge of the lower Kuiseb aquifer. Even now, accusations are made downstream that commercial farmers are withholding more than their fair share of water resources. Communal farmers accuse coastal towns of lowering the alluvial aquifer upon which their indigenous crops depend. Recent initiation of a basin management committee is one of the approaches being applied in an attempt to resolve issues and establish an agreed upon vision, shared by all users of this ephemeral river.

The Cuvelai system (map 3), which is endoreic as well as ephemeral, also presents an example of multiple use of an ephemeral wetland. In the headwaters, situated in Angola, little use is made of apparently perennial streams, although there is a proposal in hand to build a dam to recharge groundwater upon which a growing border town depends. Once the river crosses the border into Namibia, populations of people and livestock making use of the water increase significantly. Flow in the ephemeral wetlands recharges aquifers and traditional surface water sources, provides fish, supports indigenous vegetation and enhances water supply and grazing for livestock.

Where water accumulates in temporary pans, competition exists between fishers and livestock. It is only when flooding has been unusually high, as in 1971, that water flows down the entire course of these ephemeral wetlands into the end point, the Etosha Pan (Berry et al 1973). The Cuvelai basin, including the Etosha Pan, is currently the only ephemeral Ramsar site registered in Namibia (Barnard 1998).

Surface water

Flowing surface water in ephemeral systems is usually of little direct use to people because of the short duration of flow. It must therefore be impounded in artificial or natural dams and pans or recharge groundwater aquifers before it can be used by people. Flowing surface water is important, however, for germination and establishment of riparian vegetation as has been noted in the Kuiseb River (Jacobson

et al 1995), and for redistribution of fish. Flowing surface water is also responsible for the dynamics of expansion, contraction and rejuvenation of ephemeral water courses and associated dryland systems (Friedman & Lee 2002).

Groundwater

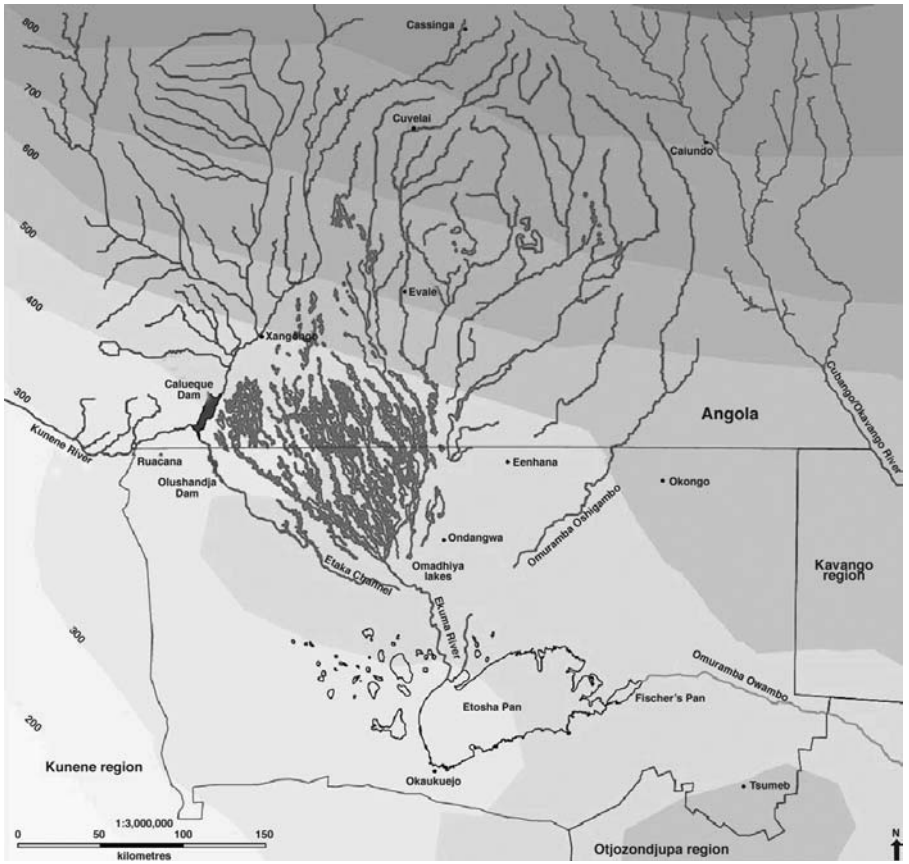
Groundwater recharge is one of the most important functions of floods in ephemeral rivers. As a flood travels down an ephemeral river, water infiltrates into the sandy and gravelly alluvial deposits of the channel beds. The degree of recharge depends on intensity, volume and duration of a flood (Heyns et al 1998).

When the groundwater table is just a few metres below surface following a flood, people and animals obtain access to groundwater by digging in the riverbed. Today, boreholes and pumps ensure year-long accessibility to water along ephemeral rivers. Permanent watering points enable formation of permanent settlements and facilitate sedentary livestock farming, irrigation and industry. This shift from a semi-nomadic to a sedentary livelihood has resulted in land degradation and even desertification in some areas. In Namibia, local communities keep vegetable gardens along the Omaruru, the Ugab, Hoanib and the Swakop rivers, while commercial crops are grown in the lower reaches of the Swakop (Jacobson et al 1995). Coastal towns of Swakopmund, Walvis Bay and Henties Bay derive their water supplies exclusively from alluvial aquifers in the Swakop, Kuiseb and Omaruru rivers (Heyns et al 1998). It is estimated that almost 100,000 coastal residents are dependent for their survival upon aquifer resources provided by Namibia's ephemeral rivers (Tarr 2002). In some Namibian rivers, such as the Kuiseb and the Swakop, a gradual decline in the groundwater table is being observed, despite some good floods in recent years. This is a first sign of unsustainable water consumption.

Constant availability of groundwater in ephemeral river channels allows for the presence and growth of woody riparian vegetation. In west-flowing ephemeral rivers dense stands of large woody trees (e.g. *Faidherbia albida* and *Acacia erioloba*) stand in contrast to the otherwise arid landscape. While constant groundwater availability plays a vital part in tree survival, occurrence of irregular, extreme floods plays a vital part in aquifer recharge, morphological reshaping of the channel and also in the age structure and spatial distribution of riparian trees (Friedman & Lee 2002). Riparian forests provide resources for people such as wood for construction and fuel, medicines and fruit, and essential fodder and shade for wildlife and livestock. Because of riparian forest and groundwater availability, ephemeral rivers are frequently referred to as the 'linear oases' of the Namib Desert (Jacobson et al 1995). Human groundwater use is in direct competition with water needs of riparian vegetation and water consumption should be carefully weighed against the value of the riparian vegetation. Furthermore, dam construction affects flood patterns of ephemeral rivers. Dams not only lower the watertable downstream, they also reduce flood size, which has a potential long-term impact on aquifer recharge, channel morphology and

Map 3

The Cuvelai water system



Source: <www.dea.met.gov.na/nnep/orientat3.htm>.

vegetation structure and distribution. The demise of most of the riparian woodland downstream of the Swakoppoort Dam in the Namib-Naukluft Park in Namibia provides a good example of this effect.

Groundwater-fed wetlands occur in Namibia's western rivers where subsurface flow is forced to the surface by bedrock. Such wetlands vary in flow rates, water chemistry and duration of flow. They provide water, food, shelter and a unique habitat for a great variety of plants and animals (Loutit 1991; Christelis & Struckmeier 2001). Archaeological evidence suggests that such wetlands have been used as human settlements for millennia and they are still frequented by local communities, their livestock and tourists today (Jacobson et al 1995).

Groundwater plays a role in both perennial and ephemeral endoreic systems, although the ecological and social importance of groundwater tends to be greater in ephemeral systems. Groundwater contributes to the baseflow of perennial endoreic systems, while it acts as an essential supply to humans, riparian vegetation and animals in seasonal systems (Parsons 2002).

Management challenges

Management challenges and, consequently, policy and legislation challenges presented by ephemeral rivers differ in kind and degree from those presented by perennial rivers flowing into the sea. Management challenges presented by endoreic systems, whether perennial or ephemeral, have more in common with ephemeral systems in that they occur in drylands. The primary factor influencing management actions on ephemeral rivers and endoreic systems is their variability of flow caused by the arid climates in which they are situated. When rivers flow for only a few hours or days in a year, the cost of a management intervention varies considerably depending on flow characteristics and the scale of the proposed intervention. Moreover, because ephemeral and most endoreic rivers are located in arid areas that are relatively sparsely populated and their flow is episodic, data and information are limited on which management interventions could be based.

Opportunities for use of surface water or groundwater of an ephemeral river vary greatly between upstream and downstream locations (Dausab et al 1994; Amoomo et al 2000; Angula et al 2001). The upstream section of an ephemeral river will have surface water present more frequently than the downstream section as it usually occurs in an area of higher rainfall. It is only larger, less frequent floods that reach the downstream water course. On the other hand, storage capacity in the form of alluvial aquifers may be larger in the lower reaches of an ephemeral river, as is the case in the 12 main westward-flowing ephemeral rivers of Namibia (Jacobson et al 1995). Consequently, long-term benefits from occasional ephemeral river flow may be greater in the downstream section of the river compared with upstream locations. Similarly, benefits to be gained from the end point of the endoreic system may be greater than those upstream in an unmanaged system, for example, in the Aral Sea at

the beginning of the 20th century. The reverse can be true with development of endoreic rivers upstream of their endpoints, the Aral Sea again being a profound example. Variations between upstream and downstream locations in terms of opportunities and benefits to be derived from ephemeral rivers, as well as from endoreic systems, cannot be easily generalised.

As populations increase and become more sedentary, more pressure is placed on ephemeral river basins (Marsh & Seely 1992). Not only do more people expect a share of the limited water available from an ephemeral river, but they also expect to use this water for more varied economic developments. Moreover, traditional livelihoods and attitudes tend to be based on the expectation of adequate water at little or no cost. These changing social and economic conditions place additional constraints on developing efficient and effective management approaches to ephemeral river basins and, similarly, to endoreic systems in arid environments.

Ephemeral and endoreic rivers are situated in drylands of the globe where poverty and underdevelopment often dominate. Although many countries in the Southern African Development Community (SADC) are currently revising their legislation (see NWRMR 2000a), policies, legislation and regulations needed to address efficient and effective water resource management are not well developed in countries where ephemeral or endoreic rivers predominate. Because of limited surface flow in the case of ephemeral rivers, they are often ignored by governments and water authorities. On the other hand, many countries involved have ratified the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa (UNCCD), the United Nations Convention on Biological Diversity (UNCBD) and the United Nations Framework Convention on Climate Change (UNFCCC), although implementation of these environmental conventions – and certainly their application to drylands and their water resources – lags far behind ratification.

Many ephemeral and endoreic rivers cross international boundaries or internal state jurisdictional boundaries (Pallett 1997). Few institutions and bureaucracies responsible for water resource management have appropriate mechanisms to handle issues associated with managing, developing or sharing ephemeral river resources (NWRMR 2000b). With the focus on decentralisation in many arid African states, capacity to manage water resources that transcend these new intrastate boundaries is limited (NWRMR 2000c). At the same time, devolution of responsibilities associated with rights over water resources is often not a part of the decentralisation process, although the UNCCD particularly promotes participation in management by resource users (see also NWRMR 2000c).

Vision and management objectives

Vision and management objectives for ephemeral and endoreic rivers in drylands must encompass sustainability of water resources as laid out in the Brundtland report

(WCED 1987), Agenda 21 (UNCED 1992) and the Dublin principles (1992), even though these instruments are often only considered, if at all, in the case of perennial rivers. Basin management approaches integrating ephemeral and perennial rivers, if they are present, surface and groundwater, endoreic and exoreic systems, and land as well as water could help to promote sustainable use of ephemeral river resources (Jacobson et al 1995; NWRMR Policy 2000a). As highlighted in the UNCCD (1996), participation by all resource managers and users is essential for appropriate and sustainable management. Partnerships among agencies and institutions, coupled with full participation and focused on integrated resource management, must be a part of the vision and management objectives for ephemeral and endoreic rivers throughout drylands (NWRMR 2000c). Results of such an approach would encompass enhanced livelihoods for those who depend on and use ephemeral and endoreic river resources, as well as the conservation of landscapes and the biodiversity they support.

Management of surface waters

Small-scale harnessing of ephemeral river water, such as rainwater harvesting, has been practised for millennia (Lovenstein & Stafford Smith 1994). Management of surface flow of perennial rivers in endoreic systems is well developed in many areas, with varying consequences.

Impoundments

The demand for readily available surface water in semi-arid and arid areas has led to the construction of some large and many small impoundments on ephemeral river systems. Commercial farmers in the upper catchment regions of pre-independence Namibia received government support to construct ground dams, and large impoundments were built to supply industrial areas in central Namibia (Jacobson et al 1995). Since independence and the withdrawal of subsidies, many of these ground dams have silted up, retaining little water even in the most abundant rainy seasons (Angula et al 2001).

Every flood carries large quantities of sediments, which provide nutrients to the river ecosystem and redefine the channel morphology (Friedman & Lee 2002). When the high sediment load of floods is intercepted by dams, it affects the functional time of a dam, and deprives the lower river reaches of nutrient materials (Agnew & Anderson 1992). In order to intercept a large volume of water flowing only occasionally, a dam on an ephemeral river must be large in relation to average inflow. There is a high risk of dam failure on ephemeral rivers due to high unpredictability of flash floods. In 2000, the Hardap Dam on the Fish in southern Namibia received rapid inflow. Authorities had to weigh up their actions quickly and carefully, based on three possibly conflicting priorities: to minimise dam failure, to ensure the safety of people living downstream, and to keep the dam as full as possible to ensure storage of

valuable water resources (Van Langehove 2002). The result was some flooding of the town of Mariental, situated nearby below the dam, but was overall an optimal solution to a difficult situation.

Surface waters in arid areas evaporate quickly. Losses due to evaporation are higher, the larger the surface area of the dam. The further up water retention is in the river, the more severely it affects flood intensity and volume in the lower reaches, which in turn reduces recharge in downstream aquifers (Agnew & Anderson 1992). Very difficult decisions have to be made when developments are planned for ephemeral rivers. Information is often limited and numerous factors, including differential land use, must be considered.

Pollution control of surface water

A water reservoir on an ephemeral river is at risk from at least three sources of pollution. Permanent surface water is at greater risk of direct pollution from the immediate surroundings (shores, air, acid rain) than the remainder of an ephemeral river, which has a layer of unsaturated soil to filter out some pollutants. The most common dam pollution occurs from materials carried downstream from the upper river. The Okapuka tannery near Windhoek in Namibia releases high concentrations of sodium chloride into a tributary of the Swakop River, and increased concentrations have been detected in the groundwater. Over time and with several floods, there is the risk that these pollutants will enter farm dams downstream and the Swakoppoort Dam, one of the key water sources for Windhoek (Roeis 2002).

Ephemeral floods naturally transport significant quantities of organic material and sediments, which accumulate in dry riverbeds during the dry season (Jacobson 1997). Accumulation of organic materials in impoundments can lead to increased nutrient levels and ultimately result in eutrophication. Decay of organic matter can cause temporary anoxic conditions in lower stratification layers of the dam, which affects aquatic life and requires constant adjustment of water abstraction depth for human consumption. High evaporation rates in arid areas also increase concentration of organic and inorganic compounds in dam water over time (Schachtschneider & Bethune 1997).

Integrated water resource management

The main aims of integrated water resource management are to supply adequate volumes of water for human use and economic development while also ensuring sustainable use of water resources for proper functioning of ecosystems and their use by future generations. In the case of alluvial aquifer resources in ephemeral rivers, sustainable use does not mean abstraction of the full aquifer storage potential, but rather the equivalent use of long-term annual recharge (Christelis & Struckmeier 2001). Appropriate management thus strives for a balance between water volumes entering the system, natural water requirements of the system and human water

demand. This logical concept is difficult to quantify and implement, particularly in variable, arid environments. Of particular relevance to ephemeral rivers is occasional aquifer recharge while abstraction and use are constant.

Aquifer recharge rates are difficult to measure, as they are site-specific and depend on a number of variables, including rainfall intensity, soil conditions, surface topography, vegetation cover, land use, watertable and aquifer characteristics (Christelis & Struckmeier 2001). Calculations of water outputs need to take into account natural losses from alluvial aquifers through springs, groundwater flow down the catchment and evapotranspiration from riparian vegetation. Such losses are difficult to quantify accurately (Christelis & Struckmeier 2001). Water abstraction is determined though metering. Unfortunately, many developing countries either do not or only partially calculate water abstraction and water supply therefore cannot be accurately quantified.

A final complication in arid developing countries is the lack of long-term, regular groundwater monitoring data on which to base models and predictions. Sampling and monitoring are limited due to financial constraints and the remoteness of some ephemeral and endoreic systems (Jacobson 1997; Parsons 2002).

Water demand management

Sustainable groundwater use is difficult to compute both on local and catchment scale. The fall of water tables is frequently used as an indicator of overabstraction, although seasonal variations and long-term climate change need to be taken into consideration. Agnew and Anderson (1992) report cases of constant watertable falls of one to four metres per annum in arid regions of China and the US. In such cases, water is clearly being overabstracted and resource managers need to focus attention on regulating water demand. Water demand management seeks to improve efficient use of existing water supplies by reducing the water demand (Winpenny 1994).

Water demand increases with population growth, level of development and infrastructure, and increased standards of living. Water demand can be separated into two components: the basic volume of water required for survival and water demand for increased productivity/comfort (White & Fane 2001). The first is a constant volume required per capita for basic survival. It is the latter demand for the product or comfort produced through use of water that can be controlled and reduced through pricing, regulation and awareness creation. Technological measures can furthermore be applied to reduce the volume of water required to produce a specific product or comfort without affecting its quality. Examples include a switch from flood irrigation to drip irrigation or installation of low-flush toilets.

Water demand management is an emerging concept that is only now being implemented in Southern Africa (Allan 2001), but it faces many challenges. Semi-arid countries such as Namibia and South Africa have provided water supplies at highly subsidised rates in the past, creating a general attitude that water is a freely accessible resource (Turton 1999). As a consequence, there is a certain antagonism

towards water use regulation and water pricing, and the effects of water awareness creation are limited. This is exacerbated in Namibia and South Africa when combined with the post-independence expectations of improved livelihoods based on improved availability of natural resources. Developing countries often do not have a policy on water demand management and have limited markets for water-saving technology. Regulating institutions are often challenged to implement appropriate regulations, overcome antagonisms and to perform regular monitoring (Gumbo et al 2002). Despite its challenges, water demand management remains a very powerful and cheap method of resource management and should receive careful consideration especially in arid and developing countries typified by water and financial constraints.

For example, water for the coastal town of Swakopmund is supplied from alluvial aquifers in the ephemeral Omaruru River supplemented by the ephemeral Kuiseb River. Rising concerns over dwindling water resources led to the adoption of a water demand management strategy for the town. Inhabitants are exposed to ongoing awareness campaigns and water tariffs have been adjusted to discourage wasteful behaviour. Regulations prohibit certain inefficient activities and all wastewater is treated and recirculated for garden use. Water demand management will remain an important resource management tool for Namibia's coastal towns in the near future as development of a desalination plant has proven not to be financially viable for the moment (Schachtschneider 2002).

Conjunctive use of surface and underground water sources

Conjunctive use of different water sources is an important management tool to conserve water in arid environments, mainly by reducing evaporative losses. Conjunctive use of ephemeral surface water, perennial river water, groundwater and unconventional water sources can increase the yield and efficiency of an interlinked water supply system, save water, delay the need to incorporate additional water supply infrastructure at an early stage to augment existing water sources and can reduce the unit cost of water.

By linking groundwater sources to a water supply system that obtains water from dams on ephemeral rivers, a major contribution can be made to increase alternative strategies available for water supply management. When a groundwater source forms part of an integrated water resource system, the aquifer can be used at its long-term safe sustainable yield in normal years, but if there is a shortage of water from dams as a result of drought conditions, boreholes can be pumped at two to three times the long-term sustainable safe yield of the aquifer over short periods of time to bridge the drought period. When the drought is over, boreholes can be rested to allow water levels in the aquifer to recover during higher rainfall periods. An aquifer can also be recharged by banking surface water or by artificially recharging the aquifer with water that has accumulated in a dam after good runoff and recharge events.

The efficiency of a dam on an ephemeral river can be increased if water can be used at a higher yield but at a lower reliability. This can be achieved by using water as fast and as much as possible to reduce evaporation losses that would have occurred over a longer time. This mode of operation reduces reliability of the dam to yield water at a certain assurance of supply but, by linking either a reliable groundwater source or a perennial water source to a dam on an unreliable ephemeral watercourse, the more reliably stored groundwater or the perennial water source can be used to meet demand when there is a failure to supply water from the dam.

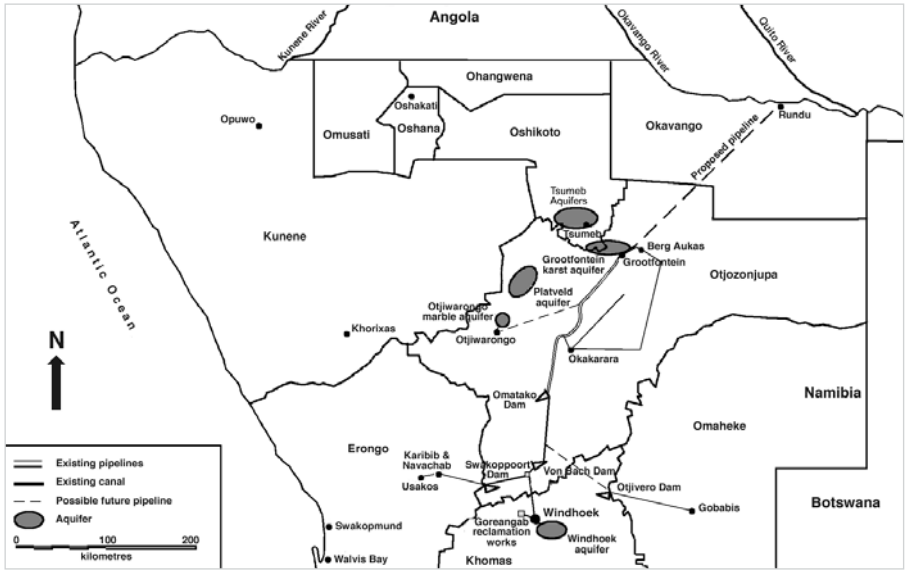
The Eastern National Water Carrier is an ambitious project that was proposed as part of the Water Master Plan of Namibia (see map 4). It is planned that the water carrier may eventually link the water sources in central Namibia to the perennial but endoreic Okavango River. The scheme has been under development for the past 33 years, and has been planned in phases over time as demand has increased and as new water sources have been incorporated.

There are three major dams on ephemeral rivers in central Namibia that form part of the Eastern National Water Carrier. These dams are linked to one another by pipelines. It is therefore possible to use the dams on an integrated basis by transferring water from dams with less favourable evaporation characteristics to dams with more favourable conditions. The total 95% assured safe yield from the dams when utilised on an individual basis, is only 8 Mm^3/a, but by operating the dams on an integrated basis, evaporation losses can be reduced and the 95% assured safe yield of the three dams can be increased to 18 Mm^3/a. The dams are also linked to the Windhoek aquifer and groundwater sources in karstified carbonate rock aquifers at Grootfontein and Tsumeb in the karst area, some 400 kilometres north of Windhoek. Recent studies of the potential of the karst aquifers show that long-term sustainable safe yield is in the order of 20 Mm^3/a. However, up to 15 Mm^3/a can be abstracted additionally on a short-term basis of not more than three years as a backup if the dams should fail to supply. This can be done without adverse effects and allows the aquifers to recover during a rest period. When groundwater from karst aquifers is used in this way on a conjunctive basis with the dams, the 95% assured safe yield of the dams can be increased to 30 Mm^3/a. Recent studies have also shown that by banking surface water from dams in the Windhoek aquifer, additional security of supply can be obtained. The safe yield of the dams can be further increased to 45 Mm^3/a. When the carrier system is eventually connected to the perennial Okavango River, this will show the advantage of using various methods such as the conjunctive use of surface and groundwater, banking of surface water and integrated use of surface waters to increase efficiency of water sources connected to the carrier.

The project started in 1969 and was to be completed up to the Okavango River by 1983. However, a number of factors have delayed completion of the final 250 kilometres. These include addition of groundwater sources, implementation of a water demand management strategy that reduced water consumption, and conjunctive use of an integrated system of interlinked water sources. Yield of water from resources in the

Map 4

Eastern National Water Carrier system



Source: Department of Water Affairs, Ministry of Agriculture, Water and Rural Development

Eastern National Water Carrier has increased to such an extent that completion of the project may well be delayed until 2012.

Artificial recharge of aquifers

Evaporative losses from surface waters in arid areas can be as high as 70% of the total volume of water. One resource management option is to store water underground. Sand storage dams and ground weirs have been used in Namibia and other arid countries for more than a century (Christelis & Struckmeier 2001).

A sophisticated large-scale recharge scheme, the Omdel, lies on the ephemeral Omaruru River in Namibia. The Omdel Dam is a key water supply scheme for the coastal towns of Walvis Bay, Swakopmund and Henties Bay (Jacobson et al 1995; Heyns et al 1998; Christelis & Struckmeier 2001).

Before dam construction, the aquifer had an average mean annual recharge of 3.5 Mm^3, while abstraction was 6.3 Mm^3/a for the coastal towns. Groundwater abstraction exceeded recharge and a steady depletion of the aquifer occurred.

The Omdel Dam (figure 2) was built taking into consideration the fact that recharge of alluvial aquifers depends on turbulence of flow and the clogging effect of colloidal material suspended in floodwaters. During less turbulent flow conditions, a layer of very fine silt or clay material is deposited on the surface of the riverbed and this reduces or completely blocks penetration of water into the aquifer after a short period of time. Quantities of dissolved salts in ephemeral river runoff are normally elevated and are enough to cause flocculation of colloidal material in the water.

The dam is situated upstream of the aquifer and initial storage of turbid river runoff in the reservoir allows flocculation of fine, suspended sediment. Clear water is then fed into infiltration ponds. From there, high aquifer infiltration occurs due to absence of silt in the water and because the aquifer comprises coarse material. The recharge system was designed to transfer the contents of the reservoir to the aquifer during the dry season so that if there was a subsequent good rainy season with runoff, there would be storage space available in the reservoir to impound this runoff. In this way, storage potential of the reservoir and recharge to the aquifer could be maximised. Recharge after flood events has improved to 50% of runoff in comparison to 20% before dam construction. In 1996, the project received the prestigious Shell Environmental Award.

A totally artificial recharge process is currently being tested in Windhoek. Purified water from the surface storage Von Bach Dam on the ephemeral Swakop River is being pumped into the groundwater aquifer underlying Namibia's capital. To date, tests are proving its success and this may be a way to ensure water supply for several years even during times of little rain.

Pollution control in groundwater systems

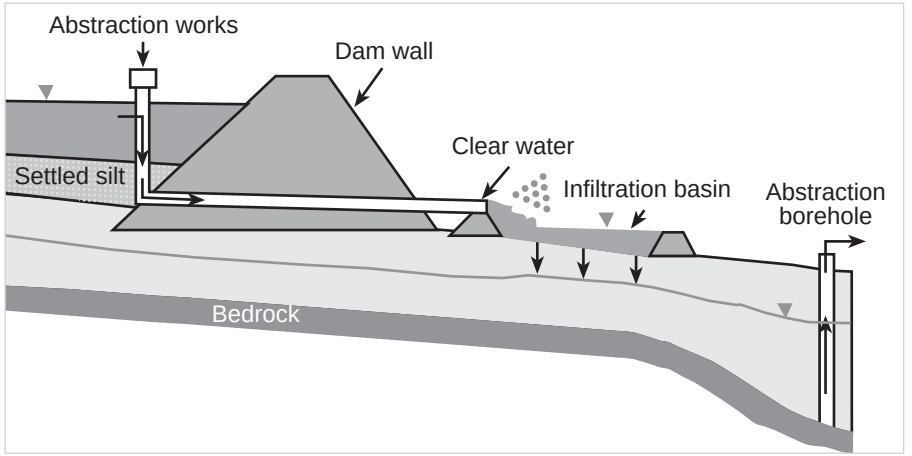
Effective enforcement of policies with regard to biodiversity and ecosystem functioning is vital to control pollution of groundwater resources. Thorough environmental assessments are required to assess the risk of pollution from mining, industrial, agricultural and household activities (Christelis & Struckmeier 2001). There are several cases of alluvial aquifer pollution in Namibia, despite existing environmental policies, proving the importance of active regulation and monitoring. There are pollution reports from copper mining activities in the upper reaches of the Kuiseb River and of groundwater pollution in the upper Omatako catchment from inadequate sanitation in the Osire refugee camp (Roeis 2002).

Conclusion

Ephemeral rivers and endoreic systems occur in drylands of the globe. Aridity and a variable climate are key overarching factors influencing their structure and

Figure 2

The Omdel Dam



Source: Department of Water Affairs, Ministry of Agriculture, Water and Rural Development

functioning. As oases of water and vegetation in an otherwise arid landscape, they have attracted people and wildlife for millennia and continue to do so today. As a consequence of their location and character, all rivers in drylands, ephemeral or perennial, are subject to increasing human and development pressures. As another consequence of their location and character, all rivers in drylands are hydrologically fragile and alterations to their hydrological systems can have far-reaching ramifications.

Desertification is a major concern where ecologically, economically or socially sustainable use of scarce natural resources is secondary to unsustainable attempts at alleviating prevailing poverty. The unique and valuable ecosystem services and biodiversity supported by these water sources in drylands require attention that is also diverted by an unsustainable focus on poverty alleviation. On the other hand, while subjected to the environmental effects of poverty, drylands are also susceptible to climate change, and may become even more arid and variable.

Sustainable use and maintenance of the longevity of the world's dryland ephemeral and endoreic rivers require appropriate management of technical, social and economic solutions coupled with inclusion, participation and support of all stakeholders – from riparian communities to the international community.

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CHAPTER 10

Changing perspectives in the management of international watercourses: An international law perspective

Laurence Boisson de Chazournes

Abstract

The adoption of the UN Convention on the Law of Non-Navigational Uses of International Watercourses in May 1997 constitutes an important step towards the joint management of watercourses. Even should the UN convention never enter into force, it is and will remain a reference document for negotiations. However, the legal and policy framework as it presently stands in the convention is not precise enough, nor sufficiently streamlined and overarching to deal in a comprehensive and effective manner with joint management issues. Accordingly, there is a need for further developing the policy and legal regime applicable to watercourses from a substantive, procedural and institutional viewpoint, through regional and basin agreements, taking into account the specificity of each watercourse.

Introduction

International law plays a significant role in managing international watercourses. While the rule of law does not in and of itself provide solutions to the many concerns about water utilisation, conservation or protection, it certainly provides the means of reaching potential solutions to international water problems. Of course, international law cannot guarantee cooperation over international watercourses. Such cooperation, however, is very unlikely to be sustainably established without appropriate legal support (see McCaffrey 2001). In providing stability and predictability to regulation, it contributes both to the avoidance and settlement of disputes. But this crucial function cannot be fulfilled efficiently in an area where the principles and rules remain rather vaguely elaborated or phrased. Building workable institutional and conventional frameworks, within which states interact, consult and exchange information, is thus essential. The rules applicable to international watercourses must therefore not only be substantive and procedural, but also institutional, providing suitable mechanisms for ensuring cooperation and sustainable management of international watercourses (see, for example, the cases of the Rhine and Danube in Sands & Klein 2001).

Until the United Nations General Assembly adopted the UN Convention on the Law of Non-Navigational Uses of International Watercourses (1997) – opened for

signature and ratification by member states in May 1997 – the international community did not have at its disposal a set of written rules and principles dealing with this issue and universally negotiated by states. Until this time, the Helsinki Rules on the Uses of the Waters of International Rivers, adopted by the International Law Association (ILA) in 1966, were the only set of written rules that could be referred to.

However, the Helsinki rules had not been endorsed by an interstate political body, but only by a non-governmental agency. In addition, discussions centred around their status as customary law, which is their binding character. The UN convention shed some light on this and enabled clarification. The codification effort initiated in 1970 by the UN International Law Commission (ILC) - a subsidiary body of the UN General Assembly - took almost three decades. Although the result of political compromises among groups of states with different interests, it helped to clarify and codify various rules and principles of the regime applicable to international watercourses.

However, the legal and policy framework as it presently stands in the UN convention is not precise enough, nor sufficiently streamlined and overarching to deal in a comprehensive and effective manner with joint management issues. Accordingly, there is a need for further developing the policy and legal regime applicable to watercourses from a substantive, procedural and institutional viewpoint, through regional and basin agreements, taking into account the specificity of each watercourse.

The UN convention as a framework for integrated management of international watercourses

Although the UN convention is the result of a compromise between the different interests, it nonetheless provides a reasonable framework for governing non-navigational uses of international watercourses. The elements of such an architecture have been negotiated at the universal level within the context of a so-called 'framework convention'. The fifth paragraph of the preamble to the UN convention clearly states:

> "the conviction that a framework convention will ensure the utilization, development, conservation, management and protection of international watercourses and the promotion of the optimal and sustainable utilization thereof for present and future generations."

Uncertainties and minimal common denominators are the price to pay for such an endeavour as the elaboration of a legal regime. The UN convention is not an exception in this respect. Many agreements, usually termed 'framework conventions' and to be found mostly in the fields of international environmental law or disarmament regulation, present similar features. Such treaties contain elements of a regulatory, programmatic and institutional nature. One of the virtues of these instruments is that

they lay down the constitutive foundations for a legal regime. The regime is then supposed to be further elaborated through additional treaties, protocols, amendments, guidelines or other types of instruments.

It is interesting to note that international watercourses are all distinctive from one another because of their characteristics, whether geographic, climatic or human, among others. This means that the UN convention is a framework convention for bilateral, regional or basin-wide agreements to be adjusted according to specific cases. It contains a common legal and policy language negotiated at universal level, to be specified and rendered more precise to meet particular needs in the context of each particular watercourse.

Another function of the UN convention is that when it enters into force, the forthcoming bilateral and regional watercourse agreements among parties to the convention will be negotiated in the light of the principles and rules it provides for, taking into consideration the specificities of each river basin. Article 3 of the UN Convention reads as follows:

> "3. Watercourse States will enter into one or more agreements, hereinafter referred to as 'water agreements', which apply and adjust the provisions of the present Convention to the characteristics and uses of a particular international watercourse or part thereof.
>
> 4. Where a watercourse agreement is concluded between two or more watercourse States, it shall define the waters to which it applies. Such an agreement may be entered into with respect to an entire international watercourse or any part thereof or a particular project, program or use except insofar as the agreement adversely affects, to a significant extent, the use by one or more other watercourse States of the waters of the watercourse, without their express consent."

From a policy viewpoint, it is also interesting to note that both the UN convention (though not yet in force) and the initiatives that led to its adoption (the ILC's draft articles on the non-navigational uses of international watercourses) have been taken into account in formulating international agreements in a variety of contexts. One such case is the draft of a cooperative framework for the sustainable and equitable use of the resources of the Nile basin (see Brunnee & Toope 2001:105) developed with the support of the World Bank, the United Nations Development Programme (UNDP) and other multilateral and bilateral donors. Another case has been the Revised Protocol on Shared Watercourses of the Southern Africa Development Community (SADC) (Salman 2001:981). These examples demonstrate the UN convention's virtue as a legal roadmap for negotiations, willingly chosen, without any legal constraint to do so.

It is in such a context that the value added by the UN convention should be assessed, in the sense that it allows for consolidation and developments based on notions and principles that have been universally defined in a framework instrument.

Scope of application of the UN convention

Another important feature of the UN convention is the expanded coverage of the term 'watercourse', which is defined as "a system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus", and an "international watercourse [as] a watercourse, parts of which are situated in different States" (article 2(a) and 2(b); McCaffrey & Rosenstock 1996). It thus encompasses the main stream of an international river and its tributaries, as well as international lakes and groundwater that are connected to other parts of an international watercourse.

A broader conception would include all waters and lands, which are part of a drainage system (ILA 1966). The Helsinki rules define an international drainage basin as a "geographical area extending over two or more States determined by the watershed limits of the system of waters, including surface and underground waters, flowing into a common terminus" (article 2).

The definition of an international watercourse in the UN convention might appear to be insufficiently comprehensive from an ecosystem perspective. Such a perspective entails that a river or lake basin must be viewed "not merely as a unit in which water resources are interlinked, but as a unit in which many elements of the environment (freshwater, salt water, air, land and all forms of life) interact within the confines of the drainage area" (Teclaff 1991:370). This would imply that the focus is on the dynamics and linkages existing in freshwater, terrestrial, marine and atmosphere systems.

Although it is true that the scope of the convention does not go this far, it does provide for elements in this direction. Article 20 requires that "Watercourse States shall, individually and, where appropriate, jointly, protect and preserve the ecosystems of international watercourses."

This obligation entails that land-based activities have to be taken into account in such a context. With respect to the marine environment, in addition, article 23 provides that:

> "Watercourse States shall, individually and, where appropriate, in cooperation with other States, take all measures with respect to an international watercourse that are necessary to protect and preserve the marine environment, including estuaries, taking into account generally accepted international rules and standards."

A similar provision can be found in the UN Convention on the Law of the Sea (UN 1982 article 207(1)) that addresses pollution from land-based sources:

> "States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment from land-based sources, including rivers, estuaries, pipelines and outfall structures, taking into account internationally agreed rules, standards and recommended practices and procedures."

Although drafted in general terms, these obligations highlight the link between fresh and marine waters, keeping in mind that the greatest share of marine pollution results from land-based activities. These elements offer a broader perspective in stressing that the watercourse is an element of a bigger and more complex system.

Building blocks of international water management

The UN convention lays down the main building blocks for water management at international level. Such foundations delineate the path for an integrated approach composed of four main pillars, while a fifth, only superficially elaborated, deserves further exploration and refinement.

Water-sharing principles constitute the first pillar. They comprise the 'equitable and reasonable use' principle and the 'no-harm' rule. The first principle is set up in article 5, which deals with equitable and reasonable utilisation and participation:

> "1. Watercourse States shall in their respective territories utilize an international watercourse in an equitable and reasonable manner. In particular, an international watercourse shall be used and developed by watercourse States with a view to attaining optimal and sustainable utilization thereof and benefits therefrom, taking into account the interests of the watercourse States concerned, consistent with adequate protection of the watercourse.
> 2. Watercourse States shall participate in the use, development and protection of an international watercourse in an equitable and reasonable manner. Such participation includes both the right to utilize the watercourse and the duty to cooperate in the protection and development thereof, as provided in the present Convention."

Article 7 articulates the 'no-harm' rule under the heading of the obligation not to cause significant harm:

> "1. Watercourse States shall, in utilizing an international watercourse in their territories, take all appropriate measures to prevent the causing of significant harm to other watercourse States.
> 2. Where significant harm nevertheless is caused to another watercourse State, the States whose use causes such harm shall, in the absence of agreement to such use, take all appropriate measures, having due regard for the provisions of articles 5 and 6, in consultation with the affected State, to eliminate or mitigate such harm and, where appropriate, to discuss the question of compensation."

Article 6 of the UN convention also enunciates a series of factors to be taken into account for such allocation, including social, economic, cultural, as well as historical considerations. They also favour a mutual and supportive application of the principles laid down in articles 5 and 7, as they include taking into account "the effects of the

use or uses of the watercourse in one watercourse State on other watercourse States" (article 6(1)(d)). Yet, it should be noted that the absence of priority ranking among the factors to be implemented generates the risk of maintaining the status quo, with no incentive to reach an agreement.

The second pillar is riparian states' *general obligation to cooperate*. According to the UN convention, such cooperation may be achieved through different means: setting joint mechanisms and commissions of which riparians are members, regular exchange of information and data, and notification of planned measures. Some of these provisions are more hotly debated than others.

Since the collection and exchange of data are key elements for preventing disputes, the establishment of joint mechanisms and commissions should be further strengthened to promote and establish adequate systems for the exchange of information (see Brown Weiss 1989:375). At present, the UN convention states this commitment in article 8(2):

> "In determining the manner of such cooperation, watercourse States may consider the establishment of joint mechanisms or commissions, as deemed necessary by them, to facilitate cooperation on relevant measures and procedures in the light of experience gained through cooperation in existing joint mechanisms and commissions in various regions."

This is a 'due diligence' obligation that does not limit states to any precise outcome. Similar language is encountered in the first paragraph of article 24 dealing with management (further defined in paragraph 2):

> "Watercourse States shall, at the request of any of them, enter into consultations concerning the management of an international watercourse, which may include the establishment of a joint management mechanism."

Joint mechanisms are thus expected to flow from the development of the regime. Yet, article 8(2) refers to the "experience gained through cooperation in existing joint mechanisms and commissions in various regions." Here, the experience drawn from past and existing agreements is seen as a way to induce states to strengthen cooperation through the establishment of institutional bodies. Although the UN convention is generally conceived – like other framework conventions – as a tool to initiate a process of cooperation among states, such a process seems reversed for joint mechanisms: it is the UN convention that would be nurtured by past practice. A certain timidity may be perceived, to say the least, in promoting cooperation.

Moreover, efforts should be made to open these institutional settings to all riparians. This might entail some flexibility in allowing all riparians of a particular international watercourse system – whether or not parties to a given watercourse agreement - to participate, as observers or in a similar capacity, in the activities of a joint mechanism established in such a context. As part of the confidence-building spirit that is crucial in promoting integrated water management, the granting of

observer status would constitute a first step towards the further involvement of 'outsider' states as parties to an eventual agreement encompassing all riparians.

The third pillar integrates the *protection of the environment* as a component of the regime applicable to international watercourses, and to prevent and control pollution. Phrased mostly in general terms, the environmental regime also needs to be strengthened to incorporate principles and rules of international environmental law, including the principles enunciated in the Rio Declaration on Environment and Development (UN 1992). The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992) is important in this respect (UNECE 1992). It contains a rather wide definition of pollution within the context of transboundary impact, including:

> "any significant adverse effect on the environment resulting from a change in the conditions of transboundary waters caused by a human activity, the physical origin of which is situated wholly or in part within an area under the jurisdiction of another Party. Such effects on the environment include effects on human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments or other physical structures or the interaction among these factors; they also include effects on the cultural heritage or socio-economic conditions resulting from alterations to those factors" (article 1(2)).

The UNECE convention (1992) also provides for respect for certain environmental principles, such as:

> "the precautionary principle, by virtue of which action to avoid the potential transboundary impact of the release of hazardous substances shall not be postponed on the ground that scientific research has not fully proved a causal link between those substances, on the one hand, and the potential transboundary impact, on the other hand; the polluter-pays principle, by virtue of which costs of pollution prevention, control and reduction measures shall be borne by the polluter; water resources shall be managed so that needs of the present generation are met without compromising the ability of future generations to meet their own needs" (article 2(5)(a), (b) & (c)).

The *promotion of dispute settlement and avoidance mechanisms* is the fourth pillar. While the UN convention provides for the classical menu of diplomatic and judicial means of dispute settlement between states, a significant addition is the fact-finding commission that can be established at the request of a party. In this regard:

> "2. If the Parties concerned cannot reach agreement by negotiation requested by one of them, they may jointly seek the good offices of, or request mediation or conciliation by, a third party, or make use, as appropriate, of any joint watercourse institutions that may have been established by them or agree to submit the dispute to arbitration or to the International Court of Justice.

3. Subject to the operation of paragraph 10, if after six months from the time of the request for negotiations referred to in paragraph 2, the Parties concerned have not been able to settle their dispute through negotiation or any other means referred to in paragraph 2, the dispute shall be submitted, at the request of any of the parties to the dispute, to impartial fact-finding in accordance with paragraphs 4 to 9, unless the Parties otherwise agree. A Fact-finding Commission shall be established, composed of one member nominated by each Party concerned and in addition a member not having the nationality of any of the Parties concerned chosen by the nominated members who shall serve as Chairman."

Nevertheless, some issues remain to be clarified. One is the role played by the scientific community in the dispute settlement process and the necessity for it to be fully incorporated into the decision-making process. Another issue relates to enforcement and to sanctions or compensatory measures to be decided upon for ensuring effective compliance with international watercourse agreements. This raises the question of incentives for countries to get involved in such legal processes. Strengthening the capacity of parties to comply with obligations under the UN convention or any related agreement should be considered in this context.

This concern is in fact addressed by the World Bank policy on international waterways: "The Bank recognizes that the cooperation and goodwill of riparians is essential for efficient utilization and protection of the waterway" (see Salman & Boisson de Chazournes 1998:194).

Great importance is placed on riparians to make appropriate agreements or arrangements for these purposes for any part of, or for the entire waterway. The financial institution stands ready to assist the states concerned in reaching this goal. In cases where differences remain unresolved between the state proposing the project (the beneficiary state) and the other riparians, prior to financing the project, the bank normally urges the beneficiary state to offer to negotiate in good faith with the other riparians to reach appropriate agreements or arrangements.

Diplomatic means, such as consultation, mediation and investigation, may also rely on incentives or the failing state to adjust its position. As a means of last resort, targeted sanctions could be exercised against such countries to put an end to their disputes with other riparians.

Lastly, a fifth, less-developed pillar concerns the *involvement of non-state actors*. The UN convention is a classical state-oriented instrument, with almost no provisions for the involvement of other stakeholders, such as local communities and non-governmental organisations (NGOs). Yet, it contains a provision that deals with individuals, ensuring access to justice and other procedures on a non-discriminatory basis, which reads as follows:

"Unless the watercourse States concerned have agreed otherwise for the protection of the interests of persons, natural or juridical, who have suffered or are under a serious threat of suffering significant transboundary harm as a

result of activities related to an international watercourse, a watercourse State shall not discriminate on the basis of nationality or residence or place where the injury occurred, in granting to such persons, in accordance with its legal systems, access to judicial or other procedures, or a right to claim compensation or other relief in respect of significant harm caused by such activities carried on in its territory" (article 32).

This possibility constitutes an important venue achievement. For example, in the context of pollution of the Rhine River, individuals were able to obtain redress and compensation through such means (see G.J. Bier vs. Mines de Potasse, Kiss & Shelton 1995:364-367).

It should be complemented, however, by other means to involve the public in the management of international watercourses. It is important in this respect to note the increasing role played by water associations (see Salman 1997). The public can also be involved through hearings, briefings and working groups. Public participation and access to information are means by which awareness can be raised and support increased for water management policies (see Bosnjakovic 1998:62). In addition, the growing body of human rights law provides for important governance parameters to ensure that an international watercourse is managed in the interests of all. Such parameters include, among others, the protection of minorities and indigenous peoples, as well as the right of access to information. The ever more vociferous affirmation of a human right to clean water is also worth noting in this respect (see McCaffrey 1992). The protocol on water and health (1999) to the UNECE convention (1992) refers to this when it states that "equitable access to water, adequate in terms both of quantity and of quality, should be provided for all members of the population, especially those who suffer a disadvantage or social exclusion" (article 5(1)).

To conclude, it should be stressed that the path for an integrated approach – as provided in the UN convention – is rather forward-looking when considering that several of its components are not part of the existing water agreements. In practice, quality and quantity issues are not always dealt with together (see, for example, Boisson de Chazournes 1998); fairness in apportionment of water resources remains a quest in many parts of the world; cooperation and exchange of information need to be strengthened as many countries still consider water data as not being part of the 'public domain'; and joint institutional mechanisms need to be established. Lastly, prevention and dispute avoidance mechanisms remain rather underdeveloped.

International Court of Justice: Its contribution to the promotion of joint management of international watercourses

Some of the necessary steps towards effective joint management have been delineated by the International Court of Justice in some of its recent decisions. Such

was the case with the dispute over the Gabcikovo-Nagymoros project (1997), concerning the erection of two dams on a portion of the Danube shared by Slovakia and Hungary.

One lesson to be drawn from the case is that the rule of law cannot be viewed in static terms. The 1977 treaty concluded between Hungary and the former Czechoslovakia on the construction and operation of the Gabcikovo-Nagymoros lock system was virtually silent on the subject of the environment, save for scattered references related to water quality preservation, as noted by the court:

> "In order to evaluate the environmental risks, current standards must be taken into consideration. This is not only allowed by the wording of Articles 15 and 19, but even prescribed, to the extent that these articles impose a continuing — and thus necessarily evolving — obligation on the parties to maintain the quality of the water of the Danube and to protect nature" (Gabcikovo-Nagymoros project 1998: paragraph 140).

The court, however, held that "the Treaty is not static, and is open to adapt to emerging norms of international law." It further stated that "the awareness of the vulnerability of the environment and the recognition that environmental risks have to be assessed on a continuous basis have become much stronger in the years since the Treaty's conclusion" (Gabcikovo-Nagymoros project 1998: paragraph 112). This statement raises an important challenge on the interpretation of existing treaties that do not include issues around the protection of the environment.

On water-sharing principles, the court stated that international watercourses should be considered as shared natural resources, and faulted Slovakia (formerly Czechoslovakia) in this respect. Quoting the 1929 decision of the Permanent Court of International Justice concerning navigation on the River Oder, the court said:

> "'[The] community of interest in a navigable river becomes the basis of a common legal right, the essential features of which are the perfect equality of all riparian States in the user of the whole course of the river and the exclusion of any preferential privilege of any one riparian State in relation to the others' (Territorial Jurisdiction of the International Commission of the River Oder, Judgment No. 16, 1929, P.C.I.J., Series A, No. 23, p. 27).
>
> Modern development of international law has strengthened this principle for non-navigational uses of international watercourses as well, as evidenced by the adoption of the Convention of 21 May 1997 on the Law of the Non-Navigational Uses of International Watercourses by the United Nations General Assembly.
>
> The Court considers that Czechoslovakia, by unilaterally assuming control of a shared resource, and thereby depriving Hungary of its right to an equitable and reasonable share of the natural resources of the Danube — with the continuing effects of the diversion of these waters on the ecology of the riparian area of the Szigetköz — failed to respect the proportionality which is required by international law" (Gabcikovo-Nagymoros project 1998: paragraph 85).

The court could have gone a step further and considered the principle of equitable utilisation in the broader context of sustainable development management. A derivative element not yet fully explored, but which deserves attention, is that the apportionment of waters is to be embedded in ecosystem thinking, taking into consideration the rights of present and future generations (UN 1992: principle 3). As for the definition of sustainable development, the court merely said:

> "Throughout the ages, mankind has, for economic and other reasons, constantly interfered with nature. In the past, this was often done without consideration of the effects upon the environment. Owing to new scientific insights and to a growing awareness of the risks for mankind — for present and future generations — of pursuit of such interventions at an unconsidered and unabated pace, new norms and standards have been developed, set forth in a great number of instruments during the last two decades. Such new norms have to be taken into consideration, and such new standards given proper weight, not only when States contemplate new activities but also when continuing with activities begun in the past. *This need to reconcile economic development with protection of the environment is aptly expressed in the concept of sustainable development.*
>
> For the purposes of the present case, this means that the Parties together should look afresh at the effects on the environment of the operation of the Gabcikovo power plant. In particular they must find a satisfactory solution for the volume of water to be released into the old bed of the Danube and into the side-arms on both sides of the river" (Gabcikovo-Nagymoros project 1998: paragraph 140; author's emphasis).

Also worthy of note is that the decision highlighted the fact that the law on international watercourses not only consists of the UN convention, important though it may be, but also of other sources of international law, such as "newly developed norms of environmental law" (see Gabcikovo-Nagymoros project 1998: paragraph 112). In order to give more effect to this vision of a more holistic regime for international watercourses, the court expressly stated that cooperation between riparians in the management of international watercourses is crucial. In this context, attention should be paid to the environmental conventions dealing with nature conservation – such as the Convention on Wetlands of International Importance especially as Waterfowl Habitat (also called the Ramsar convention, 1971) or the Convention on Biological Diversity (1992) – which contribute to the better protection of international watercourses as habitats and elements of larger ecosystems.

In the 1999 case concerning Kasikili/Sedudu Island (between Botswana and Namibia), the International Court of Justice also pointed to some interesting features of

the management of international watercourses. The main focus of the case revolved around the determination of the boundary between the two African states, the apportionment of the island in dispute and the method to be applied to resolve the matter, given the existence of a treaty between Great Britain and Germany concluded in 1890 and the rules and principles of international law (see Ashton 2000 for more details).

On the criteria to be favoured, the court found:

"that it cannot rely on one single criterion in order to identify the main channel of the Chobe around Kasikili/Sedudu Island, because the natural features of a river may vary markedly along its course and from one case to another. The scientific works which define the concept of 'main channel' frequently refer to various criteria: thus, in the Dictionnaire français d'hydrologie de surface avec équivalents en anglais, espagnol, allemand (Masson, 1986), the 'main channel' is 'the widest, deepest channel, in particular the one which carries the greatest flow of water' (p. 66); according to the Water and Wastewater Control Engineering Glossary (Joint Editorial Board Representing the American Public Health Association, American Society of Civil Engineers, American Water Works Association and Water Pollution Control Federation, 1969), the 'main channel' is 'the middle, deepest or most navigable channel' (p. 197). Similarly, in the Rio Palena Arbitration, the arbitral tribunal appointed by the Queen of England applied several criteria in determining the major channel of a boundary river (Argentina-Chile Frontier Case (1966), United Nations, Reports of International Arbitral Awards (RIAA), Vol. XVI, pp. 177-180; International Law Reports (ILR), Vol. 38, pp. 94-98). The Court notes that the Parties have expressed their views on one or another aspect of the criteria mentioned in paragraph 29 above, distinguishing between them or placing emphasis on their complementarity and their relationship with other criteria. It will take into account all of these criteria" (paragraph 30).

Hence, the court's decision was as follows:

"88. The foregoing interpretation of the relevant provisions of the 1890 Treaty leads the Court to conclude that the boundary between Botswana and Namibia around Kasikili/Sedudu Island provided for in this Treaty lies in the northern channel of the Chobe River.

89. According to the English text of the Treaty, this boundary follows the 'centre' of the main channel; the German text uses the word 'thalweg'. The Court has already indicated that the parties to the 1890 Treaty intended these terms to be synonymous and that Botswana and Namibia had not themselves expressed any real difference of opinion on this subject (see paragraph 25 above).

It is moreover clear from the travaux préparatoires of the Treaty (see paragraph 46 above) that there was an expectation of navigation on the Chobe by both contracting parties, and a common intention to exploit this possibility.

Although, as has been explained above, the parties in 1890 used the terms 'thalweg' and 'centre of the channel' interchangeably, the former reflects more accurately the common intention to exploit navigation than does the latter. Accordingly, this is the term that the Court will consider determinative in Article III, paragraph 2.

Inasmuch as Botswana and Namibia agreed, in their replies to a question put by a Member of the Court, that the thalweg was formed by the line of deepest soundings, the Court concludes that the boundary follows that line in the northern channel around Kasikili/Sedudu Island."

Relying on the social and economic relationships prevailing between Namibia and Botswana, the Court added:

"102. The Court observes, however, that the Kasane Communiqué of 24 May 1992 records that the Presidents of Namibia and Botswana agreed and resolved that:

'(c) existing social interaction between the people of Namibia and Botswana should continue;

(d) the economic activities such as fishing shall continue on the understanding that fishing nets should not be laid across the river;

(e) navigation should remain unimpeded including free movement of tourists'.

The Court further observes that in explanation and in pursuance of the foregoing agreement, Botswana stated at the oral hearings:

'Botswana's policy is to allow free navigation, including unimpeded movement of tourist boats even in the southern channel. This policy applies to boats owned by Namibian tourist operators as well. The only requirement is that all tourist boats should be registered. This requirement is meant solely to prevent the danger of environmental pollution of the Chobe River. Experience has shown that some tourist boat operators tended to transport their boats from Okavango waters, infested with river weeds, down to the Chobe River, without applying for a trans-zonal permit. The Department of Water Affairs, and not the Botswana Defence Force, is responsible for enforcing the policy on anti-pollution of the river waters.

Botswana's policy on free navigation, including the free movement of tourist boats, was set out in paragraph (e) of the Kasane Communiqué … Since the Kasane Communiqué was agreed in May 1992, there has been no complaint from the Namibian Government that Botswana ever breached paragraph (e) of the Communiqué which guarantees unimpeded navigation.'

Subsequently, Botswana added that:

'Botswana also wishes to reiterate that tourist boats from Namibia are free to travel in the southern channel. The only requirement is that all such boats

should be registered, in order to control noxious aquatic weeds … this requirement is backed by proper legislation, namely, the Laws of Botswana Aquatic Weeds (Control) Act, which commenced in December 1971. The provisions of this Act were later discussed with, and endorsed by the Water Affairs Department of Namibia. Since then, Namibian tourist boat operators have registered as many as 53 boats, to travel in Botswanan waters of the Chobe River. These 53 Namibian boats are permitted to navigate in the southern channel, like any others that have been licensed.'

103. The Court, which by the terms of the Joint Agreement between the Parties is empowered to determine the legal status of Kasikili/Sedudu Island concludes, in the light of the above-mentioned provisions of the Kasane Communiqué, and in particular of its subparagraph (e) and the interpretation of that subparagraph given before it in this case, that the Parties have undertaken to one another that there shall be unimpeded navigation for craft of their nationals and flags in the channels of Kasikili/Sedudu Island. As a result, in the southern channel of Kasikili/Sedudu Island, the nationals of Namibia, and vessels flying its flag, are entitled to, and shall enjoy, a treatment equal to that accorded by Botswana to its own nationals and to vessels flying its own flag. Nationals of the two States, and vessels, whether flying the flag of Botswana or of Namibia, shall be subject to the same conditions as regards navigation and environmental protection. In the northern channel, each Party shall likewise accord the nationals of, and vessels flying the flag of, the other, equal national treatment."

Hence, although international watercourses can be used as boundaries, the decision emphasises the necessity to envision such watercourses also as spaces of cooperation, thus transcending the issue of boundary. The court reminded the two countries of the need to create mutually satisfactory conditions for their nationals through the establishment of a common regime.

Conclusion

The adoption of the UN convention constitutes an important step towards the joint management of watercourses. Even should the UN convention never enter into force, it is and will remain a reference document for negotiations. It also contains rules of a customary nature, as stated by the International Court of Justice in the Gabcikovo-Nagymoros case regarding the principle of equitable and reasonable share of natural resources (see paragraph 112).

However, cooperation still has to be developed further toward effective joint management of international watercourses, in line with the concept of integrated water resource management, as delineated in the ministerial declaration of The Hague on water security in the 21st century (paragraph 5):

"The actions advocated here are based on *integrated water resources management*, that includes the planning and management of water resources, both conventional and non-conventional, and land. This takes account of social, economic and environmental factors and integrates surface water, groundwater and the ecosystems through which they flow. It recognises the importance of water quality issues. In this, special attention should be paid to the poor, to the role, skills and needs of women and to vulnerable areas such as small island states, landlocked countries and desertified areas."

A more optimal regime for international watercourses should aim at including all water, as well as land that is part of a drainage system. An institutional framework providing for an adequate and regular exchange of information would allow riparians to manage the watercourse in the interests of all. Such management should involve the different stakeholders and be embedded in an ecosystem perspective. Metaphorically speaking, in such a context, the sharing and allocation of waters would find its place as a natural part of such a regime and no longer as a predominant pattern from which the joint management system derives. In other words, the sharing of water should not obviate the need to look at a watercourse from an holistic perspective, with the allocation of water components being one of its elements.

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CHAPTER 11

Watersheds and problemsheds: A strategic perspective on the water/food/trade nexus in Southern Africa

Anton Earle

Abstract

Conventional wisdom maintains that water scarcity may lead to conflict and war between states. The riparian states of the Okavango basin are all under varying degrees of water stress, necessitating the joint management of transboundary water in the region. The fact that disputes over water very rarely lead to conflict between states has much to do with the role of water in the modern economic landscape. There is no correlation between economic development and water resources in a country, as some of the poorest nations on earth have vast reserves of fresh water. The factor more important to ensure continued economic development is the level of social adaptive capacity, including aspects such as wealth, the level of education among the population and the sophistication of the economy. The small water reserves available can be used in the sector of the economy where they generate the most income and cheap staple foods can be imported with the profit, analogous to the import of virtual water. Subsidisation of irrigated agriculture by the state can be used as a tool to encourage rural development. It is argued in this chapter that this is highly ineffective, as water is not the ultimate limiting factor to agricultural development in arid countries. Low prices for staple foods, caused by overproduction and agricultural protectionism, pose the largest threat to local agriculture. The obstacles to agricultural development, as well as the solutions to overcoming water scarcity are located not within the watershed, but on international trade markets. The Permanent Okavango River Basin Water Commission (OKACOM), as the organisation managing the Okavango River, is in a prime position to implement policies leading to such a positive outcome.

Introduction

Agriculture is central to any food security policy as it accounts for all food grown on land. Self-evident as this may be, it is important to remember that the size of land is finite and, more importantly, available water that is suited to the production of food is even more so. The big question is deciding where and how this food should be produced. In the past, food self-sufficiency, achieved by meeting all food needs through domestic supplies, was a policy objective of many countries. It had the effect

of keeping foreign exchange in the country, where it could be used to import products not locally produced. Yet, in the early 1990s, nearly 80% of malnourished children lived in developing countries that produced food surpluses (FAO 2000a). The current trend is to move toward a policy of national food security, relying on other sectors of the economy to generate capital to be used to import various food products not produced locally. The theory of comparative advantage would dictate that countries tend to focus on manufacturing products in which they have a comparative advantage in the factors of production.

In the arid regions of the world, such as the Okavango basin, water is perceived as the factor of production in short supply. It also happens to be a relatively mobile natural resource, compared to factors such as soil and sunlight. Great water transfer schemes have ensured the security of supply for various water-short civilisations for centuries. These transfers imply dependence upon foreign sources and have political, economic, as well as environmental repercussions. The juxtaposition of security and dependency in the context of shared watercourses has prompted the prediction that the wars of the 21st century will be waged over water. There is much evidence to the contrary, especially in the Middle East, which ran out of water in the 1970s. Although the region is by no means stable today, there is no evidence that disputes over water resources have fuelled tensions between states. If anything, the reverse is true, with several examples of states on politically stressful terms with one another actually cooperating in water resource management. Although in a de facto state of war with each other, Israel and Jordan cooperated in the management of the Jordan River basin long before the Oslo peace accord of 1994 (Wolf 1993; Allan 1999; Jagerskog 2001).

Political will, regime creation, natural resource endowments and socioeconomic development levels all play a role in determining how countries respond to water scarcity. Just as Adam Smith put forward his illustrative device of the 'invisible hand of the market' to explain economic theory, so too can the concept of 'virtual water' give insight into the interplay between water resources, food security and international trade. The aim of this chapter is to shift the focus of thinking and debate within the region away from the river basin, with finite water resources in it, to that of a 'problemshed', with a variety of options available to ensure continued economic development. The concept of virtual water will illustrate the ability of an economy to overcome problems of water resource scarcity and ensure continued economic development in the face of aridity. This approach has implications for conflict mitigation and allows riparian states to arrive at trade-off situations with a positive sum result. Angola, Namibia and Botswana have indicated a readiness to move away from sharing the waters of the Okavango River towards sharing the benefits of the river. Additionally, it will be proposed that water is not the limiting factor to agricultural expansion in developing arid nations. Agricultural trade protectionism in the world's largest markets limits local production of staple crops and has a tangible effect on the food security policies of developing countries.

Implications of water resource scarcity

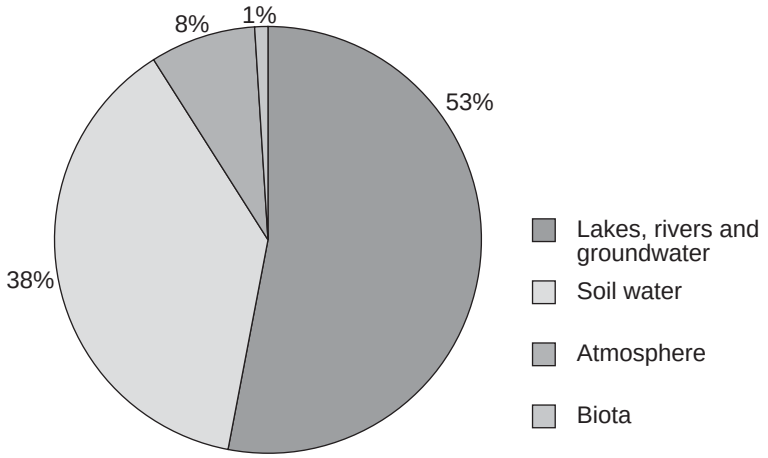
There is some debate over what constitutes water scarcity in a country. On a per capita basis, Namibia – with 10,211 m^3 per person annually – has three times more water than France – with 3,439 m^3 per person annually (FAO Aquastat 2002). This fact is routinely ignored in water scarcity assessments and highlights the limitations of quantitative indices. In the above example the fact is that much of the water counted as being part of the Namibian supply lies in rivers on its borders. This water has to be shared with its neighbours, yet water assessments frequently fall prey to this double counting, including the full flow of the river in both the neighbouring countries' supplies. There is also the factor of evaporation, accounting for 98% of Namibia's rainfall. A qualitative assessment of water resources in a country differentiates between the types of water available (Falkenmark 1989). A water scarcity index gauges the level of renewable surface and exploitable groundwater reserves in a country, generated both locally and externally (FAO Aquastat 2002). The majority of the world's food is not grown using the above water, but rather soil water trapped between particles in the soil horizons. Irrigated agriculture accounts for 43% of world grain production, with soil water supplying the moisture needs of the remainder (Berkoff 2001). Soil water comprises about 38% of the fresh water available on earth (see figure 1).

France and other temperate-zone countries are grain exporters due to their large reserves of soil water, freely available to them as rainfall. Levels of soil water are negatively affected by high rates of evapotranspiration. Therefore, although Johannesburg and London receive similar volumes of rainfall annually (just more than 600 mm), the former has much lower volumes of soil water than the latter. The temporal and geographic variability of rainfall experienced by many arid parts of the world, combined with high levels of evapotranspiration typical in these areas, preclude much of the earth's surface from being suitable for growing rainfed or irrigated grain (see map 1).

Areas with low levels of soil water can augment their supplies through water transfers and grow crops under irrigation. The high rates of evapotranspiration – in excess of 3,700 mm annually in parts of Botswana and Namibia, compared with a world average of 1,200 mm – pose the risk of salinisation of soil in arid regions (FAO Aquastat 2002). Whole tracts of land can be rendered sterile through the accumulation of salts left behind as residues from evaporated irrigation water. From Sumeria to California there are many examples of the devastation caused by the injudicious use of irrigation water in arid regions (Postel 1999). Coupled with the potential dangers of overirrigation is the fact that a positive rate of return on irrigated grain production can prove difficult to achieve (Berkoff 2001). Capital outlay costs per hectare on irrigation schemes in Southern Africa are typically US $1,250-2,900, depending on the system used (FAO 1998). This amount includes only direct costs of 'in-field' works and excludes large storage dams and roads, although these would also have secondary uses. At the present grain price of around US $120 per tonne, a hectare of

Figure 1

Exploitable freshwater reserves

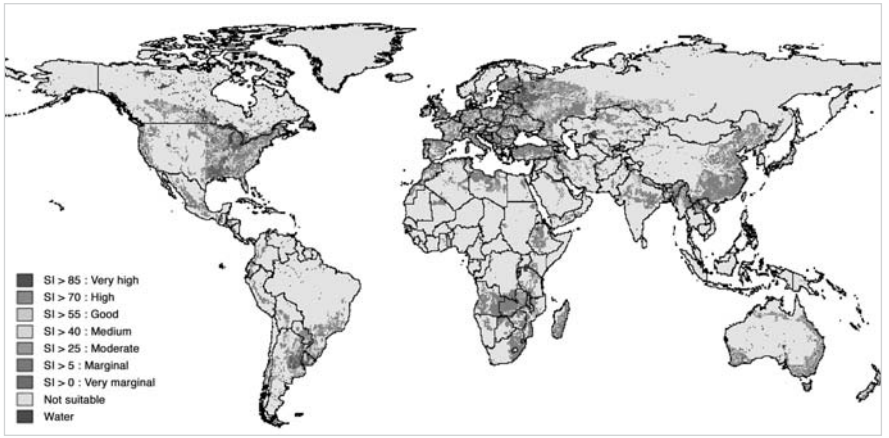


Note: Figures exclude deep groundwater and icecaps.
Source: After Miller 1998.

Southern African soil would realise a return of US $600, assuming a five tonne yield (World Bank 2002). Once other costs have been deducted, such as the operation and maintenance of the irrigation system, fertilisers, labour and machinery, very little is left to cover the initial capital investment in the irrigation system. Water consumed in the production of five tonnes of wheat, excluding runoff, would total about 6,500 m^3, as the production of a tonne of wheat requires about 1,300 m^3 of water (Krieth 1991). The value added to every cubic metre of water used to produce wheat or other grain crops works out to about US $0.09. Roughly 10 times more value can be added to a cubic metre of water used to produce oranges, as these need about 400 m^3 of water per tonne of production. A tonne of aluminium refined from ore adds about US $307 to every cubic metre of water consumed, or 3,411 more than wheat. Typically, domestic use in a country will account for roughly 15% of water consumed, with industry adding perhaps another 30%, depending on the level of economic development. Agriculture frequently uses more than 50% of the water available, yet rarely contributes more than 10% to gross domestic product (GDP) in developing countries. The average water use value for grains, including millet, sorghum, maize, wheat and rice, is about 1,000 m^3 of water for every tonne of mass.

Map 1

World areas suitable for rainfed and irrigated wheat



Source: IIASA 2000.

What emerges is a picture of water resources scarcity suited to a particular economic activity. A shortage of soil water indicates that the production of staple grain crops will not be economically viable (see figure 2). Yet, there are other options open to countries that would allow them to develop their economies within the limits imposed by their water resources.

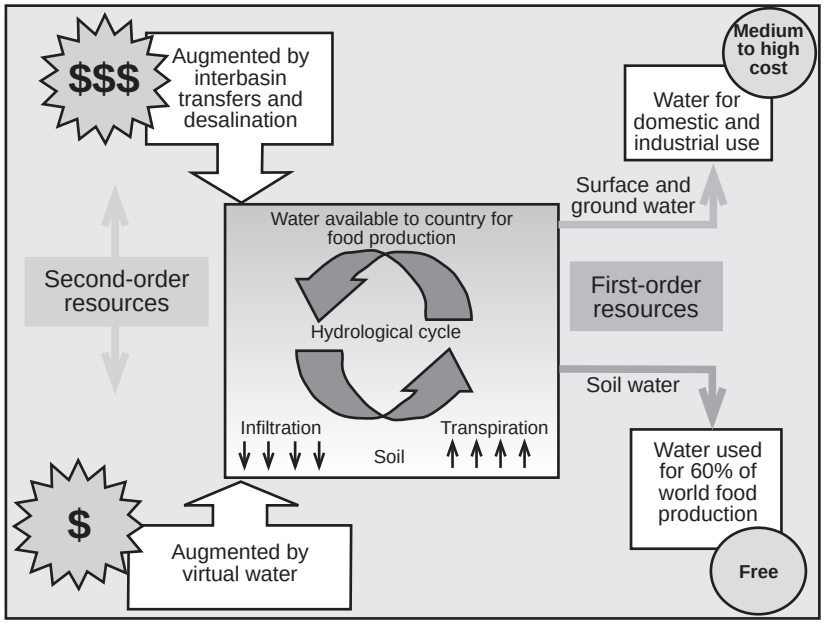
Other options can assist in overcoming a shortage of local water resources for food production, but with a financial cost. The water available for the production of food can be augmented by water transfers, desalination and virtual water. The first two are high-cost options, whereas the last is available at a low cost due to the availability of cheap grain.

It is noted by Berkoff (2001) in a World Bank water strategy paper that:

> "irrigation barely features in such classic texts as those on food policy by Timmer, Falcon and Pearson (1984) or on agricultural development by Eicher and Staatz, ed. (1998). These volumes focus on such issues as the role of agriculture in economic change and development, agricultural technologies, and prices, markets, credit, employment and trade. Irrigated farming systems are considered along with other systems but are not usually given any particular prominence."

Figure 2

Water resources in relation to economic development of 160 randomly selected countries



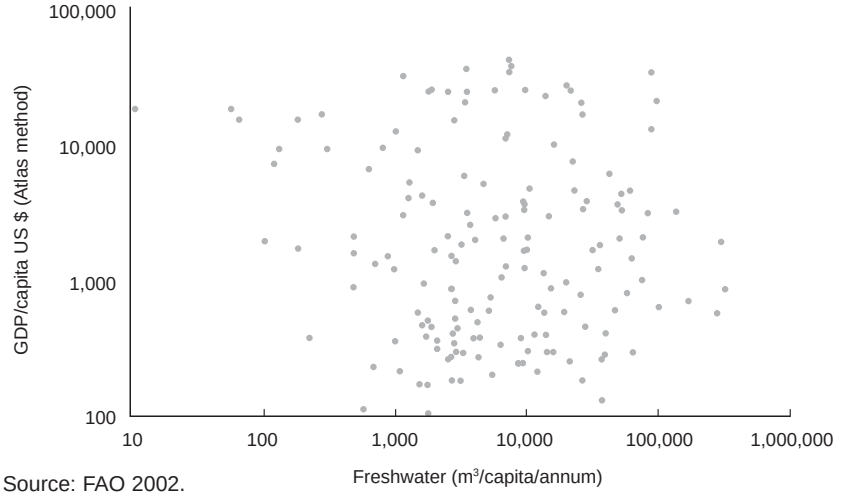
In fact, there is no correlation between a country's level of socioeconomic development and its freshwater reserves (see figure 3).

The mitigatory effect of virtual water

Cyprus, the Bahamas and Bahrain all have very low levels of freshwater resources – less than 1,000 m^3 per person annually. All three have high GDP per capita of more than US $12,000. At the other end of the spectrum, Bangladesh, The Gambia and Cambodia have vast freshwater resources, but GDP per capita of less than US $500 (World Bank 2002). Not surprisingly, the former three countries are importers of staple foods. Income generated in other sectors of the economy is used to import virtual water in the form of cheap grain from temperate regions. As the production of a tonne of wheat requires about 1,300 tonnes of water, there is a considerable saving

Figure 3

Water resources in relation to economic development of 160 countries



Source: FAO 2002.

of the local, scarce water supplies. The water available to the country for food production is augmented by imports of virtual water. These imports are considerably cheaper than the other two options of increasing the supply of freshwater. Desalination of seawater and interbasin water transfer schemes are both too costly to be viable as a source of water for food production. Desalinated water currently costs about US $1 per m^3, approximately 10 times more than the value added by grain production. Water transfers bring a host of other potential problems, such as the insecurity of relying on an external source for water supplies and potential environmental consequences to the donor basin.

A country facing low levels of a resource, in this case water, can continue to develop as long as it has the necessary social adaptive capacity (Turton 2000; Ohlsson & Turton 1999). If its economy is wealthy, such a country will find ways to overcome its lack of natural resources and to ensure its continued economic development. A good example is Israel, which pursued a policy of food self-sufficiency until the mid-1970s. Since then, water has been diverted to more profitable sectors of the economy at the expense of agriculture (Allan 2000). The foreign exchange earned through the export of manufactured products and tourism is used to import the country's staple foods (see figures 4 and 5).

In 1956, agriculture constituted 20% of Israel's GDP. By 1999, this figure dropped to less than 2% (Allan 2000). The total renewable fresh water available to Israel annually is about 1.7 km3 (FAO Aquastat 2002). As can be seen in figure 5, Israel imports about three million tonnes of grain annually, representing close to 4 km^3 of virtual water, saved locally. Water scarcity would only limit the development of a country if there were very low levels of social adaptive capacity. The small volumes of water available in a country can be used for the activity where they generate the most income, as well as taking care of household needs. In direct consumptive uses, such as water used for drinking and certain manufacturing processes, local water resources are critical. If water is used as an intermediate good (as in the case of agriculture), it forms part of a range of other inputs, which all have an effect on the production of food. Economic issues such as trade preferences and barriers, and development assistance can have a greater impact on food production than water resources, and will be examined in the next section.

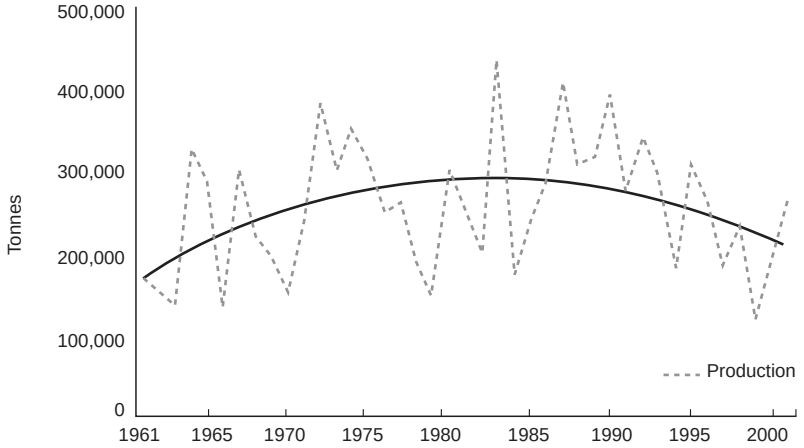
In the case of Israel, virtual water allows the country to continue its economic development, diverting water to the sector of the economy where it generates the greatest yield. This allows the country to implement policies of demand management and sectoral allocative efficiency. The fact that the country is short of water is publicly admitted and supported. There are situations where virtual water can slow efforts to conserve water and implement water demand management. Countries that choose for political reasons not to admit that they are short of water can continue to allow large volumes of water to be consumed by inefficient uses. Egypt was well on its way to becoming a net grain importer in the 1980s. By 1993, it produced almost twice as much grain as what it imported (see figure 6). The trend is continuing, with large new irrigation schemes being planned by the Egyptian government.

It is highly unlikely that Egypt could ever feed its growing population solely from locally produced grain, as imports still form a large portion of consumption. What the importation of virtual water has allowed, however, is for the country to cast itself in the role of an agrarian nation, while ensuring that enough water is available for other sectors of the economy. Publicly the message is that there is no shortage of water in Egypt and therefore no reason to implement demand management. The reason for the above attitude is that Egypt's principal source of water is the Nile, shared with a number of other riparians, which have all indicated that they would like to increase their use of the water flowing through their territories. If negotiations ever start with these riparians, Egypt hopes to argue for a larger share of the water based on the principle of prior use (Allan 2000).

Either local water reserves can be used in the sector of the economy where they generate the most income, like in Israel, or they can be used as a political bargaining tool. In both cases, grain imports will make the specific policy direction possible. Local water ceases to be essential to the food supply of the country and can be used in other activities. This allows countries sharing water resources in arid regions to achieve positive sum outcomes as the volumes of water required to ensure social and

Figure 4

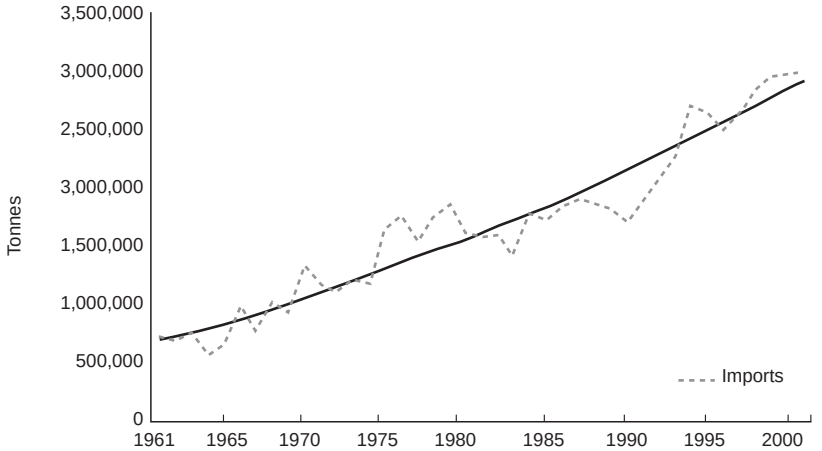
Israeli grain production



Source: FAO 2002.

Figure 5

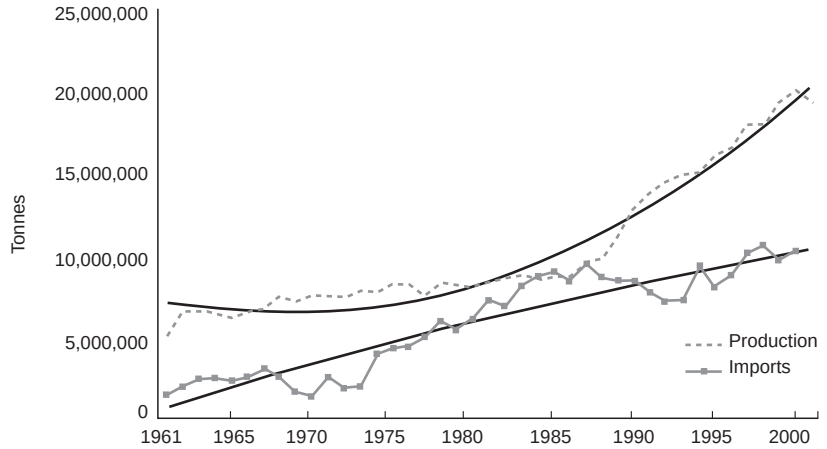
Israeli grain imports



Source: FAO 2002.

Figure 6

Egyptian grain production and trade



Source: FAO 2002.

economic development are relatively small. As long as the available water resources are utilised in the economically most efficient way within the region, the main thrust of interaction ceases to be the arbitration over the division of water resources. Instead, the issue of debate becomes the manner in which economic gains from the water are distributed within the region.

Trade, development and food security

Throughout this analysis of the interaction between water, food and trade, the focus is on grain. The reason is that grain, including wheat, maize, rice, sorghum, millet and barley, comprises roughly 70% of the daily calorie intake of the poor in developing countries (FAO 2002a). These are the people most at risk of food insecurity. As countries develop and per capita incomes increase, grains form a proportionately smaller component of the household food budget. In the European Union and the United States, only about 20% of the population's calories is provided by grain, while close to 30% is provided by animal products. Animal products form

about 7% of the average calorie intake of a person living in Africa. The grain trade does provide a good proxy for food consumption globally, however, as much of the world's meat products, specifically cattle, are fed on coarse grains. Coarse grains are separate to grains destined for human consumption, but frequently benefit from the same agricultural support and protection measures, which will be discussed later.

In arid developing countries, irrigation schemes can be used as a form of development assistance to farmers. The thinking is that the rural poor can become food self-sufficient and even earn an income from the sale of staple foods as long as they have the necessary water resources. Over the past half a century, innumerable irrigation projects have been implemented by governments, aid organisations, religious groups, the World Bank and farmer cooperatives. In many ways, the support of agricultural development schemes is well suited to countries in the semi-arid tropics, as they have the climatic advantage of increased solar energy. Those in the southern hemisphere have the strategic advantage of being able to supply the northern markets out of season. Water can be put to good use in uplifting the lives of the rural poor, in a manner that a large industrial development would find difficult to achieve. As long as there is water, it is reasoned, a type of agrarian utopia can be achieved, stimulating the economy into higher growth.

Frequently, the reality is very different from the dream. There is evidence that irrigation schemes funded by the World Bank in sub-Saharan Africa and South Asia frequently fail to deliver the expected rates of return on the investment (Berkoff 2001). After completion, yields from irrigation schemes are frequently as high as anywhere else in the world. Yet, some years later, yields and the areas being cultivated often drop, causing production and the ability to cover operation and maintenance costs to decline. As most irrigation schemes operate on some form of operation and maintenance cost-recovery from participating farmers, the scheme frequently runs out of money and falls into a state of disrepair.

Farmers, whether subsistence or commercial, act according to what is economically the most efficient. If they cannot recover the capital invested in a certain input through an increase in overall returns, they will not adopt the input. The majority of the rural population of sub-Saharan Africa are landed peasants practising rainfed agriculture. This has always been a risky business due to the dependence upon unreliable rainfall. In good years, large harvests are possible in many areas, yet droughts and floods are a persistent part of the environment of much of the region. The area should thus be a prime candidate for irrigated farming, with high levels of solar energy and large areas of land available. Yet, this is seldom the case. One of the main obstacles to the profitability of an irrigation scheme, at least by covering the operational and maintenance costs, is the success of world grain production. Although the world population has grown at a high rate over the past century, food production has more than kept pace, with production per capita increasing by 25% from 1961 to 1998. The net result has been a steady decline in world food prices, especially grain, since World War II (Merret 1997). Prices for grain in 2001 were less than half of those for 1960 (see figure 7).

The increase in production of grain stems mainly from efficiency gains on large-scale rainfed farms in developed countries. Various technologies have been used to 'industrialise' farming in these countries, with genetic modification technologies, although in their infancy, poised to bring about further gains in productivity. Since the 'green revolution' 30 years ago, there has also been increased production in many developing countries, usually aided by irrigation and fertiliser use. The first developing countries to embark on the mass production of irrigated grains – Indonesia, South Korea, Taiwan and China – had a significant advantage over countries currently trying to emulate them. The costs of many inputs to intensive agriculture, such as fertiliser, machinery, labour and land, have either increased or remained stable. These costs have to be incorporated in an irrigation scheme and paid for by sales from a product subjected to a real value decrease of about 50% over the past 40 years.

Rising productivity is not the only reason for increases in the production of grain. Trade barriers and protectionism in the major grain exporting countries depress prices in various ways. Three main methods of providing agricultural assistance are:

- restricting imports, either through taxation or limitation on quotas;
- providing government subsidies for goods and services to farmers; and
- paying export subsidies to local farmers.

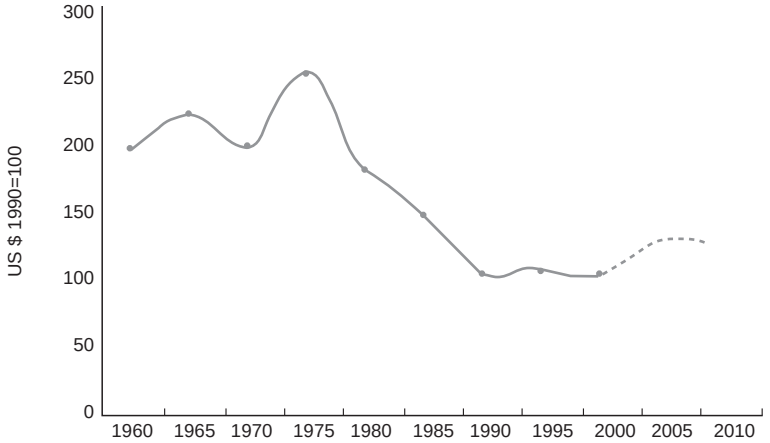
The World Trade Organisation (WTO) Agreement on Agriculture of 1995 sought to reduce the levels of support given to farmers. Developed countries were meant to drop their aggregate measure of support by 36% over six years, and developing countries by 24% over 10 years (Devereux & Maxwell 2001). There are two main problems with the agreement, hindering trade liberalisation. First, the base period during which countries must reduce their levels of support (1986-1988) coincided with the period when support was at its highest (see figure 8). The effect is that any reduction still leaves agriculture heavily supported in these countries.

The second problem is that the average reductions are not trade weighted. Simply put, this means that a country can cut the support on a marginally traded item by 57% and the support on a more important item by 15% to achieve an average of 36%. Although export subsidies to farmers have decreased considerably, other forms of protectionism are still at very high levels. Imports are still restricted and local producer subsidies are paid to farmers. The amounts involved are substantial, with the new US Farm Bill officially estimated at a value of US $171.5 billion over 10 years (ABARE 2001a). Most of this will be paid to farmers in the form of direct subsidies and soft loans to compensate for low world prices, effectively insulating them from the market.

These price support mechanisms are countercyclical, with the levels of support high when prices are low, limiting natural responses that create supply and demand equilibrium. The result is higher variability, which affects producers and consumers in other countries. The bulk of world grain exports are from developed countries, with the US by far the largest player (see figure 9). In effect, the US dominates and controls

Figure 7

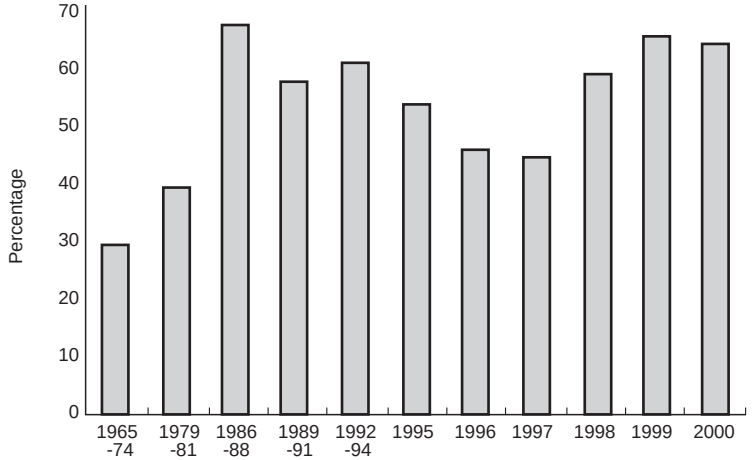
World grain prices per tonne, 2001



Source: World Bank, 2001.

Figure 8

Rates of agricultural assistance in member countries of the Organisation for Economic Co-operation and Development (OECD)



Source: ABARE 2001.

world grain markets due to the extent of its exports. It has been calculated by the Organisation for Economic Co-operation and Development (OECD) using its ADLINK simulation model that, if US wheat production increases by 10% in one year, the world price would fall by about 8% over the same period (ABARE 2001a). While this estimated price decrease is only for the short term, it is clear that US production levels have a pronounced effect on world markets (see figure 10).

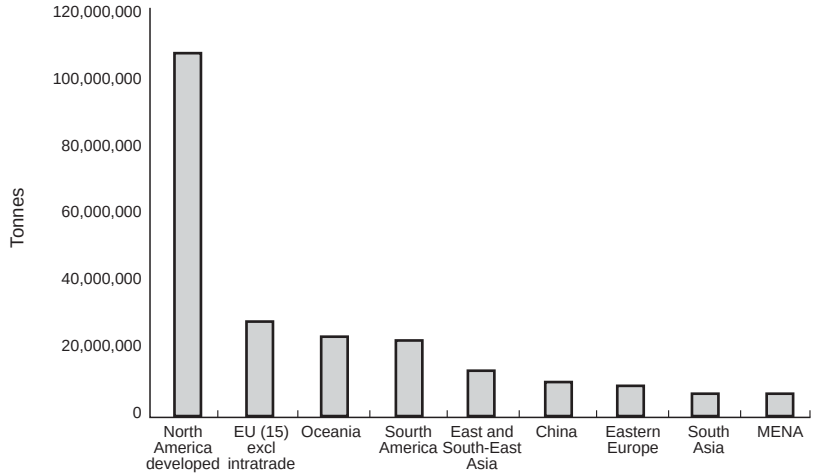
US support for agriculture is concentrated in a few major commodities, called the farm programme crops, which constitute less than one-third of the total agricultural production. These crops include wheat, feedgrains, rice and cotton, and are supported by production subsidies from the government. Although overall agricultural support in the US is relatively low – at about 23% of total agricultural income – it is focused on these crops. Wheat receives support of more than 45%. Sugar and dairy prices are kept artificially high due to import quotas excluding products from other regions, and are therefore subsidised by consumers buying these products. There are strong stakes within the US that ensure the perpetuation of agricultural support measures, even though these are detrimental to the overall economy of the country. In 2000, agriculture contributed 1.12% to GDP, down from 1.7% in 1990 (ABARE 2001c).

The European Union is in a similar situation with regard to agricultural subsidies. These have become entrenched in farm values in the region with prospective landowners calculating the value of subsidies expected on a farm. In 2000, the wealthiest 17% of farms received more than 50% of the aid. These farms all had household incomes higher than the average EU wage of EUR 19,500 (ABARE 2000b). For every dollar a farmer in Europe spends on producing wheat, the EU provides another dollar and a half (ABARE 2000a). To end such subsidies now would be politically stressful, as the farming lobby in both the US and the EU are well organised and highly motivated, placing great pressure on governments to preserve the status quo. There have been attempts to reform the agricultural systems, most notable the Common Agricultural Policy (CAP) of the EU, but with little net effect (see figure 8). “Future negotiations may agree more substantial cuts, but it is reasonable to expect Europe’s heartland agricultural products to remain heavily protected well into the twenty-first century” (Devereux & Maxwell 2001).

It is not only the developed countries that subsidise their agricultural sectors, as many developing countries also seek to protect their local farmers. Generally, the level of assistance given to farmers in developing countries is much less than in developed countries, frequently due to budget constraints. Both India and China support local producers of grains by paying market prices above world prices, but due to the small quantities exported by these countries, there is little effect on international prices. It is argued that, if these governments did not support local farmers, grain imports into these countries would increase, potentially leading to a rise in world grain prices. This is unlikely as the level of subsidies paid to farmers in developing countries is relatively low. For example, the world price for wheat in 1997 was US $112 per tonne, while Indian

Figure 9

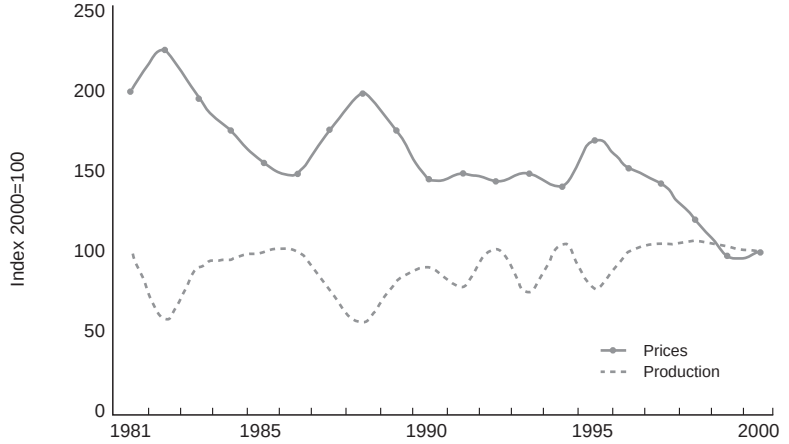
Major grain exporters



Source: FAO 2002

Figure 10

World prices for grain compared to US grain production



Source: After ABARE 2002.

farmers were paid US $120 per tonne. In comparison, farmers in the United Kingdom received US $190 per tonne from their government in the same year (Berkoff 2001).

The removal of trade barriers and other forms of protectionism would have a major impact on the agricultural sector of the international economy – changing prices, stocks, competitiveness and eventually arriving at some kind of equilibrium. The international effects of a reduction in agricultural support levels have been estimated by the Australian Bureau of Agricultural and Resource Economics (ABARE), using its general trade and environment model (GTEM). It included effects such as changes in productive efficiency and intersectoral capital shifts resulting from a drop in tariffs. If a 50% reduction in agricultural support levels was implemented, the model predicted a 0.14% rise in world GDP annually by 2010, relative to the reference case of no support reductions. This represents amounts of US $40 billion for developed countries and US $14 billion for developing countries. Gains in developed countries would stem mainly from cost savings resulting from cutting down on agricultural subsidies. In developing countries, the largest gains would be by countries currently producing and exporting products that receive high levels of support in developed countries (ABARE 2002a). Such a model can only act as a guide to one possible scenario, and not all possible outcomes. What it does show, however, is that there are benefits to both developed and developing nations associated with a decrease in agricultural protection. What it cannot predict is how countries may respond to price changes in commodities. A product not previously profitable in a certain region due to low world prices may be viable under a higher price structure.

The effect of low grain prices

High production levels and agricultural support mechanisms are instrumental in causing a reduction in food prices, due to excess stock being made available on the world market. It could be argued that these low grain prices are beneficial to the poor in both developed and developing nations. Certainly, this may be the case for the urban poor in the developed world and, to a lesser extent, for the urban poor in the developing world. The majority of food insecure people are rural poor living in sub-Saharan Africa and South Asia (UNDP 2002). Impoverished farmers may wish to break out of the cycle of subsistence agriculture, allowing them to invest capital in technology and inputs from the cash generated. Assuming some sort of irrigation scheme has been provided and paid for by outside capital, these farmers would only have to cover the water use and operational and maintenance charges. To attain a higher yield from the land available, they would also need to add fertiliser. Once all these expenses are deducted from the price attained at the market, there is some income left as profit. Increasingly, local markets are flooded with cheap grain imports, often sold at less than the cost of irrigated production. There are years when the price is perhaps high enough to justify irrigated production, but due to the high level of interannual variation in prices, it is difficult for farmers to make long-term plans, as

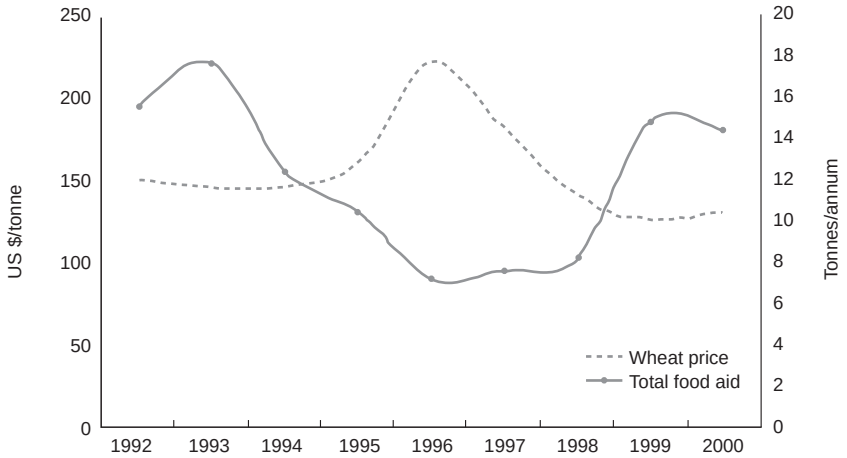
there is no agricultural support or subsidy should the price be low. The rational decision in many cases is not to invest extra capital in farms through irrigation or fertiliser use. Farmers revert to a subsistence lifestyle, relying on rainfall to provide enough moisture for their crops to be sufficient to feed their families. As income cannot be generated through the production of grain on such farms, farmers rely on income derived from off-farm activities. These include finding work in the urban areas or selling their labour on other people's farms. In urban areas, they would benefit from low grain prices, if they have employment. Labourers on farms would benefit from higher producer prices, as this would increase the demand for labour.

Reverting to rainfed subsistence farming exposes farmers and their dependants to increased risk of drought. Where an irrigation supply can usually be maintained in drought years, the rainfed farmer has little recourse to mitigating strategies. When drought strikes, it can lead to a critical depletion of the food supplies. If most of the rural poor are employed as casual labourers on surrounding farms, they are unlikely to receive enough income, as drought would diminish production in the agricultural industry generally. Therefore, the rural poor, whose subsistence crops have failed, need to buy their food on the markets, potentially driving up local prices. If the economy is not strong enough to provide some income for them, they face the danger of starvation. Obviously, more grain can be imported, at relatively low prices, but this may still be outside the reach of the poor resulting in a small and dispersed local market, which makes it difficult to achieve economies of scale on transport costs. The net result may be that large numbers of people rely on food aid. Generally, food aid shipments tend to be highest when prices are the lowest and world stock the greatest (see figure 11). In times of mass crop failures, when the world price for grain is high, countries receive less aid than at times when the price is low. This situation is caused by producer countries using food aid donations as a way of lowering the quantities of grain on the world market in a bid to bolster low prices. As countries have had to reduce the level of support provided to their domestic farmers, alternative methods of supporting prices are increasingly being used.

In summary, the effect of low grain prices is to remove the incentive for local farmers to invest in technology on their farms. They revert to rainfed subsistence agriculture and other forms of income generation. The risk posed by drought is thus increased and, unless levels of social adaptive capacity are high enough, there is the possibility of reliance on food aid or facing starvation. The argument presupposes that agricultural sustainability is based on profitability. It is possible for governments to fund all capital and operation and maintenance costs involved in irrigated farming, allowing farmers to produce grain and sell it for a profit. Such a policy is not likely, as the trend is for governments to cut back on support spending, both due to obligations under the WTO's Agreement on Agriculture, as well as general budget cuts proposed by the International Monetary Fund (IMF). Even if a country bucked the trend and subsidised its irrigated agricultural sector in order to produce food crops, the high costs associated with providing irrigation in the developing world are

Figure 11

World wheat prices compared to food aid shipments



Source: ABARE 2001b.

prohibitive – up to US $18,000 per hectare if all indirect costs are factored in (FAO 1998). It would be difficult to justify spending such large sums of money on an activity that will remain unprofitable for as long as current trade practices are in place. For this reason, many governments supporting irrigated agriculture choose to focus on the production of high-value cash crops. Such activities can be economically viable, as these products do not only fetch higher market prices than grain, but also consume less water in their production, with fruit and vegetables using less than a third of the volume of water required by wheat (Krieth 1991). Non-food cash crops such as coffee and sugarcane are also water efficient, but frequently face the same unstable world market prices as grain. Quite frequently, the only effect of subsidising irrigation is to transfer production from rainfed farmers to those practising irrigation, without adding significantly to overall production (Berkoff 2001).

Conclusion

What is apparent is that the nexus of water, food and trade is not linked in the intuitively obvious way. Water is not the crucial limiting factor to food production,

food security or economic development. The fact that a country faces a shortage of freshwater resources does not necessarily lead to low economic growth. Second-order or socioeconomic resources can be used to overcome such a water shortage, with virtual water augmenting the local water available for food production.

The issue of crucial importance to any country is that the level of second-order resources should be sufficiently high to overcome a shortage of water, and not the other way around. Water should be used in the sector of the economy where it will generate the highest profit. In the Okavango basin, this often means tourism with valuable foreign income from visitors to natural attractions. The environment becomes the prime user of water to ensure continued ecological functioning. Tourism has the advantage over agriculture of lower levels of protection in the developed world, although there are other types of uncertainties attached to this industry. Mining and manufacturing industries can also be viable water efficient activities, adding a high value to the water consumed.

The approach can shift the emphasis away from water-sharing towards benefit-sharing. Botswana would certainly want the unique ecology of the delta to be kept intact as it is a significant generator of income in the region. This is to be balanced with the desire of the upstream riparian states to use water as a tool for development. At the one extreme is the scenario of all three countries clamouring for as much of the water as they can secure, causing large-scale environmental destruction in the process. The other extreme is Botswana paying the upstream riparians not to develop their sections of the river. Far-fetched as this is, the answer is located between these two extremes.

Agriculture can be a development tool in developing economies wishing to kickstart economic growth. Unless a country is blessed with large resources of soil water, irrigation is needed to produce most crops. Low world prices, brought about by high production and agricultural protectionism, make it difficult to produce food crops profitably, affecting the sustainability of irrigation schemes. Water does not limit continued agricultural expansion, as even water-rich developing countries struggle to become major food producers. The central issue limiting modern agriculture in developing countries is price. Low world prices and their causes need to be factored into any agricultural development policy, whether aimed at food or cash crops. If the terms of trade for a particular product are not in a country's favour, it is highly unlikely that it will ever be able to compete internationally with such a product, no matter what its comparative advantage may be in the factors of production.

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CHAPTER 12

Shared freshwater resources: Management or governance?

Bastien Affeltranger and Alexander Otte

Abstract

Trading off the extent to which water is an economic or a social good, introduces a gap between private and public actors. On the one hand, water managers from the private sector aim at making sure that water provided is duly paid for, so that infrastructure investment and operational costs can be covered. On the other hand, public authorities are expected to make sure that enough water (quantitatively and qualitatively) is provided to people. In this sense, there is a *management-governance* duality in the water resource sector.

The purpose of this chapter is therefore to consider how market-oriented water management could be integrated in governance processes. The design of balanced agenda-setting and decision-making processes will be discussed, which would involve public authorities, elected decision makers and private sector stakeholders. This aims at establishing socially acceptable (and/or accepted) water allocation patterns, and the design of technically feasible, economically realistic and environmentally sustainable water management practices.

First, the public-private interaction is considered in the context of river basin management. Lessons learned from participatory processes in water management are reviewed, with a focus on public participation. Suggestions are made on how these lessons can be useful in the design and implementation of public-private arrangements. Focusing on basin development planning, conclusions are drawn that can hopefully be of use in the Okavango River basin.

Introduction: Water market versus water welfare?

Water is not the only environmental medium about which the question is raised whether it should be considered as a common good or as a commodity. For example, much has been said and written about the so-called ‘pollution permits’ – titles or licences authorising holders to emit predetermined quantities of CO_2 – and about the new ‘air’ market that such permits may generate (with ‘rich’ countries, for example, buying the right to pollute from poorer countries). This silently destroys the possibility for least developed countries to count on future industrial development and slows down innovative processes to reduce pollution in industrialised countries.

On the one hand, considering environmental media like air or water as *common goods* means that equitable (or even free) access of all people to these media should be maintained, because they are vital to human life. Therefore, air and water can be understood as basic human *rights*. On the other hand, water is considered as an economic resource, with scarcity and distribution costs reflected by water pricing.

The question here is not so much whether water should be distributed free of charge to people or not, but rather who should design water *allocation patterns* (so that equitable access to water can be maintained for all) using which procedure, and upon which criteria, principles and values such tradeoffs should be based. Furthermore, it should be established who should be tasked to operate the management and distribution of water resources and how much users should pay to receive water. The underlying question is to clarify how water authorities and managers can avoid poor users (those who cannot pay the price) from being excluded from the water distribution system, and whether the state is considered as being in charge of caring – and paying – for those left out by a commercial allocation system.

In 1992, the *International conference on water and the environment* (Dublin, 1992) stated that water is both an economic and a social good. In turn, considering water as a commodity legitimates market forces requests for a liberal approach to water management, while water as a social good questions state and institutional capacity to balance equitable allocation and allocative efficiency, thus introducing a *governance impetus* in water management policies.

This statement has several consequences for the management of shared freshwater resources. Actually, water resources are by definition always *shared* by a diversity of water users. The question is rather at what scale the water-sharing process should be considered. For example, in the context of an international river basin, the sharing of freshwater at basin level involves different countries and states, or multilateral agencies. From another point of view in the same basin – at national level, for instance – other categories of water users (farmers, companies, municipality officials, dwellers, and others) will be involved. Quite naturally, there are interrelationships and influences between basin and sub-basin scales, as well as between the various categories of stakeholders. The media largely contribute here to the dissemination of water-related issues in public opinion.

The (sometimes controversial) opposition established between water considered as an economic versus a social good stresses one of the many dimensions of water uses and reveals a fundamental tension in the management of freshwater resources.

Indeed, deciding whether, or to what extent, water is an economic or a social good, introduces a gap between two parties. On the one hand, the public authorities have the duty to make sure that enough water (quantitatively and qualitatively) is provided to people. On the other hand, water managers from the private sector aim to make sure that water provided is duly paid for, so that infrastructure investment and operational costs can be covered. In this sense, a *management-governance* duality is clearly evident in the water resource sector.

It is thus important to consider how market-oriented water management could be integrated in governance processes. In this regard, balanced agenda-setting and decision-making processes could be designed, involving public authorities, elected decision makers and private sector stakeholders. These would aim to establish socially acceptable (and/or accepted) water allocation patterns, and to design technically feasible, economically realistic and environmentally sustainable water management practices.

Who should decide what is – or is not – acceptable, and for whom? The human nature of water consumption actually changes the very nature of the resource. It calls for water management solutions that can integrate or balance ecological, environmental, technical, sociocultural and economic factors. The integration of these parameters should be – and sometimes actually is – the task of a proper water *policy*.

Should the market or the state take the first step in terms of water policy design? A ‘centralised’ conception of the state would advocate for public authorities to take the lead in establishing guidelines for water allocation and distribution. Yet other views may consider that such water policy in fact more likely derives from a socioeconomic context that is more favourable in terms of water demand and supply. For instance, according to Allan and others (1999):

> “water service provision is part of the cure. Stimulating economic growth and enhancing livelihoods remain the development imperatives that will create a context where water policy reform can be considered and implemented. But only if we can get the right balance between caring for the resource and water service provision for livelihoods.”

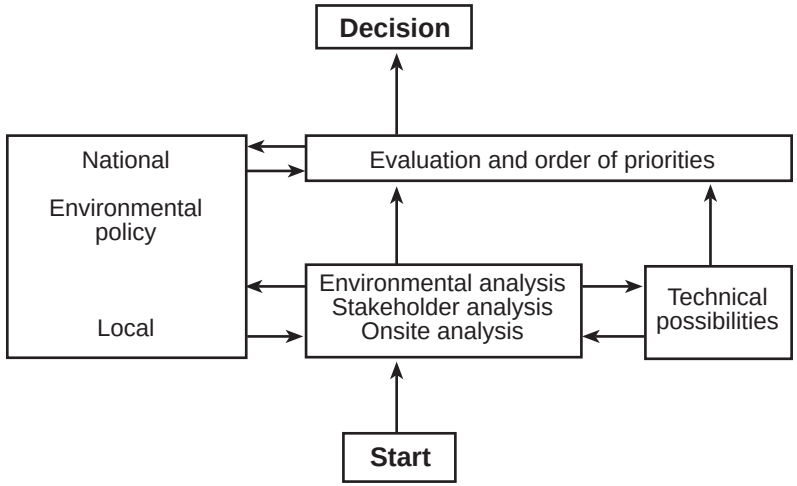
Based on the outline of a method to assess the sustainability of water management solutions, Eilersen and others (1999), as well as Matsui and others (2001) show that the decision-making procedure over water is an iterative process involving sociotechnical factors, as well as policy-relevant considerations (see figure 1). Together with water shortage, lack of funding, and lack of expertise, these authors also list the lack of institutional support to water-planning decisions as one of the problems facing developing countries today.

How should such water policy be designed, implemented and enforced? Who should be responsible for building consensus between numerous water users, and who should be accountable for tradeoffs between various uses of water? Should these duties be the responsibility of the state or the market, or should ‘hybrid’ options be established for decision-making? Eventually, could it be possible to get out of the state/market alternative, and in such a case, which other stakeholders should also be involved?

Market pressures and increased pricing of water resources are indeed growing trends in both developed and developing countries, although for different reasons. In so-called developed countries, both the management and marketing of drinking water are increasingly delegated by municipalities to private sector companies. State

Figure 1

Assessment method



Source: Eilersen et al 1999, in Matsui et al 2001.

intervention usually takes place at either national (for example, the establishment of safety regulations and quality standards for drinking water), or regional levels (policy design, institutional arrangements for basin-scale management of water resources and mitigation of water-related hazards, among others). The European Union established water quality regulations even at supranational level.

In so-called developing countries, the management of water at local level has frequently been characterised by community-based or spontaneous initiatives (small settlements, 'home' wells), possibly with the support of non-governmental organisations (NGOs) and/or international aid (technical and financial). Water management and sanitation in larger cities have increasingly involved service providers from the private sector (both private and semi-public funded companies).

Yet, at national level, 'conditionality' criteria put forward by development agencies, or promoted by lending institutions, have introduced a strong liberal influence on the design of public water policies, thus drawing the recipient countries towards an increased privatisation of water resource management.

The underlying discourse of this policy considers that privatisation would lead to a more cost-efficient management of water resources, alongside with an increased

transparency of action in public services and institutions. In addition, the pricing of water is expected to discourage users from wasting water and other irresponsible behaviour and practices unfit to a water scarcity context. In short, making people pay for water is seen to have the potential of making them more responsible, resulting in the saving of water resources.

But, what happens when people cannot pay for the water they need, or if water users cannot pay the price that their neighbour can afford (competition over access to water)? And what if the parties consist of a community, on the one hand, and a large water-consuming industrial plant, on the other?

In other words, how can the equitable access of all users to water be maintained in a market context, and what role should be played by the different parties, both public (state) and private (market and private sector), as well as by stakeholders from civil society? Answers to these questions have to take into account technical, environmental, social, economic, political, cultural and ethical factors.

Below, issues are addressed that are related to the interaction between the public and the private sector, with particular attention to partnerships over water within the context of river basin management. With the focus on shared water resources, lessons learned from participatory processes in water management are reviewed. The purpose is to discuss the possible architecture of water governance methods and tools at both basin and sub-basin scales. This aims to contribute to the ongoing and future efforts of different stakeholders in the Okavango River basin.

River basin management and public-private partnerships over water

River basin management: A sociotechnical challenge

River basins sustain ecosystems, are essential sources of water for households, agriculture and industry, and fulfil many non-consumptive uses. Yet, due to population growth and overexploitation, the water demands made on river basins are increasing while the capacity of basins to meet these demands is decreasing (UNESCO 1999).

Over the last years, two key concepts in water management have gained ground internationally: that of 'integrated management' and 'river basin management' (Zoeteman 1999).

According to Mostert and others (1999), following the logic of sustainable development, the aim of river basin management can be defined as ensuring the multifunctional use of rivers and their basins for present and future generations. Yet, different levels should be distinguished in river basin management: institutional framework, planning, analytical framework, operational management and river basin users (see figure 2).

Both integrated management and river basin management conceptually enlighten the limits (technical, environmental, social and political) of a mere 'engineering'

Box 1

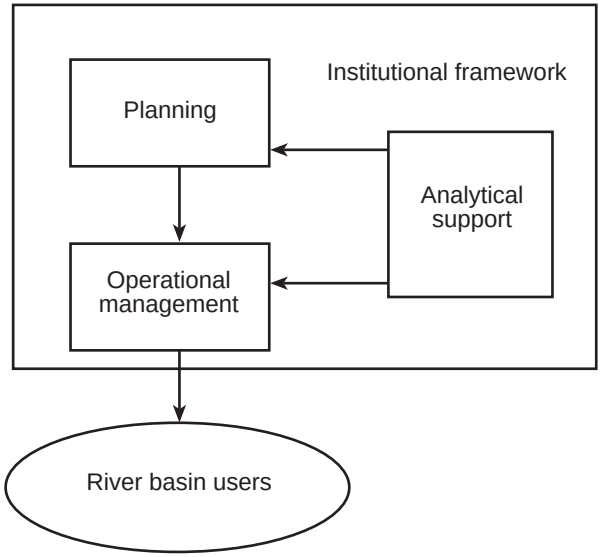
Definitions

Integrated management refers to an approach that takes into account all relevant stakeholders, all functions, and all aspects of water, including quantity and quality issues, with the aim to manage water resources in a sustainable way.

River basin management (RBM) refers to the water system or geographical scale that is considered the most relevant for sustainable water management.

Figure 2

Levels in river basin management



Note: No feedback mechanisms are indicated.
Source: Mostert et al 1999.

approach to solve water problems. In addition, water-related institutional solutions deriving from these concepts are not universal and must be tailored to basin characteristics (Keijts 1999). River basin management has increasingly been presented by water authorities, planners and managers as a way to achieve multiple water-related purposes, both technical (including ecological and environmental) and social (including political). Because it helps stakeholders to arrive at decisions based on consensus over conflicting water *uses* and challenging water *users*, effective river basin management is considered to contribute to the prevention of conflicts about water (for instance, in contexts of water scarcity) and so-called 'water wars', which are thought to derive from such contexts.

In national and international river basins, an open dialogue is necessary between water sector cooperators on different policy levels; water managers and water users; water managers and land-use planners; and the government, farmers, industry, NGOs and citizens. In some cases, legislation establishes basic principles of water management, and clarifies the expected role of the private sector (Carmo Vaz 1999). In Mozambique for instance, water legislation consists mainly of the 1990 Constitution Act and the Water Law (Law 16/91 of 3 August 1991; see Ibraimo (1999) for a detailed description of Water Law, Rights and Supply in Mozambique). The National Water Policy was approved in 1995 (Resolution 7/95 of 8 August 1995) and includes the following principles:

- Water is a scarce resource.
- It has to be conserved and used sustainably.
- Water has economic value.
- Water pollution must be prevented and combated.
- Water is in the public domain.
- Water abstractions and effluent discharges must be licensed.
- Private initiative has a role in water development.

The multiple functions of river basin management point to the need for present and future managers to be trained in both technical and non-technical topics, such as hydrology, hydraulic engineering, environmental issues, decision-making processes, the involvement of stakeholders, and national and international water law (Overbeek 1999). More generally, it is advised that training programmes in water management result from a design jointly drawn up by representatives of the public and private sectors. The purpose would be to ensure that water practitioners from both sides share the same *professional and occupational culture* (language, methods, tools, and more) regarding water issues.

Consequences for public-private partnerships

The conventional strong reliance on a combination of technical solutions and a supposedly benevolent state that arranged for a substantially subsidised supply of

water is no longer a feasible strategy. Yet, the expectation that the government shall provide water remains a common attitude (Lundqvist et al 2001).

Striking a sound balance between water-related public and private interests raises the issue of institutional arrangements that are designed to establish water *allocation* patterns (between water users), and clarify water *management* practices within specific water-use sectors (including the allocation of responsibilities for agenda-setting and decision-making).

Participants at the international river basin management workshop (27-29 October 1999, The Hague) identified generic features usually observed in (more or less) successful river basin management initiatives. Some of their conclusions that are relevant to public-private partnerships around water in river basin management include:

- "The institutional structure for RBM should facilitate the necessary co-ordination within the water management sector and between the water management sector and other sectors such as land-use and environment … the institutional structure should also be a means of empowerment [of] all stakeholders, including economic interest groups, local communities, environmental NGOs and women" (II.a.7-9).
- "Decentralisation should be pursued as much as possible in order to bring RBM as close as possible to the individual citizens and to facilitate local variation in response to differing local conditions and preferences [subsidiarity]" (II.a.13).
- "There may be a distinct role for private entities … in the provision of water services and water management. Private ownership of water infrastructure is a controversial issue that needs to be carefully explored" (II.a.18).
- "Water rights should be flexible and responsive to changing circumstances at both the national and international level" (II.a.19).

According to Mostert and others (1999), privatisation may be positively introduced in river basin management as a possible solution to the "shortcomings of large bureaucracies." They also maintain that privatisation is only possible for specific services such as the construction and operation of water supply and wastewater treatment infrastructure – not for regulatory functions such as policy-making. This confirms the essential and proactive role to be played by public authorities in shaping guidelines to water management practices.

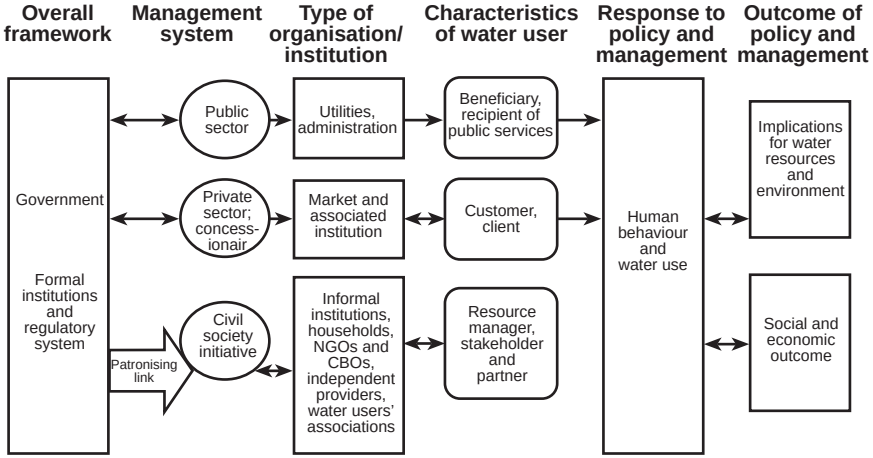
A midway option between the 'fully public' or 'fully private' provision of water services is the provision of publicly owned private companies.

Lundqvist and others (2001) have established a relationship between the kind of water management system (public sector, private sector/consessionair, civil society initiative), the type of organisation/institution, the characteristics of water users, and the outcome of policy and management (see figure 3).

Apparently, these management options seem disconnected. In practice, mixed or hybrid solutions are chosen by governments and the private sector.

Figure 3

Types of management systems and the context in which they operate



Note: Arrows show hypothetical direction of relationships and response.
Source: Lundqvist et al 2001)

Water markets

Participants at the international river basin management workshop in 1999 made specific recommendations on the establishment of water markets. Tradeable water rights can therefore be an important tool for river basin management, but are only effective if a number of conditions are met:

- the basic water demands of citizens and ecosystems are safeguarded;
- the rights are defined and agreed upon by water users;
- the exercise of these rights are physically possible;
- monopolies can be prevented; and
- an international agreement on the issue is concluded, in the case of international river basins.

Several difficulties arise when establishing a water market. Stephenson (2001) lists the range of water-related services that can be bought and sold to users:

- simple source and disinfecting to protect sources against contamination, with no organised transport of water;

- pump and supply line to a reservoir or standpipe;
- individual standpipes or connections for each house or for each pair of houses; and
- individual household supplies, with multiple connections to kitchens, ablution facilities and toilets.

It should be kept in mind that water distribution and wastewater management issues need to remain integrated in both the design and implementation of water management schemes and governance patterns. Moreover, problems in the privatisation of water services are likely to vary depending on the level of socioeconomic development, as well as the level of water stress, thus calling for flexible management and governance tools that would make it possible for public and private water authorities to adapt their decision-making processes to different situations.

Along with other environmental and technical difficulties, Stephenson (2001) proposes a list of problems due to poor institutional involvement in the management of water resources in developing countries. These problems – some of which are listed below – are more directly connected to financial and accountability issues in the business management of water and the maintenance of distribution systems:

- The perception exists that alternative technologies are better, notwithstanding public preferences.
- The underrecovery of costs reduces financial sustainability.
- Subsidised costs annoy those providing subsidies.
- Cross-subsidies result in decreased usage by high payers, and overusage by low payers.
- Low contributions by poor users means suppliers do not feel obliged to extend or maintain services.
- The priorities of public officials will favour wealthier users and public salaries above poorer users.
- Cuts in services to non-payers waste the capital installation cost and result in users finding alternatives, possibly not as hygienic.

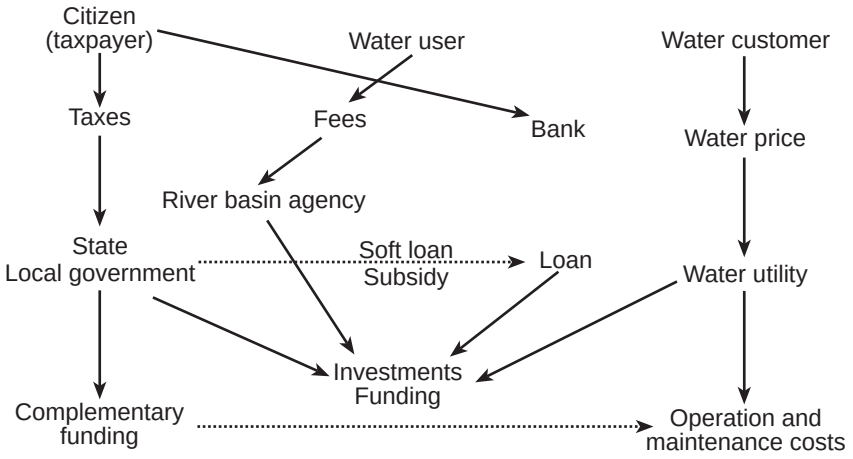
The establishment of a water distribution scheme also raises the issue of the financial sustainability of the system (for example, capital investment in the distribution infrastructure, and operation and maintenance costs). Lee and others (2001) conceptualised the financing channels of a water distribution system as shown in figure 4.

Lyonnaise des eaux, a French company involved in the water distribution sector, lists some of the major difficulties related to water services in poor neighbourhoods (in Stephenson 2001):

- Connection costs are too high.

Figure 4

Water distribution: Financing channels



Source: Lee et al 2001.

- Customer management costs are too high with a high percentage of unpaid bills, high rate of unbilled or fraudulent consumption, low consumption resulting in relatively high collection costs, and high network maintenance costs.
- Consumers may find alternative water procurement strategies – network, standpipes, wells, water deliverers, uncontrolled sources such as ponds and rivers, and more.

According to Stephenson (2001), "the focus [when developing water markets] must be on developing institutional arrangements that provide services at least cost and in a way that is responsive and accountable to beneficiaries." In addition, several shifts in emphasis should be conducted in parallel:

- from top-down approaches to approaches that are a judicious mixture of top-down and bottom-up;
- from a focus on the construction costs of facilities to lifetime costs of facilities (including operation and maintenance); and
- the recognition of the need to ensure the financial and environmental sustainability of projects.

Establishing water markets, possibly on the basis of a public-private regulation or allocation of tasks and responsibilities, is one of the many tasks that may be performed by public-private partnerships. Other activities that can be addressed through such cooperation include:

- monitoring of water parameters (level, turbidity, dissolved oxygen, temperature, pollutants, among others) and integration of data in a publicly owned database (service contracts can be established between the state and riparian companies);
- participating in the design of water allocation patterns, and in establishing priorities for land use, infrastructure investment and other sociotechnical tradeoffs;
- shared managing of water demand and supply in extreme weather conditions, such as droughts and floods (managing water quantity and quality);
- providing information and conducting awareness campaigns for public education on water issues (consumption patterns, resource scarcity, pollution and water-borne diseases); and
- developing consensus-based rules for the operation of reservoirs and dams, with special attention to reservoir operation in extreme events (such as droughts and floods).

Participatory processes in water management: Framing partnerships

Much has been done and written about the participatory management of water resources – both in national river basins and sub-basins, and in international river basins. Participatory processes involve stakeholders from both the public and private sectors, and some lessons learned in planning for public participation are presented below, which may be useful in the design of public-private partnerships.

The basic principle of the participatory management of water resources is that stakeholders, such as water users, should have a say in the making of decisions that affect their lives. Although sometimes considered as a time-consuming process – and it sometimes is – the involvement of stakeholders in water-related decision-making is commonly viewed as a means to improve the quality of the decisions made, and the efficiency of their implementation (Mostert et al 1999). Yet, it should be kept in mind that the lack of an appropriate framework to encourage stakeholder involvement, as well as a highly sectored development in the river basin can be limitations to efficient participatory decision-making on water issues (Gaal Vadas 1999).

Water-related issues that could be addressed through participatory processes in water management include the following (adapted from Affeltranger 2001a):

- water-related international agreements (including treaties on transboundary rivers, river basins and water resources);
- water-related bilateral and regional conflicts and tensions;
- the management of national and international river basins and groundwater;

- the conservation and rehabilitation of water capacities and quality at local level or in small catchment areas;
- catchment-based stormwater management and a catchment-level approach to integrated water management and planning, including the mitigation of water-related disasters and the reduction of vulnerability to water-related hazards;
- water-related decision support systems, including those for water allocation;
- environmental impact assessments and the management of wastewater treatment facilities; and
- decision-making processes on water resources in the public (including the design of water-related legislation) and private sectors.

Participants at the *Conference on participatory processes in water management* (June 1999, Budapest) agreed on the following advantages to collaborative water planning:

- Participatory processes contribute to consensus-building, with consensus being the strongest decision.
- Decisions based on consensus are more widely known and accepted by the community.
- Consensus may help to mobilise human and community resources for action.
- Collaborative planning helps to identify all the dimensions of a problem or decision.
- Participatory processes contribute to the socioeconomic cohesion of a community.
- Participatory decisions support integrated, preventive solutions, rather than reactive solutions.
- Collaborative planning involves solutions that cost the least or are free.

Langton (2000) identifies a series of principles for meaningful public participation in water resources management:

- Always seek the community good.
- Develop a community relations approach.
- Strengthen the civic culture.
- Involve the entire organisation.
- Assure senior management support.
- Be frequent, if not ‘virtual’, relying on information and communications technologies such as the internet.
- Plan/evaluate continuously with rigour and communicate the results to the public.
- Share leadership responsibility.
- Collaborate with other agencies.
- Integrate and respond to public input.

In terms of public participation methodology, a framework for the planning stages for public participation would include the following (adapted from Creighton 2000, and Walesh 1995):

- *Decision analysis*: clarifying the decision being made; specifying the planning and/or decision-making steps and schedule; and deciding whether public involvement is needed, and for what purpose.
- *Public participation planning*: specifying what is needed to involve the public during each step of the planning and/or decision-making process; identifying internal and external stakeholders; identifying techniques to be used at each step of the process, taking into account the needs of different population subgroups and stakeholders; and linking the techniques in an integrated plan.
- *Implementation planning*: designing the activities of public participation, for example, a workshop agenda, where meetings will be held, who will make the presentations, and feedback activities and communication options for presentation of the results.

It must be added that particular attention must be paid to the careful monitoring of water-related participation processes (which implies the definition of indicators), and a final evaluation of the participatory process. Both the indicators and the success assessment features should be defined on the basis of consensus among water stakeholders.

Langton (2001) suggests key features that are essential to the satisfactory involvement of stakeholders in the water decision-making process:

- *Government lead:* Government authorities should be proactive and should take the initiative to involve representatives of civil society and community leaders in water-related decision-making processes. Indeed, community participation should be pushed forward as an emergency solution in a context of social pressure. By providing good conditions (including practically) for the establishment of dialogue, the government contributes to building trust.
- *Early involvement:* Stakeholders likely to be committed to water-related activities should be involved in the early stages of the decision-making process. Communities should participate in reaching consensus on four major issues: a needs analysis, a resources assessment, an inventory of broader social expectations, and the design and implementation of water supply options (and wastewater management).
- *Keeping time:* Consensus-building takes time. Authorities should therefore plan in advance of water-related decisions to be made, so that time is available for users and communities to receive sound information on the situation, understand and process it, and finally make their contribution to the decision.
- *Informed consensus:* Community leaders and representatives of civil society or stakeholders should receive all the necessary information from the authorities so that they can contribute to the decision after having considered all aspects and dimensions of an issue. Technical services should therefore be provided by the state to ensure that technical knowledge can be ‘translated’ into common language.

- *Sharing the process:* Participatory processes often involve, for practical reasons, a limited number of participants and stakeholders. The essential question therefore is to assess to what extent they represent the communities and populations concerned with water issues. In this sense, the yardstick to measure the quality of participation is not so much the total number of participants, but rather the categories of the public who have been represented and who voiced their opinions and needs in the process. Participatory processes should therefore be highlighted by the mass media. This would contribute to the appropriation of the process by the community at large. This also increases the visibility of the state’s initiatives.
- *Providing feedback:* Stakeholders and community members involved in water-related participatory processes should be provided with feedback on their contributions. The objective is for the authorities to recognise their commitment as a specific added value, so that these stakeholders remain motivated to participate in future schemes.

Mostert and others (1999) suggest another set of criteria to be considered if public participation is to realise its potential:

- *Timing*: Public participation should be organised early enough to influence decisions, but not before the different plans and ideas are specific enough to attract the interest of the public. Public participation could possibly be organised during different phases and could target a variety of segments of the public: in early phases (semi-)professional NGOs, and later, the local population and individuals.
- *Methods:* Different methods are appropriate to different target groups. For instance, information meetings for semi-professional NGOs should not be the same as those targeting local communities. The type of issue at stake (complex, controversial) and the specific culture are also important. For instance, in a culture where consultation with the public is seen as a sign of leadership weakness, the usual western methods of public participation could be political suicide and other methods will have to be devised. Whenever the chosen methods allow for large numbers of participants, members of the public themselves should be able to choose to participate – after receiving sufficient information in an appropriate form to make such a choice.
- *Follow-up:* If decision makers do not take the results of public participation seriously, the result could significantly damage legitimacy and acceptance. In this respect, a legal-administrative approach to public participation could be useful – for example, a legal requirement to publish and react to the comments received in combination with access to justice.
- *International basins*: In international basins, reluctance by authorities to organise effective public participation at international basin level tends to be quite high. It can be seen to complicate international negotiations. Reaching the public is also more difficult than in smaller national basins. However, a number of (international) river basin commissions have made meetings of their plenary body

and/or subsidiary bodies more open. In most cases, the general public cannot participate in the meetings, but NGOs can sometimes get observer status, and/or can be asked to answer specific questions.

Three comments must be made about the recommendations discussed above. First, the private sector is often considered as being distinct from civil society. It is clear that a distinction should be made in terms of institutions between public-private partnerships, on the one hand, and public participation, on the other. The latter refers more to water users as individuals and groups, whereas the former refers to larger water providers (urban water suppliers) and users (quantitatively and qualitatively, such as companies and major polluters). However, both cooperative undertakings can learn from each other, and should be kept interrelated by public authorities. Public participation practice may also have direct or indirect consequences in terms of human resources management *within* companies.

Second, the involvement of water users in the design and/or validation of legal and administrative documents structuring the participation process should be advocated. This means that water users and stakeholders are capable of reading, understanding and commenting on the legal and/or regulatory material provided to them – which is seldom the case in developing countries. In such contexts, the authorities should strive for a consensus-based design of water management *objectives* and monitoring *indicators* (for both patterns of water uses, and availability of water resources).

Public participation in international basins touches upon the issue of *scale* in water-related decisions (international and basin-wide, or national and sub-basin level). The idea is not for all stakeholders to participate at all levels of decision-making, nor during all stages of the decision-making process. Rather, a *link* should be maintained between the different participatory levels and schemes (through advertising and communication mechanisms, among others).

It should also be kept in mind that the different levels of water-related decisions and actions can influence one another (lobbying, scape-goating, use of the media as a means of pressure), as explained by Shamir (1999). He pointed to the importance of the viewpoints of farmers' groups and their political influence in the Israeli-Jordanian talks on the shared management of the Jordan River.

The question whether and how NGOs should be involved in decision-making processes focused on international or national river basins raises the issue of the representivity of these organisations. In short, who speaks on behalf of which water users? Some criteria are suggested to assess the relevance of NGO selection in a water-related decision-making process (adapted from Affeltranger 2001b):

- *Organisational criteria*: When was the NGO established, and what are its principles or objectives? Is it local or national, and does it belong to an international network? What is its funding source(s)? What are the relationships, if any, with political groups and/or private sector entities?

- *Sociopolitical criteria*: How many registered members does the NGO have? What is the turnover rate in membership? To what extent can the NGO be considered as being representative of a specific category of water users or stakeholders? What communication process enables the NGO to keep in touch with its members: a bottom-up needs assessment, an iterative design of the NGO's policy and strategy, or a feedback loop for top-down reporting/information/validation of statements made and actions taken by NGO delegates?
- *Participation skills criteria*: Has the NGO already been working with public authorities? On what issues has it already made stands, or taken actions? Has the NGO already been involved in sociotechnical controversies? With what success? Who/what team will speak in the name of the NGO at the negotiation table?
- *Technical skills criteria*: What is the level of water-related expertise within the NGO? Is the NGO capable of understanding the terms of the issue at stake, or will it need additional information/training? Would additional information be requested for the NGO's spokespersons only, or does the NGO need further support to explain water issues and decisions to its members?

A basin development plan for the Okavango River?

Although the signature of the SADC Protocol on Shared River Basins and the creation of the SADC Water Sector are encouraging signs, Carmo Vaz (1999) reaffirmed the importance of establishing new deals in the management of water-related issues at the level of the Southern African Development Community (SADC). The harmonious integration of the economies of SADC countries requires a new way of making water-related decisions in the region, and water remains a sensitive sociopolitical issue.

Moreover, a higher level of social and economic development can be considered an asset in the management of water resources within the context of water scarcity. According to Allan and others (1999), while particular levels of water certainly do not determine economic outcomes, the reverse is not true. High levels of development of a political economy – that is both its economic strength and diversity, and its governance capacity – enable even a seriously water-deficit economy to operate effectively. A strong and diverse political economy has numerous water management options – a weak entity does not. In other words, investing in both democratic and political stability and socioeconomic development positively contributes to the management of water scarcity.

Basin development planning: An opportunity and a method to form partnerships

Basin development planning offers both an opportunity and a methodology to gather public and private entities, together with stakeholders and civil society around

the water negotiation table. Just like political stability in Okavango riparian countries influences the potential for a peaceful, upstream-downstream management of water, socioeconomic development at basin scale cannot be separated from development in each riparian country.

Any basin development planning effort should be undertaken simultaneously on two levels – at river basin level and at sub-basin or national catchment level. Both the methodology (for example, the identification of development goals and options) and the monitoring of development results (such as macroeconomic indicators) should follow parallel tracks in Okavango riparian countries.

Elements are suggested below that advocate for an increased involvement of water actors in a development planning process at both basin and sub-basin levels. The mutual recognition of present and future water resource needs (both quantitatively and qualitatively) is a key to more peaceful water relations between Okavango riparian countries. Yet, negotiations over water do not only require the goodwill of the parties, but also documents and data to establish a dialogue, or to feed a controversy with scientifically or technically approved elements that have been agreed upon by the parties. The consequences are twofold.

First, each riparian country should be in a position technically to locate and quantify water sources they currently rely on (mapping of surface waters and aquifers, monitoring of withdrawn volumes), and to sketch the patterns of social, economic and environmental uses of water (quantitative distribution of water consumption between users of drinking water, agriculture, industry, tourism, ecosystems, and more). Whereas the former requires mainly scientific and technical expertise, the latter also demands an efficient institutional and administrative system for the collection and processing of socioeconomic data.

Second, riparian countries should also be capable of sketching water consumption patterns for the coming five, 10 or 20 years. This would require water authorities to access information on development schemes by integrating demographic and environmental projections, as well as educational, industrial and financial scenarios and data. This means that such socioeconomic planning material becomes available at national level, and that water consumption patterns can technically be derived from these broader development schemes.

Jointly sketching a concerted plan for the socioeconomic development of the basin would imply that Okavango basin countries are capable of striking a balance between the benefits of their own, nation-wide social and economic objectives, and the costs and externalities that these objectives would imply in the other riparian countries. In short, socioeconomic development patterns designed in one country should be both socially acceptable and environmentally sustainable basin-wide.

Yet, establishing a basin development plan does not mean that all basin countries should design or follow the same plan, nor that national growth rates should remain even basin-wide.

Expected advantages of an Okavango basin development plan are that:

- Countries maintain a dialogue and an institutional agreement for peaceful dispute settlement.
- Each country can communicate on the (negative) consequences of a decision made by another one.
- All countries can speak with a unified – and peaceful – voice when looking for technical or financial support from a regional institution (for example, SADC), from the international community (United Nations agencies and programmes, donor countries, the World Bank, the International Monetary Fund, the European Union, and others).
- Countries are more likely to attract private sector investors, especially for basin-wide or transboundary industrial or business activities.

The design and implementation process of a basin development plan is expected to yield lessons learned that can be provided to other countries that share rivers in the region, with the Okavango basin being a possible test case for SADC, as well as a study basin in the Green Cross International *Water for peace* initiative.

What could be the role of external support agencies?

According to Alaerts (1999), most external support agencies have articulated specific water policies and programmes over the past decade. Some of these players are large, and take a broad development view – yet, among the five international development banks, only the World Bank, the Asian Development Bank and the Inter-American Development Bank have elaborated water policies (1999).

Other players take a more sector-based perspective, or focus on specific water-related issues – including the United Nations Food and Agriculture Organisation (FAO), the UN Environmental Programme (UNEP) and the UN Development Programme (UNDP).

Basin development planning is a complex undertaking by nature. It has multiple purposes, and may make requests to various funding sources. It involves different categories of water users and other relevant stakeholders (both from inside and outside the river basin). In this sense, it is the duty of water planners at basin level (international authority in charge of river management) and sub-basin level (public authorities in countries) to perform the *integrative* governance function of basin development plans.

Some UN agencies are multidisciplinary by nature (or by mandate), and can be instrumental in helping authorities of international river basins to design, implement, evaluate and review the basin development planning process. For example, the Division of Water Sciences of the UN Educational, Scientific and Cultural Organisation (UNESCO) develops methods and tools to establish science-based basin development planning, and to bring together different categories of stakeholders so that they can make socially feasible and environmentally sustainable decisions. The division also acts as the secretariat of the International Hydrological Programme (IHP) (see box 2).

As a contribution to the UN *World water assessment programme*, UNESCO Programmes, including IHP have launched the project *From potential conflict to co-operation potential*. The initiative is an attempt to help governments and water authorities to build social peace and political stability at river basin level through improved dialogue and exchange (see table 1).

Green Cross International (GCI) currently runs a project for conflict prevention and resolution through civil society participation entitled *Water for peace*. UNESCO and GCI have combined their complementary approaches and established a joint programme on *From potential conflict to co-operation potential: Water for peace*.

With regard to cooperation in shared river basins, UNESCO provided support to the promising *Universities partnership* on water conflict analysis and dispute resolution. This partnership involves Oregon State University, United States; University of Pretoria, South Africa (African Water Issues Research Unit – AWIRU); University of Aberdeen,

Table 1

From potential conflict to cooperation potential: Project objectives and outputs

Overall objective	To enhance and capitalise on the cooperation potential of water. To mitigate the risk that potential conflicts can turn into real conflict.
Operational objectives	Defining and surveying conflicts in water resources management. Monitoring indicators of potential conflict and cooperation potential. Providing educational material and programmes. Providing decision support tools. Disseminating results and good practices.
Project outputs	Web-based information and reference system. Contribution to the World water development report. Potential conflict and cooperation indicators and their interpretation. Toolkits of techniques. Educational material. Educational modules and training course. CIRBM Network.

PC-CP Dissemination Material, available at UNESCO Division of Water Sciences, Paris

Box 2

The International Hydrological Programme

The International Hydrological Programme (IHP) is the major instrument of UNESCO to carry out its water-related activities. After the successful International Hydrological Decade (1965-1974) conducted by several UN agencies, the IHP was established in 1974 under the aegis of UNESCO, where its secretariat has been located ever since. It is an intergovernmental programme with 160 member states. Every two years, the IHP intergovernmental council meets to set policy guidelines and to make major decisions on its implementation.

The plans for the successive programme phases of six years are made in full consultation with member states and reflect the current needs of countries.

The fifth phase (1996-2001), designated *Hydrology and water resources development in a vulnerable environment,* set out to stimulate a stronger interrelation between scientific research, application and education. The emphasis was on environmentally sound integrated water resource planning and management, supported by a scientifically proven methodology.

The current sixth phase (2002-2007), designated *Water interactions: Systems at risk and social challenges*, is based on the fundamental principle that freshwater is as essential to sustainable development as it is to life and that water, beyond its geophysical, chemical and biological function in the hydrological cycle, has sociocultural, economic and environmental values that are interlinked and mutually supportive.

Some of the interactions to be further investigated include those between surface water and groundwater; atmospheric and terrestrial parts of the hydrological cycle; fresh water and salt water; global watershed and river reach scales; quantity and quality; water bodies and aquatic ecosystems; science and policy; and water and civilisation.

United Kingdom (School of Law); Asian Institute of Technology (AIT), Bangkok, Thailand; University of New Mexico, US; University of Costa Rica, San Jose; University of Zimbabwe, Harare; Linkoping University, Sweden (Department of Water and Environmental Studies); and a partner university from China.

Conclusion

Before and since the founding of the tripartite Permanent Okavango River Basin Water Commission (OKACOM) in 1994, several initiatives were taken aimed at joint

decision-making over water resources in the Okavango basin. Solving water scarcity problems in the basin indeed requires cooperative efforts, based on a shared understanding, agreement and recognition of the needs, aspirations and responsibilities of each basin state (Ashton 2000). Joint basin development planning is expected to contribute to these requirements.

Yet, prior to the design of future plans for the basin as a whole, each country should be in a position to clarify what social, economic, environmental and institutional future it wants, and what it wishes to avoid. This nation-wide planning task is the responsibility of the government – it is the duty of elected decision makers to sketch what the future should look like for the country.

Deciding on social and economic plans for a nation is not an undertaking that can be done at state level only, nor can it be kept away from civil society. In short, the participation of stakeholders is crucial to the relevant and efficient design of development schemes. There are mainly two reasons for this. The first reason is *options* – only a broad participatory process enables decision makers to get a clear picture of the nation's aspirations and capabilities, as well as of scenarios that can be seriously considered for the future. The second reason is *ownership* – only a broad participatory process is likely to help decision makers to win social support for the choices they make, and ease their implementation. Last but not least, participation constitutes one of the imperatives of democracy.

In other words, efforts by riparian countries should not be confined to international state level only, but national decision makers should also embark on a consultation process at country level, prior to taking a basin-wide stand. However, any participatory process conducted at national level should not be presented to stakeholders as a separate initiative distinct from negotiations undertaken at basin level. The major reason is that a 'basin perspective' in the public debate would help stakeholders to see that national decisions are, to a certain extent, basin-wide decisions as well. The aim would be to build 'common basin ownership' that can be peacefully shared by inhabitants of Angola, Namibia and Botswana.

It is suggested that decision makers of these three countries create a small task force, composed of delegates from the private and public sectors, and involving representatives of universities and training institutions in the countries. This task force should be established in cooperation with relevant SADC divisions and services, as well as with due attention to bilateral/multilateral agreements and partnerships already existing between Okavango riparian countries, and other countries of Southern Africa. The *Water for peace Okavango pilot project* could form an appropriate basis for the development of this initiative. The role of this task force could be to:

- obtain a clear picture of the expectations of the different categories of water stakeholders along the Okavango River;
- identify the objectives of public authorities in terms of socioeconomic development at both country and river basin scales;
- capture the water-related questions that stakeholders ask in the process;

- undertake field missions and draw lessons from basin development planning initiatives undertaken (or ongoing) in other basins worldwide;
- report to the authorities in riparian countries, inform other decision makers, and make public any conclusions relevant to water users; and
- prepare a draft basin development plan, which includes details on the participatory process to involve stakeholders and to win social support for the planning effort.

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CHAPTER 13

The importance of instream flow requirements for decision-making in the Okavango River basin

Heather MacKay and Brian Moloi

Abstract

This chapter provides an overview of instream flow requirements (IFR) for the protection and maintenance of aquatic ecosystems, with particular reference to the Okavango River basin. The chapter covers the conceptual basis of IFR, indicating the links between the sustainability of water resources and the maintenance of aquatic ecosystem health, structure and function, and hence the need to allocate adequate water for ecosystem maintenance. There is a range of available methodologies for the determination of IFR, and the selection of an appropriate methodology depends on issues such as scale, resolution, the level of confidence required, data availability and capacity constraints. These aspects are broadly discussed, with specific reference to the Okavango River basin. In the final part of the chapter, recommendations are provided to guide possible future determination and implementation of IFR in the Okavango River basin.

Background

Instream flow requirements (IFR) is a generic and widely used term that refers to the water required to protect the structure and function of aquatic ecosystems at some agreed level. Other terms that are sometimes used include ‘environmental water allocations’ or ‘environmental flow requirements’. In the United States, the term ‘minimum ecological flows’ is also used.

Methodologies to determine IFR were originally developed in response to the question posed by engineers designing outlet structures for large dams: What is the minimum flow that must be released from the dam for the downstream aquatic ecosystem to survive? However, the generally accepted approach has more recently been to determine not just the absolute minimum flows required, but those that will maintain an aquatic ecosystem in a particular desired state of ecosystem health. In recent research and studies, explicit links have been made between the state of aquatic ecosystem health that is desired or maintained, and the level of ‘goods’ and ‘services’ provided by such an ecosystem, including recreational potential, fisheries, and aquatic plants for food, basketwork or housing construction (Turpie et al 1999). The required flows are therefore currently seen as a critical element in protecting the value of and benefits provided by the natural ecological functions of healthy aquatic ecosystems.

Conceptual basis for instream flow requirements

Why protect aquatic ecosystems?

The conventional approach to water resource management, especially in developed countries, sees water resources as being important primarily for the volume of water that can be abstracted and supplied to users to meet offstream demands such as those for urban water supply, irrigation and industrial development. What this approach does not normally take into account is that the commodity aspect of water is only one part of a complex ecosystem, which includes an aquatic component (streams, rivers, wetlands, groundwater) and a terrestrial component (the land and soils over or through which the water flows). Ecosystems provide much more benefits than just water. In particular, if the aquatic ecosystem is healthy and functional, humans can enjoy an array of ecosystem goods and services, among others:

- the assimilation, decomposition and transport of certain biodegradable wastes, within limits, due to the natural decomposition and dilution processes;
- sequestration of heavy metals that might otherwise cause toxic effects on aquatic organisms and on humans who might consume those organisms;
- attenuation of floods and mitigation of potential damage due to flooding;
- storage of water for later release during the dry season, which is a particularly important function of headwater seeps, sponges and springs, as well as wetlands, and which helps to ensure the reliability of flow in surface water resources;
- food resources such as fish, shellfish and plants;
- material resources such as reeds for thatching and timber for building;
- medicinal plants;
- support of subsistence livelihoods such as floodplain or recession agriculture; and
- maintenance of cultural, spiritual and recreational activities that, in cases such as ecotourism and recreational fishing, may have important economic spinoffs.

Many of these benefits are difficult to measure in economic terms, and have tended to be ignored or discounted in major water resource development projects. Yet, in developing countries, many people may depend on the natural ecosystem structure and function for their livelihoods. If ecosystem goods and services are lost, reduced or degraded, those people who have been reliant on such goods and services must be compensated or provided with alternatives. Such alternatives are seldom economically or environmentally sustainable, and may require cross-subsidisation by another sector of the population.

There is growing awareness that, particularly in developing countries, aquatic ecosystems must be protected in order to ensure that the benefits of ecosystem goods and services can be sustained in the long term. Aquatic ecosystems in Southern Africa have become adapted to natural seasonal cycles and generally high interannual

variability, and are thus resilient to some degree. However, if they are overutilised – for example, if too much water is taken out or too much waste put in – they will become degraded, their structure and function will be compromised, and key species, components or processes may be lost. A balance must be found between the consumptive use of water for offstream activities, and the provision of instream flows for maintenance of the ecosystem structure and function on which people depend for goods and services.

It is reasonable to assume that there is a relationship between the health status of an aquatic ecosystem and the abundance, variety and value of the goods and services that are provided by such an aquatic ecosystem. A healthier aquatic ecosystem should clearly be able to support a greater diversity or quantity of goods and services to humans. Ecological research has been directed towards the quantities or flow of goods and services that are associated with different levels of aquatic ecosystem health, while recent research in the field of resource economics has been aimed at quantifying the value of those ecosystem goods and services in monetary currencies (Turpie 1999). Thus, the costs and benefits of managing aquatic ecosystems at different levels of ecological health can be assessed, and decisions about water utilisation can be made accordingly.

What is needed to protect and maintain the health of aquatic ecosystems?

A healthy aquatic ecosystem is where the major ecological components of habitat and biota are present, and all the major ecological processes are supported and functioning well. This includes natural processes such as decomposition and nutrient cycling, oxygenation and carbon sequestration, photosynthesis and primary production, grazing, predation and reproduction. An ecosystem does not have to be pristine to be healthy, although generally speaking, the closer to natural a system is, the healthier it is likely to be.

In order to protect the health of an aquatic ecosystem, four components of the ecosystem must be addressed:

- A sufficient volume of water must be provided, distributed in as close to natural a pattern as possible.
- Water quality, including the physico-chemical and biological characteristics, must be maintained at appropriate levels to protect biota and their associated ecological processes.
- The character, extent and condition of instream and riparian habitat must be maintained to provide sufficient habitat of a suitable quality to support viable biotic populations.
- The character, distribution and condition of biotic populations (fauna and flora) must be preserved to maintain ecological processes that depend on these populations.

The overall health of an aquatic ecosystem will depend on the degree to which these four components are supported by water resource and land management activities.

The measurement of ecosystem health is still a developing science, and many monitoring tools and techniques are now available that allow an assessment of the health of an aquatic ecosystem in comparison to some reference condition – usually the natural, unimpacted condition (Roux et al 1999). Within the limits of uncertainty, it is therefore possible to set quantitative objectives for aquatic ecosystem health, and then allow utilisation of water resources, such as abstraction and waste discharge, to the extent that the desired level of ecosystem health can still be maintained.

It is important to note that aquatic ecosystems are impacted directly through the consumptive uses of water resources, as well as indirectly through the effects of land-use practices. It will not help to design and build a dam that can release sufficient water of the right quality at the right time to protect downstream aquatic ecosystems, if aquatic habitat, at the same time, is degraded due to unsustainable land-use practices, the destruction of riparian vegetation, smothering by sediments as a result of catchment erosion, and the loss of local species due to the introduction of invasive alien plant and animal species. This is dealt with in more detail later in this chapter.

What are instream flow requirements?

For the purposes of this chapter, instream flow requirements are defined as:

- the quantity and quality of water, expressed in terms of the magnitude, duration, timing and frequency of specific flows; and
- the quality of water, expressed in terms of the ranges, frequency and duration of occurrence of concentrations of key water quality variables that are required to maintain a desired level of aquatic ecosystem health.

The desired level of aquatic ecosystem health is usually related to the ability of the ecosystem to provide certain desired ecosystem goods and services, or to the maintenance of a single specific good or service, such as a subsistence or commercial fishery.

Why are IFR important for decision-making?

Traditionally, decision-making about water resources has been primarily focused on the volume of water that could be abstracted from a river or other water resource, and kept in storage or diverted for offstream use. There are many examples of large water resource development projects in Africa where cost-benefit analyses were carried out to ascertain the feasibility of a development, but these cost-benefit studies did not take into account the economic value (usually non-monetary) of the goods and services provided by the natural aquatic ecosystem. These goods and services were often lost or severely reduced if provisions for IFR were not made once the development was implemented. Hence, the long-term social and environmental costs

of water resource development projects were often not accounted for, although these costs frequently outweighed the benefits of the development itself.

To make water resource and allocation decisions without considering the aquatic ecosystem and the IFR to maintain the aquatic ecosystem is an approach that is deeply flawed. The report of the World Commission on Dams (WCD 2000) has highlighted the need to determine and make provision for these requirements, and to broaden cost-benefit studies to include all ecosystem goods and services.

Most countries in the Southern African Development Community (SADC) now subscribe to the principles of Agenda 21 and the Dublin principles on water, which require development, use and management of water to be environmentally sustainable. In addition, as awareness grows of the real value and importance of aquatic ecosystem goods and services, the realisation also increases that water use must be balanced with ecosystem protection, not only to protect the intrinsic value of the ecosystem itself, but also to protect the value of ecosystem goods and services for people. In order to protect aquatic ecosystems, there is a need to understand their water requirements, and how these ecosystems are affected by changes in the water regime due to development and use. Only once this understanding is gained, can the limits of sustainable water use be quantified so that water resources are not overutilised.

In many countries, and SADC countries are no exception, decisions about water resource developments and water allocations are made by a national or catchment-based water agency, while the protection of aquatic ecosystems is usually the responsibility of an environmental or wildlife agency. The situation may be complicated if an agricultural agency has overlapping responsibilities, as may be the case with the subsistence utilisation of ecosystems, for example, in floodplain agriculture or fisheries. Policy and legislation are often fragmented or even contradictory, and when this is added to the problem of multiple agencies with overlapping or interlinked responsibilities, the common result is that decisions on water management do not take the requirements or objectives for aquatic ecosystem management and protection adequately into account.

Whatever the governance arrangements, all relevant agencies within a country (and in all basin states in the case of a shared river basin) need to:

- agree on the importance of IFR in sustainable water resource management, the protection of ecosystems and biodiversity, and the maintenance of subsistence livelihoods;
- cooperate at national level and with local stakeholders in the setting of objectives for aquatic ecosystem health and the determination of IFR to achieve these objectives; and
- collaborate in regulating impacts in their own sectors, including land use, water use and resource use, so that aquatic ecosystems are fully protected.

If the principle of making water allocations for aquatic ecosystems is to be implemented with any real commitment and effectiveness by governments and

stakeholders, then the water allocated to ecosystems should lead to enhanced quality of life for people, and should not prejudice the provision of basic water supply, sanitation and food security. This is particularly important in Southern Africa, where large numbers of people rely on the natural functions and processes of aquatic ecosystems for subsistence livelihoods. If IFR are not determined and included at the planning stage of water resource development projects or water allocation strategies, it becomes much more difficult to 'retrofit' these requirements once developments are in place. Not only may physical constraints have been imposed due to the design and construction of flow release mechanisms at large dams, but the reallocation of water from existing users to ecosystems can lead to lengthy negotiations and legal processes while water users seek to protect their perceived rights.

Main issues associated with instream flow requirements

Policy and legislation

National policy to support the allocation of water to meet IFR, specifically to protect and maintain aquatic ecosystems, is fairly new in most countries where it has been implemented. Commonly, the issue is addressed in environmental policy, legislation or regulations. However, experience is beginning to show that, unless IFR or water allocations for aquatic ecosystems are explicitly mentioned and given clear status in water policy and legislation, they are not likely to be implemented in practice, even though the water requirements of aquatic ecosystems may be determined in the planning phase of water resource development projects and in environmental impact assessments. It is not sufficient to have the issue only addressed in environmental policy and legislation (MacKay et al 2002).

The SADC Protocol on Shared Watercourse Systems provides a framework for collaborative decision-making on the utilisation and protection of water resources in a shared river basin, but does not specifically mention IFR. However, the principles on which the protocol is based support the protection of the aquatic environment and the control of water utilisation by each member state through an authorisation or permit system. Each member state would administer the permit system and make water allocations according to procedures set out in its own national policy and legislation, but within the limits of an agreed 'fair and equitable share'.

This means that the national policies and laws of states that share a particular watercourse or river basin may need to be reviewed and aligned to establish the status of IFR, to determine these requirements and the allocation of water to meet them, and to support the authorisation of domestic and other water uses in a way that respects and gives effect to IFR.

Consideration should be given to the incorporation of local customary law into policy and regulations for the determination of IFR in particular river basins.

Customary law has often been developed over long periods and is tailored to the sustainable management of ecological resources in a river basin. It represents an important knowledge resource related to management, and is likely to have much wider support at community level than policy imposed by central government, leading to a better chance of the successful implementation of measures to fulfil IFR.

In relation to the Okavango River basin, it will be necessary to take into account the deliberations and resolutions of the 8th conference of parties to the Ramsar convention (November 2002). Two resolutions were adopted at the conference, one dealing with the implementation of the recommendations of the World Commission on Dams, and the other related to the determination and management of water allocations for wetland ecosystems. The second resolution addresses the needs for contracting parties to review national water policy and legislation to ensure that water allocations for wetland ecosystems are given clear status in water law, and that procedures for allocating water to users take environmental water allocations into account.

Determining instream flow requirements

There are two primary ways in which IFR can be expressed:

- either as the volume and quality of water that must remain in a river, watercourse or water resource at specific points in the resource to maintain a particular desired level of aquatic ecosystem health; or
- as the volume of water that may be abstracted from specific points in a river, watercourse or water resource and the magnitude of change in water quality that may be allowed in a river, watercourse or water resource for aquatic ecosystem health to be maintained at a particular desired level.

In general, IFR are expressed in relative terms, as the proportion of the virgin or present-day flow that must be maintained, or that may be abstracted, and the allowed deviation from natural or background water quality conditions. Although the aim in both cases is the same – to protect aquatic ecosystems and maintain a certain desired level of aquatic ecosystem health – the scientific process to determine these levels may be slightly different depending on the approach that is taken.

How much water must be left in the ecosystem? This approach is suited to situations where water utilisation is already fairly high, possibly even tending to the overutilisation of water resources in the basin, and to fairly well-regulated systems, where major abstractions are made from dams or weirs rather than run-of-river, and where scheduled releases can be made from flow control structures to meet IFR. The determination of IFR then establishes the conditions that must be achieved in the river or water resource for flow and water quality, and establishes the limits of utilisation that can be allowed, through the following relationship:

Total allowed abstraction = total virgin flow – IFR

This relationship is multidimensional, and must address the spatial and temporal variability (seasonal and interannual) of the flow pattern that is required to support ecosystem functions and processes. Overall, water allocations to individual users should not add up to more than the total allowed abstraction. The decision on the total allowed abstraction must be embedded into local and regional development planning processes to ensure that developments are planned and implemented, while recognising the constraint of total allowed abstraction.

This approach is somewhat similar to strategic environmental assessment as limits are set to establish the allowed level of development of water resources, irrespective of the nature of each individual project. Individual projects such as dams and large weirs, or substantial discharges that may have a significant impact on the aquatic environment, may still require a separate environmental impact assessment. If water resources are already overutilised when the IFR are determined, then a strategy can be drawn up for progressively implementing water demand management measures and achieving a situation where water use is contained within the limits so that these requirements can be met.

The disadvantage of this approach is that, if the IFR that are initially determined turn out to be too low after monitoring to offer adequate protection to the aquatic ecosystem, then it can be difficult to reduce already authorised water use or to reverse impacts to meet new, higher requirements. Thus, it is prudent to ensure that the determination of these requirements is conservatively done.

How much water can be abstracted from the ecosystem? The alternative approach to provide water for the protection of the aquatic ecosystem is rather to determine how much water can safely be abstracted from the system, or how much change in water quality can safely be allowed, before the impact becomes unacceptable or exceeds some agreed target level. In this case, the absolute water requirements of the ecosystem are not determined as IFR, and only the allowed relative change is determined and translated into use limits.

This approach is similar to environmental impact assessment as several water-use scenarios may be developed and tested to ascertain their impact on the aquatic ecosystem. A water-use scenario is then selected that corresponds to the maintenance of a desired level of ecosystem health (which may be the present state, or the 'no observable effects' level). Water uses are evaluated and authorised, as long as the combined impact of all water uses does not exceed the allowed abstraction or change in water quality.

This approach is more suited to river basins where there has been little or no large-scale development of water resources, and the impact of human activities is still relatively insignificant. It is appropriate for systems that display a high level of natural variability in rainfall, runoff and water chemistry, since it is difficult to design an appropriate flow regime in these cases for the water that must be left in the system. However, it is usually possible to assess what the impact may be of removing certain flow components such as interannual floods. The approach is also suited to unregulated

rivers, where abstraction is mostly run-of-river, and those where there are few hydrological gauging stations and few large flow control structures from which to make releases dedicated to meet IFR. Auditing and control of human activities are mostly through measures directed at the sources of impact, so that regulation occurs through the metering of abstractions and the imposition of effluent discharge standards.

The disadvantage of this approach is that, unless regulation and auditing of individual water uses are effective, it can open the door to cumulative impacts, where a project-based environmental impact assessment is carried out for each successive 'small' development project, and where each demands 'just a little more' water. Without an effective programme to monitor ecosystem health of which the results are regularly reviewed and incorporated into management and regulatory activities, the condition of the aquatic ecosystem can gradually degrade until the desired level of health is no longer maintained.

Uncertainty and confidence in the determination of instream flow requirements

Ecosystems are inherently uncertain. There is always a degree of randomness in their responses to environmental driving forces such as flow and water quality. A degree of uncertainty thus exists in any prediction of either the response of an ecosystem to a change in one of the environmental drivers, or the specification of the driving force needed to maintain a particular level of ecosystem health. Each ecosystem is also unique. Although general principles and an understanding of causal relationships can be extrapolated from one ecosystem to another, the determination of IFR for one ecosystem may not be directly transferable to another, even a neighbouring ecosystem.

Uncertainty can be reduced and confidence increased by the lengthening of timeseries datasets, so that causal relationships within the ecosystem and between the ecosystem and its environmental drivers can be identified and quantified as far as possible. In general, the less data available for a certain ecosystem, the lower will be the confidence in the IFR designed to maintain such an ecosystem in a particular state. The typical problem, though, is that highly confident answers on IFR are immediately required, or in the short term for decision-making in a river basin. To get around this conflict, any determination of requirements should ideally provide results that are conservative, with a safety factor built into the determination to allow for uncertainty. The lower the confidence, the higher should be the safety factor. As a result, whatever water resources or water allocation decisions are taken should at least not lead to irreversible damage to the aquatic ecosystem. As monitoring programmes are implemented and datasets built up, it should be possible to review the determination of IFR on the basis of a better understanding of ecosystem dynamics, possibly reducing the safety factors and potentially making more water available for allocation or development as confidence improves.

Ideally, before entering into water-sharing negotiations, a high-confidence, agreed upon determination of IFR should be available. In the short term, this might not be possible in the Okavango River basin. Although many studies have been undertaken about Panhandle and the delta, data from the upper and middle reaches of the basin is sparse. Any determination based on present data is likely to yield medium confidence answers for the Panhandle and delta, low to medium confidence answers for the middle reach of the basin between the confluence of the Cuito and Cubango rivers and the Panhandle, and low to very low confidence answers for the reaches above the Cuito-Cubango confluence.

Methodologies to determine instream flow requirements

Setting habitat-based endpoints

In determining IFR, it is necessary to select quantitative, verifiable management endpoints towards which the ecosystem is managed. An endpoint usually represents a particular desired level of ecosystem health, expressed in terms of the water quantity, water quality, habitat conditions and biotic conditions required to meet this level. Requirements would then be set that would achieve these endpoints.

For reasons of scale and resolution, the endpoints for management are generally habitat-related and expressed at the river-reach level (DWAF 1999). Since patterns of flow and water quality vary between headwaters and downstream reaches, it is not appropriate to set IFR as a 'single number' (such as the percentage of mean annual runoff), which applies throughout a river basin. The basin must be divided into representative reaches, of which each would require a separate determination and specification of its IFR.

To be useful in developing operational rules for a river basin, any method for determining IFR must address the magnitude, timing, frequency and duration of flows, and must indicate both intra-annual and interannual variability. Generally, the ecologically important flows are (King et al 2001):

- 'maintenance' dry season low flows, which maintain ecological processes and critical habitats and refuges for biota during the low-flow season;
- wet season low flows, which maintain important wet season ecological processes and habitats;
- intra-annual floods or freshets, which are often triggers for ecological processes such as spawning and migration, and which flush out poor quality water and small debris that may accumulate during the dry season; and
- larger floods, which maintain channel geomorphological characteristics, flush out accumulated sediment and reshape the cross-section of the watercourse.

Freshets and interannual floods play an important role in moving and distributing sediment in a rivercourse or water resource. The geomorphological habitat is formed

through a complex interaction between water and sediment. This interaction has its origins in sediment delivery mechanisms from the land surface of the catchment to the river, which are influenced by topography, soil characteristics, rainfall characteristics and land uses. Depending on what is happening on the land surface, and what the instream flow regime is, sediments can accumulate in certain places in the aquatic ecosystem and be lost from others, thus changing the balance between different types of habitat. The determination of IFR takes into account this interaction between sediment and water by requiring geomorphological studies to be conducted, of which the results are used to predict the outcome of certain modified flow regimes with regard to sediment distribution, gains and losses in the aquatic ecosystem, and the subsequent impacts on availability of instream habitat.

Resolution, confidence and application of methodologies

There are several types of methodologies to determine IFR. Selecting the appropriate methodology will depend on the confidence required in the final determination, the quantity and type of data available, and the resolution required.

Low-confidence, low-resolution methodologies usually rely on hydrological data inputs (observed or simulated virgin and present-day hydrology), and generate as outputs relatively coarse estimates of IFR such as the mean or median annual flow volume required at a certain control point or points in a river basin (known as IFR sites) in order to maintain a desired level of aquatic ecosystem health. While this level of determination is adequate for coarse planning purposes, it is not of sufficient resolution to allow development of dam operating rules or abstraction permitting rules. The seasonal distribution and timing of flows required for the ecosystem can usually not be resolved. However, the advantage of low-confidence, low-resolution methods is that they are relatively rapid and cheap to apply.

One of the best known low-confidence methodologies is the so-called Montana method (Tennant 1976), in which the proportion of the virgin mean annual runoff provided to a river ecosystem can be related empirically to the ecological condition of the ecosystem. This methodology relies on observations of ecological conditions made by its developer in many North American rivers, which were then related to flow in the river at the time of observation. The method is suitable only for northern temperate ecosystems, and cannot be applied with confidence elsewhere, especially in ecosystems where flows are strongly seasonal or episodic. However, a modified version of the Montana method has been developed in South Africa (DWAF 1999), based on experience from local studies, and has been extensively used for planning purposes and in the scoping phase of some environmental impact assessments.

A range of methods is available for high-confidence, high-resolution determination of IFR. Spatial resolution is at river-reach level or smaller, temporal resolution ranges from monthly to daily flows. Application of these methods in a specific river system can take anywhere from several months to several years, since

they are generally data-intensive, require detailed ecological, hydraulic and hydrological surveys, and usually involve multidisciplinary teams in numerical modelling studies.

The best documented examples of more comprehensive methods are the building block methodology (King et al 2001), which has been developed and extensively applied in South Africa, the instream flow incremental methodology (IFIM), which is widely used in the US, and the holistic approach, which has been applied in Australia (Tharme 1996). These methodologies are suited for application in the 'how much must be left in' approach. A more recently developed methodology, the downstream response to imposed flow transformations (DRIFT) (Brown & King 2000) has been tested in the Lesotho Highlands Water Project, and is suited for application of the 'how much can be taken out' approach. The comprehensive methods rely on:

- identification of and agreement on the desired ecosystem goods and services to be maintained;
- quantification of the required state of ecosystem health to provide these goods and services; and
- translation of the desired state of ecosystem health to flow and water quality specifications (the IFR), which will maintain this level of ecosystem health.

Methodologies to determine instream water quality requirements

The commonly used approach to setting requirements for instream water quality is to determine the natural background conditions from results of water quality monitoring at relatively unimpacted sites, and then to establish an allowed deviation from natural conditions. This may be represented as an allowed proportional change from natural conditions or an allowed change in concentration of a particular water quality variable. The change is usually inferred from the results of field or laboratory studies of the tolerances of aquatic biota to changes in water quality.

One of the most common problems in Southern African ecosystems is the lack of long-term water quality monitoring datasets that can be used to describe and quantify natural unimpacted conditions accurately. This is particularly relevant for certain 'system variables' such as temperature and salinity, which often provide cues to trigger important seasonal ecological processes such as spawning and migration of fish and other fauna, and germination and flowering of plants. If the timing or magnitude of seasonal changes in these variables is altered too far from what is natural, then these ecological processes may be compromised or may not occur at all in a particular season.

Another common problem is also data-related. Most national water quality monitoring networks in Southern Africa do not include concurrent monitoring of ecological indicators such as aquatic invertebrate populations and very little information is available on the tolerance ranges of indigenous organisms under field conditions. Few local or regional laboratories have the facilities to conduct the

experiments required to establish tolerance ranges of indigenous organisms in the laboratory, and information is therefore often limited to species that may be native to the northern hemisphere. Tolerance ranges, deviations and non-exceedence levels for Southern African water resources are usually established on the basis of water quality criteria used in developed countries such as the US and Australia, although these have not been thoroughly tested to ascertain their applicability for Southern African conditions. The *South African water quality guidelines for aquatic ecosystems* (DWAF 1997) represent the current best effort to derive locally applicable instream water quality guidelines. These guidelines were developed using international studies on warm water northern hemisphere species that can be expected to have similar tolerance ranges to equivalent Southern African species.

The determination of instream flow and water quality requirements must be integrated. Once the IFR have been determined, the implications of the altered flows for water quality must be ascertained, since there may be a loss of dilution or an increase in evaporation, particularly in low-flow seasons. This could cause concentrations of certain substances to exceed the determined instream water quality requirements and possibly reach toxic levels, a situation that might not have occurred under natural flow conditions. The effect of the proposed IFR on water quality should ideally be modelled prior to implementation, and their determination adjusted until the instream water quality requirements can be met with an acceptable degree of assurance.

Data for the determination of comprehensive instream flow requirements

Hydrological data

Of primary importance is hydrological timeseries data for each of the sites selected as being representative of specific river reaches, and for which IFR are set (King et al 2001). The timeseries should be constituted from daily hydrology, and average daily flows in m^3/s are required, for as long a period as possible, in order to establish typical ranges of daily flows and to provide information on seasonal and interannual cycles and their variability. Since the IFR sites for a river basin will seldom coincide exactly with hydrological gauging stations, hydrology data from a nearby gauging station are usually extrapolated to an IFR site through the use of a hydrological model. In many cases, little hydrological data is available, and the daily hydrology for IFR sites must be simulated using a rainfall-runoff model.

Hydraulic data

At each IFR site, a cross-sectional profile of the channel is surveyed, and a stage-discharge calibration curve is generated from water-level measurements made concurrently with a range of different measured flow rates. It is particularly important

to have measured flows and water levels for periods of low flows, since there may be significant non-linear effects of friction in shallow water. This necessitates site-specific empirical determination of flow-related parameters (such as Manning's 'n' value) that are used to quantify the relationship between water depth and flow rate at an IFR site. The hydraulic calibration curve is used to translate the habitat parameters of velocity and depth at the IFR site, as recommended by specialist ecologists, to the hydrological parameter of flow rate that is used by water managers to operate and manage the river basin. Much of the confidence in the final determination of IFR thus rests in the accuracy of the hydraulic calibrations. A minimum of four flow calibrations should be undertaken at each IFR site, covering the full seasonal range of flows in any one year.

Geomorphological information

Geomorphological studies for the determination of IFR usually require an assessment of current sediment distribution patterns along a river, including an analysis of particle sizes, and of medium-term historical records. The historical analysis is often best done through the study of past aerial photographs. During the determination of IFR, the geomorphological information is used to predict what instream flows will be needed either to maintain the current patterns of sediment movement and distribution, or to restore patterns that will lead to geomorphological habitat meeting the necessary conditions for the desired ecosystem health status.

Water quality data

Timeseries water quality data should ideally be available for each IFR site or for a monitoring point nearby. The minimum sampling frequency required to establish seasonal patterns of water quality changes would be one sample every month. In addition, timeseries water quality data for an unimpacted site should be available in order to determine natural background conditions. In practice, however, this is seldom the case, and water quality patterns, variability and trends must be inferred from only a few samples. If at all possible, water quality and flow rate should be measured concurrently at the same site, in order to determine empirical flow-concentration relationships for each water quality parameter. These flow-concentration relationships are used to predict possible water quality changes that could result from a change in the flow regime once the IFR are implemented.

Ecological data

The availability of suitable ecological data is most often the weakest point in any determination of IFR, since there are very few long-term ecological monitoring programmes currently in place that measure specific characteristics of biotic populations at the appropriate scale and resolution. Most of the comprehensive

methods to determine IFR require timeseries data related to the character, distribution and condition of riparian and instream vegetation, aquatic invertebrates and fish. Other species may also be used as representatives of the aquatic ecosystem if these species are of high conservation importance (such as endangered species) or of commercial importance. The timeseries data is required to establish seasonal and interannual variability in biotic communities, to identify important ecological processes and the environmental cues that initiate these processes, and to identify long-term trends in ecosystem health. Ideally, timeseries ecological data should have been measured at the same time and place as hydrological and water quality parameters, since the relationship and response of local biota to changes in flow and water quality can then be quantified, rather than assumed on the basis of expert judgement or extrapolated from laboratory studies.

Socioeconomic information

The social and economic importance of goods and services provided by the aquatic ecosystem is usually ascertained through extensive public consultation and participation processes. Surveys are designed to identify the current and desired uses being made of the ecosystem, including resource harvesting, recreation, ecotourism, water abstraction and offstream uses, and to estimate their economic value. The social and economic surveys are usually carried out as part of the specialist studies associated with the actual determination of IFR, although they can be done as part of baseline monitoring. The objective of these socioeconomic studies is to identify the agreed suite of desired goods and services that should be provided by the aquatic ecosystem so that ecologists can translate these requirements to a desired level of ecosystem health.

Prior and post-determination monitoring

For the effective determination and implementation of IFR, careful attention should be given to two aspects of monitoring:

- pre-determination monitoring, of which the objectives are to establish background and baseline conditions prior to implementation, to identify major spatial and temporal trends in hydrological, water quality and ecological parameters, and to describe the biophysical and biotic characteristics of the ecosystem; and
- post-determination monitoring, of which the objectives are, first, to check that the recommended IFR actually result in the desired ecosystem health status being achieved and to adjust them if necessary, and secondly, to check that the IFR are actually being delivered and to take corrective action if necessary.

Time and money spent on a well-designed pre-determination monitoring programme, which incorporates the proposed IFR sites, will significantly enhance the

confidence in the process and its outcome. This in turn supports acceptance by stakeholders and other water users, thus helping to ensure successful implementation. Pre-determination monitoring programmes typically last for one to three years, although the longer the period covered by the dataset, the higher the confidence in the final determination.

Post-determination monitoring is important, since it can generate valuable learning about the response and sensitivity of an aquatic ecosystem to changes in the flow and water quality regimes, allowing for more refined management and delivery of IFR as understanding grows about causal linkages within the ecosystem.

Implementation of instream flow requirements

The development of methodologies for the determination of IFR was originally initiated in order to derive more environmentally friendly operating rules for rivers that had become highly regulated for power generation or water supply, or to provide information to support mitigation of the downstream impacts of proposed large dams. Hence, the building block methodology (King et al 2000) generates output that is primarily suited for use by dam designers and operators. However, not all water uses in a river basin are focused around large dams. In many cases, information on the IFR is needed to:

- manage and control run-of-river abstraction, either small-scale or large-scale;
- regulate discharges of wastewater; or
- control groundwater abstraction that may impact surface flow from springs and eyes or baseflow in streams.

The sections below address some of the issues around the implementation of IFR, whether in regulated or unregulated river basins.

Dams, weirs and flow-control structures

Most dams, weirs and flow-control structures are built to store and deliver water to places where it is not usually found in one season or another, for example, to provide water for dry-season irrigation. The resulting flow regime is thus often very artificial, and can have severe impacts on the downstream aquatic ecosystem. In the design phase of large dams, it is necessary to determine the IFR, particularly the peak flood flow rates, to ensure that the dam can deliver the required flows at the required times. If the outlet structures are too small, the important flushing and scouring floods cannot be released, and this may lead to substantial changes in habitat downstream, including sedimentation and reed encroachment. If normal daily flow releases are too high, serious erosion of downstream habitat, changes in banks and incision of the river channel may result.

Large dams also cause significant changes in water quality downstream, especially when the water column becomes stratified in the reservoir behind the dam. If water is released from the bottom layers of a stratified reservoir, the resulting outflow is likely to be much colder than the surface waters and will probably have a low dissolved oxygen content and high concentrations of dissolved substances. These factors can cause severe mortality of biota in the downstream ecosystem. Many large dams are now designed to incorporate variable-level outflow structures so that water can be released from any chosen depth in the reservoir, depending on the downstream water conditions. Operating rules need to address this aspect of water quality, providing for monitoring of water quality at various depths in the reservoir and in the river downstream, in order to select the correct release scenario.

Dams and weirs also trap sediment and nutrients, leading to a deficit of these in the downstream ecosystem. This may affect habitat, through net erosion downstream, and ecological processes through a lack of nutrients to support primary production. It is possible to design dams that can bypass some sediment, although the costs of construction will be increased.

Dams and weirs form physical barriers for most migratory species, which can lead to losses of key species if they are unable to migrate to and from breeding and spawning areas. Any dams and weirs should be designed to incorporate appropriate fish ladders or equivalent structures to enable the passage of migratory species.

Once IFR have been converted into daily operating rules for a dam or for a river basin, there is a need to ensure that the required flows are delivered to the downstream ecosystem in a pattern that is as close to natural as possible. If river flows upstream of the dam rise due to a rainfall event, then the flow releases from the dam to meet the IFR should be timed to coincide with this rise. Usually, this will require real-time monitoring of river flows at a site upstream of the dam where the flow pattern is reasonably natural.

Similarly, if a natural drought occurs, then the IFR during the drought period should be adjusted downwards in order to ensure that the downstream ecosystem also experiences drought conditions. A determination of IFR usually includes flow specifications for maintenance conditions (such as normal rainfall years), as well as drought conditions. The natural stresses associated with drought conditions are necessary to maintain the health and resilience of the downstream ecosystem. However, once the natural drought has passed, instream flows should be returned to maintenance levels. Artificial prolonging of drought conditions can result in severe, irreversible changes to an aquatic ecosystem, particularly when a naturally perennial river is forced into a seasonal flow regime, or a seasonal river into an episodic or ephemeral regime.

Managing run-of-river abstraction

Implementing IFR can be especially challenging in an unregulated river basin where most abstraction is run-of-river. There may be little or no opportunity to compensate for abstraction by making dedicated releases from a dam for the

downstream ecosystem. In this case, abstraction has to be managed, controlled and monitored in order to ensure that the IFR are met.

Control options include metering of abstractions, and limitations on pump capacities or pipe diameters. While this may be practical in the case of large commercial water users, it may be extremely difficult for small-scale or subsistence uses of water. Yet if population density is high, the sum of many small-scale abstractions can represent a significant removal of water from the system, possibly compromising the IFR. Water tariffs can be applied to encourage reduction in water use or more efficient water use, but awareness creation and the education of water users are generally more effective in promoting understanding and support for IFR.

Customary law or water-sharing practices may provide important mechanisms for gaining and maintaining community support for the implementation of IFR, since such customary practices have often been developed over long periods of time to suit local socioeconomic and environmental conditions (MacKay et al 2002).

Groundwater abstraction and baseflow

In many perennial rivers, dry-season flows may be maintained largely or solely by inflows from groundwater or from the water stored in the soils of river banks. Excessive abstraction of groundwater through wells or boreholes in the riparian zone or close to a river may cause dry-season flows in the river (known as baseflows) to be reduced or to stop altogether.

In determining IFR, some indication should be provided of how much abstraction of groundwater can be allowed in the riparian zone or near the river without compromising baseflow in the river. There are techniques available to determine the contribution of groundwater to baseflow in a river: the simplest is hydrograph separation, a form of analysis of hydrological timeseries data. If higher confidence or resolution is required, then it may be necessary to carry out a geohydrological survey when the field ecology studies for the determination of IFR are conducted.

This issue will be particularly relevant in the Okavango River basin, since there is a strong and complex link between surface water and subsurface water. Uncontrolled abstraction of groundwater from aquifers that are near to or in hydraulic connectivity with surface waters could lead to significant changes in surface water flow and chemistry (McCarthy et al 1991; 1993). The total allowed abstraction from the Okavango basin should be expressed in terms of the allowable groundwater abstraction from certain delineated aquifers, as well as the allowable surface water abstraction from specific points in the system.

Tributary management and offstream storage

Efficient and effective implementation of IFR requires integrated planning at the river basin level. The sites of dams, weirs and flow-control structures relative to the

main stem of the river must be considered. Large dams on the main stem of a river generally have a more significant impact on downstream ecosystems than do smaller dams on tributaries. A recent international trend has been to discourage the building of large dams on the main stem of a river in favour of offstream storage reservoirs and smaller dams on tributaries.

The impacts of dams and weirs in a river basin can be mitigated to a degree if key tributaries are maintained in a relatively undeveloped condition. The flow contributions from these tributaries help to maintain a more natural flow regime in the main stem of the river. In addition, the undeveloped tributaries provide important ecological refuge areas, from which the main stem ecosystem can be repopulated in the event of loss of species due to natural disasters or accidents. An IFR determination, if carried out at river basin scale, should address these issues and identify the key tributaries that should be protected and on which development should be limited.

In the Okavango basin, the Cuito and Cubango sub-catchment systems exert significant influence on the flow regime downstream of the confluence of these two rivers, particularly in terms of the timing, duration and magnitude of the annual flood that reaches the Okavango Delta. If the pattern of inflow to the delta is to be maintained as close to natural as possible, then it will be necessary to identify those tributaries within the Cuito and Cubango sub-catchments that are most important in determining the timing, duration and magnitude of the annual flood, and to consider limiting development on these tributaries, or at least developing them so that their flow patterns remain close to natural.

Water quality management

Water quality management strategies should be linked to the determination of IFR. For example, if the IFR will result in less water being available instream in the dry season, effluent discharge standards may need to be made stricter to take account of the reduced dilution capacity. Many countries utilise uniform national effluent discharge standards, but may need to consider developing basin-specific or reach-specific standards to be consistent with the specifications of IFR.

The question whether more ‘clean’ water should be made available for instream dilution of pollution impacts is controversial and varies with the policy of each country. However, it is generally accepted that:

- Once IFR have been determined and altered flows lead to water quality problems due to the impacts of pollution from human activities, then the sources of pollution should be managed and controlled, rather than simply diluting the problem with higher flows of clean water from upstream.
- If altered flows lead to water quality problems related to natural causes, for example, naturally occurring high concentrations of dissolved salts, then IFR should be adjusted upwards until sufficient dilution is achieved in low-flow seasons to maintain the concentrations of key water quality variables within the allowed ranges or levels.

Habitat and alien species

In the determination of IFR, specific flow rates are usually set to ensure inundation of certain key habitats at critical times of the year. The assumption behind this approach is that, if flow rates are sufficient to maintain an adequate distribution and extent of critical habitats, the biota will be supported and ecological processes will be maintained. However, if aquatic ecosystems are to be protected, there are two kinds of impacts on aquatic habitat that must be addressed: flow-related and unrelated impacts.

Flow-related impacts on habitat include change, loss or degradation of habitat due to changes in flow. Changes in flow may be due to regulation, abstraction of water, or input of excess water such as stormwater and effluent discharges. The parameters of hydraulic habitat (velocity, depth and wetted perimeter) may be affected to such an extent that:

- an insufficient area of inundated habitat remains (for example, if the water in a rapid or riffle becomes so shallow that fish can no longer migrate through the rapid);
- hydraulic characteristics are changed (velocity may be increased so that biota cannot maintain their position and are washed out of refuges, or velocity may be reduced leading to increased warming of water, evaporation and concentration of salts); and
- critical habitats are no longer accessible at the necessary times of the year.

Flow-related habitat impacts can generally be mitigated or reversed by providing an appropriate flow regime.

Impacts unrelated to flow include loss or degradation of habitat, and subsequent loss of species due to structural changes in a water resource or watercourse. These can include:

- the imposition of barriers to movement such as dams and weirs, where no fish ladders are provided;
- the removal or destruction of riparian vegetation due to poor land-use practices;
- the smothering of habitats by erosion-induced sedimentation, or loss of habitats due to instream and bank erosion; and
- the introduction of alien fauna and vegetation, which either cause damage to habitat (such as grass carp that have been released in the Limpopo system and that damage the roots of riparian trees and instream vegetation), or which destroy indigenous species (such as water hyacinth that covers water surfaces, reducing light penetration and oxygen diffusion).

If these impacts are to be mitigated, impacts unrelated to flow usually require some structural intervention or physical management efforts to restore habitat and remove invasive alien species.

Participation in the determination and implementation of instream flow requirements

A participatory approach to both the determination and the implementation of IFR is essential. This primarily aims to ensure that stakeholders, water users and communities are properly represented in the decision-making process, and that those ecological processes or components on which people depend are identified and protected by an appropriate determination of IFR. In addition, especially where there is a long tradition of subsistence use of various components of the aquatic ecosystem, indigenous knowledge may provide valuable information about ecological processes, and help to identify causal relationships between flows, water quality and ecosystem responses. Indigenous knowledge may be able to compensate to some degree for lack of long-term monitoring data, if this knowledge is properly captured and formally incorporated into the process of determining IFR.

Participation also helps to ensure support for implementation. If stakeholders, water users and communities understand the rationale for the determination of IFR, and the benefits that they will gain in terms of the protection of ecosystem goods and services, they will be much more likely to change their behaviour, water and land-use practices to help achieve the objectives of the IFR.

Determining and implementing instream flow requirements in the Okavango River basin

A study of instream flow requirements in the Okavango basin would need to answer the following questions:

- If a particular agreed suite of ecosystem goods and services is to be delivered, what is the desired ecosystem health status, within natural patterns and ranges of change, of each representative reach of the Okavango River basin?
- If the desired ecosystem health status is maintained in each reach, how much water can be abstracted, from which points in the system and at what times of the year? Which instream water quality and habitat conditions must be maintained?
- What form can abstraction take – groundwater abstraction, run-of-river abstraction, small weirs and dams, a few large dams or offstream storage?

The impact of individual water resource development projects would still have to be assessed against the allowed abstraction as determined in the study of IFR. For dams and weirs, more detailed studies might be needed in each case to derive daily operating rules for flow releases.

Much attention has been focused on the water requirements of the Okavango Delta ecosystem in recent years, and recent studies have addressed the allowed abstraction immediately upstream of the delta and Panhandle system (CSIR 1997). However, the water resources in the basin all provide ecosystem goods and services to some degree,

particularly for subsistence purposes. To focus only on the delta would be short-sighted at best. Technically, it would reduce the confidence in the determination of IFR, since upstream-downstream dependencies, whether ecological or hydrological, would not be adequately addressed.

It is necessary to take a more strategic view of medium and long-term development needs in the basin as a whole, and consider how best to develop the water resources of the basin in such a way that critical aquatic ecosystem components, of which the delta is only one, are not compromised. There still remains a chance to be proactive in the Okavango basin with this kind of planning, whereas in many other African river basins, the options for maintenance or restoration of aquatic ecosystems are now severely limited due to incremental development and planning that have not encompassed the basin as a whole integrated unit.

The most significant constraint to the implementation of such an integrated approach is not technical but political. The three basin states would jointly have to agree on how and where water resource developments would be sited and operated in order to meet the needs of each country in an equitable but environmentally sustainable way. Political and economic stability would be essential for successful cooperation, since storage facilities and other water resource developments might be situated within the borders of one country, but might be utilised by other basin states. Overcoming sovereignty issues will be very challenging, although the Permanent Okavango River Basin Water Commission (OKACOM) could play a critical role in facilitating this process.

Technical aspects of the determination of instream flow requirements in the Okavango River basin

Data limitations

Although there have been several studies in recent years in the Okavango basin, particularly focused on the lower reaches and the delta, there is a critical data gap in long timeseries of flow, water quality and ecological parameters. Most studies tend to be research-focused or 'once-off', with insufficient long-term monitoring programmes to deliver the kind of data needed for the determination of IFR. Such data must enable the specialists to identify longer term trends and patterns, which are necessary to ascertain the natural ranges of variability of the ecosystem and hence to derive appropriate flow and water quality specifications to maintain a desired level of ecosystem health.

Another critical aspect is to gain a better, quantitative understanding of the complex interaction between water and waterborne sediments in the Okavango basin. This interaction sustains most of the key habitats in the middle and lower reaches of the basin, including the delta, and it is essential to obtain improved predictive capability on the potential impacts on habitat of a reduction in flow, a reduction or increase in sand supply to the river and the combined effects of these.

The need for a single independent basin study

Information on the Okavango basin, especially on ecological responses to changes in the flow regime, is limited and confined to certain areas of the basin. Hence, there is neither wide agreement on the primary driving hydrogeological and geomorphological processes that maintain the aquatic ecosystems of the basin, nor on the possible ecological responses to changes in these driving processes. Expert opinions differ and it is extremely difficult to reach agreement on the IFR that would maintain particular levels of ecosystem health. The allowed rate of abstraction of water therefore cannot be determined with any more than low confidence. It is likely that water-sharing negotiations will require, as a basis for agreement, a high-confidence determination of the IFR, but it may take several years to achieve this level of confidence.

The other consequence of inadequate studies is that upstream-downstream linkages and causal relationships cannot be identified and quantified throughout the basin, making it difficult to assess the significance and extent of downstream impacts of proposed water resource developments.

It is essential that a single, independent basin study should be commissioned to determine IFR. Through OKACOM, the basin states should all participate in developing the terms of reference for the study, so that the outcome can properly serve the negotiation and decision-making processes. Agreement on the terms of reference should help to achieve later agreement on the study outputs and outcomes.

Regulatory aspects of the implementation of instream flow requirements

The most important aspect of IFR is not so much their determination but rather their implementation. Some thought will need to be given to how IFR would be implemented in the Okavango basin, and agreement reached on this aspect, before or at the time of determining IFR.

In theory, IFR could be implemented either by building a series of large dams and operating the whole system somewhat artificially, making dedicated releases for downstream ecological needs. This is not a realistic scenario, especially given the recent recommendations of the World Commission on Dams regarding the need to justify the costs and benefits of large dams.

In practice, IFR in the Okavango basin are likely to be implemented through some system of allocating and controlling offstream and instream water uses. Important questions that must therefore be addressed and resolved include:

- Will minimum standards be set for allowable impacts or water uses? Will these be applicable throughout the basin? On what basis will they be set, and how will they be enforced (through auditing, self-regulation or economic instruments such as tariffs and charges)?

- Will water uses be individually licensed or permitted throughout the basin? If so, who will be responsible for evaluating and issuing licenses or permits? Will this be done by a single basin authority with delegated powers, or will each basin state retain responsibility for licensing and permitting in its own territory?
- If each basin state retains responsibility for licensing and permitting, what will the arrangements be for consultation with and approval of the other basin states, particularly in the case of large impacts?
- Will a system of real-time water accounting be instituted to ensure that each basin state takes only its agreed share of water? If so, how can this be achieved in a relatively ungauged basin such as the Okavango, and who will take responsibility for it?

The resolution of these questions will have implications for institutional development in each of the basin states, as well as for a possible river basin management organisation. Depending on the approaches that are adopted, regulation and administration may have significant cost, technology and manpower implications. There must be upfront agreement on how these will be addressed, who will pay and how much they will pay for the long-term management of the basin's water resources.

Post-determination monitoring and response

The design of the post-determination monitoring programme is usually part of determining IFR. The specialists who are involved in the determination collaborate with the future basin managers to design a long-term monitoring network that will provide appropriate information to assess whether or not the desired objectives are being met, but which is cost-effective and can be implemented. Carrying out the monitoring network design without either the specialists or the basin managers present is not advised, since considerable resources may then be expended on a programme that cannot deliver information on which actions can be taken. Recent programmes based on the objectives hierarchy concept (Rogers & Bestbier 1997) have proven to be robust, cost-effective and focused. This model should be considered in the design of a long-term monitoring programme for the Okavango River basin.

Part of the monitoring network design includes the identification of appropriate responses to situations that arise, or issues that are identified as a result of monitoring. This must be agreed between the basin states prior to the implementation of IFR.

Recommendations

If water-sharing agreements are to be put in place in the Okavango River basin, a medium to high-confidence determination of IFR will be necessary prior to the start of negotiations. Considerably more data is required to achieve this level of confidence, and there are other elements of the successful determination and

implementation of IFR that must also be addressed. It is necessary to develop a five to 10 year programme, which may culminate in a water-sharing agreement, but which comprises considerable technical foundation work in the initial years. The main elements of a comprehensive programme to support water-sharing negotiations and, ultimately, the achievement and implementation of a water-sharing agreement, are:

- alignment of policy, legislation and regulation requirements for the implementation of IFR in each basin state;
- design and execution of a baseline monitoring programme to provide the data necessary for a medium to high-confidence determination of IFR;
- capacity-building for the determination and implementation of IFR;
- actual determination of the IFR for the basin;
- design and installation of an appropriate gauging network to provide information for long-term management of the basin; and
- institutional development within each basin state, and of a river basin management agency (which is not addressed in this chapter).

There must be appropriate sequencing of the activities listed above, since there are dependencies between them. These elements are discussed in more detail below.

Policy, legislation and regulation

Basin states will need to agree in legislation on the status of water allocations (quantity and quality) for the protection of aquatic ecosystems. Following this, a review will be needed of relevant national policies and legislation in the environment, water and agricultural sectors. An initial analysis of the current situation should provide guidance on the extent of the review and revision needed in each country. The bureau of the Ramsar convention has provided considerable technical guidance for such initiatives, and this should be accessed when necessary.

Basin states will also need to agree on how water use will be regulated and controlled, and national regulations regarding water allocation, permits, discharge licences and resource utilisation may require revision and harmonisation. Agreement must also be reached on the consultation process between basin states related to the approval or veto of water resource developments that may have significant downstream impacts. If a river basin agency with statutory powers is envisaged, decisions will be required on the licensing and auditing responsibilities that will be delegated to the agency by the basin states.

Determination of instream flow requirements for the Okavango basin

Basin states should provide input into and agree on the detailed terms of reference for the determination of IFR. It is recommended that specialist consultants with appropriate

experience are appointed to develop detailed terms of reference for a three to five year programme leading up to the determination of IFR. This programme could include:

- low-confidence determination of IFR to provide initial, conservative estimates for planning purposes;
- review of available methodologies and selection of an appropriate high-confidence methodology;
- early selection of IFR sites for a high-confidence determination; and
- design of a three to five year pre-determination baseline monitoring programme, focused on the chosen IFR sites, which will provide the necessary data for a medium to high-confidence determination throughout the basin, or at the IFR sites.

The development of these terms of reference could be done through OKACOM, and would take six to 12 months, given the need for consultation with and agreement by the basin states.

Baseline monitoring programme

The data requirements for the determination of IFR should be identified as part of the terms of reference, and a baseline monitoring programme should be designed. Given the extreme natural variability of the Okavango system, as long as possible (three to five years) should be allowed for baseline monitoring. Flow monitoring will be most important, at least to provide calibration data for hydrological modelling. Simulated hydrological data will have to be used, since there are no datasets of sufficiently long duration. It is likely that, at the least, IFR sites will need to be selected that will be representative of the Cuito and Cubango systems upstream of their confluence, a site between the confluence of these two and the Okavango Panhandle to represent inflow to the Panhandle-delta system, and sites within and at the distal end of the delta. Hydrological, water quality and ecological parameters should be monitored at the selected IFR sites.

Given the difficulty of access to remote monitoring sites, the problem of landmines in Angola, the lack of capacity and probable funding constraints, remote-sensing may prove a cost-effective and efficient way of monitoring, especially the ecological parameters related to vegetation and geomorphology. For other aspects such as water level and some water quality parameters, basic measurements and fixed-point photographic monitoring can be carried out by local people, schools and ecotourism operators.

Capacity-building programme

Once the detailed terms of reference have been formulated, it will be clear what specialist expertise is required for the determination and implementation of IFR. At this point, it would be useful to identify key personnel from each basin state who will

be involved, directly or indirectly, in the determination, and ensure that there is sufficient capacity available within the basin states to carry out a significant portion of the work programme. It is essential, both for acceptance of the IFR and for their successful long-term implementation, that local expertise is utilised as much as possible. The Okavango system, in its variability and complexity, is unlike any in the northern hemisphere, and expertise from this part of the world will be of limited value in determining IFR for this system. Allied to this is the need to understand and address the close relationship between people and aquatic ecosystems in the Okavango basin – this can really only be done adequately by those who know the region, the system and its people well.

Capacity-building for the determination of IFR in the Okavango basin can be proactive. South Africa is initiating several large IFR studies over the next 10 years, using various methodologies. These will provide ideal opportunities for graduate students and young professionals from the Okavango basin states to work alongside experienced specialists prior to the Okavango study commencing.

Gauging network

A permanent gauging network and post-determination monitoring programme should be designed during the IFR study, and implemented as soon as possible afterwards. The determination of IFR specifies flows to be met at particular IFR sites, and gauging and monitoring stations should ideally be close to the IFR sites to allow for auditing of delivery of the specified instream flows. However, the gauging network must be appropriate to both the level of confidence required, and the capacity and resources available to maintain a network. Local people can be used very effectively to collect long-term data, as long as there is some central coordinating point in the basin (possibly OKACOM) and data quality is assured through appropriate training.

Conclusion

In order to make sound decisions about the sustainable, equitable utilisation not only of water in the Okavango basin, but also of the goods and services provided by water resources, it will be essential to undertake a medium to high-confidence determination of IFR for all reaches in the basin. Such a determination should be seen as one element in a broader long-term programme that will culminate in a water-sharing agreement and a strategic plan for water resources in the basin.

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CHAPTER 14

Policy-making in the Okavango River basin

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Abstract

Using the lens of empirical and analytic research findings on policy and policy implementation in industrialised as well as developing countries, this chapter is an attempt to understand and explain what is needed to design, formulate and implement the policies that relates to the Okavango River Basin. This chapter is therefore a deliberate attempt to provide a conceptual framework for policy and policy making in the Okavango Delta. The discussion of concepts, as well as perspectives on related fields, this chapter defines key concepts, including policy, policy process, policy analysis, policy management and policy implementation.

Introduction

This chapter provides a kind of conceptual framework for policy and policy-making in the Okavango Delta. The concepts discussed here would not only guide policy makers, but would also provide some insight into policy as a convenient tool in environmental conservation and management.

The policy process normally starts when a need is identified by one or more stakeholders in society, who feel that the actions of government detrimentally affect them or another segment of society. They mobilise support to persuade policy makers to act in order to change the status quo in their favour. This preliminary process to introduce or change policy is normally termed ‘policy agenda-setting’. It is a crucial phase in policy-making for two main reasons. Firstly, it determines who influence or control the policy-making process. Secondly, it determines how stakeholders influence the policy agenda. Thus agenda-setting is both substantive and procedural. It is therefore critical to explain the conceptual and contextual issues of agenda-setting.

Although all management functions in the Okavango Delta are interrelated, decision-making has a specific significance for policy-making. This chapter explore the concept of policy and policy-making via the decision-making process. Following the discussion on decision-making and related fields, a thorough explanation of policy, the policy process, policy analysis and policy management will follow. The implementation of policy in the Okavango Delta will be the final test of its success. The critical aspect of policy implementation is explored towards the end of the chapter.

Conceptual issues

An agenda is usually a list of items to be dealt with during a meeting. The agenda determines the order in which items will be discussed. The higher an item is on the agenda, the better the chance that it will be discussed and dealt with. The lower it is, the greater the chances that discussions of preceding items will take up all the time allocated to the meeting, and that the later items will have to be shelved for another meeting. An agenda prioritises issues for attention by decision makers. Jones (1984:57) points out that agenda-setting, like perception, aggregation, organisation and representation, is about "getting problems to the government." The term 'agenda' "portrays those issues judged to require both formal and informal methods and procedures for gaining access to and influencing policy process and substance in government."

Writing on the ecology of policy-making, Dubnick and Romzek (1999:197) define the following stages in the policy process:

- problem identification;
- problem articulation;
- agenda-setting;
- policy formulation;
- policy legitimisation;
- programme design and development;
- programme implementation;
- programme reassessment; and
- policy change.

Thus, in the narrow sense, agenda-setting is preceded by problem identification and the ability to articulate problems before they reach the agenda stage. This suggests that not all problems or issues identified or even articulated in public actually reach the agenda-setting stage, as they must pass through a prescreening phase first. Once an issue has been identified as being of sufficient interest or significant enough to justify policy attention, it forms the focus for further clarification, formulation and structuring, before the importance of acting on it by the policy system is conveyed to policy makers.

Policy issues are conflicts or disagreements about the nature and origin of political problems and, consequently, imply a difference in approach to problem-solving. Policy problems, on the other hand, are needs and opportunities that are not used, which may have a detrimental effect on at least one segment of society and may be constructively addressed through public action (Fox & Meyer 1995:97-98). Policy agenda-setting, in a wider sense, is therefore a deliberate process of planning and action, which defines and prioritises policy issues and problems, and mobilises support and lobbies decision makers to take appropriate action.

In problem definition, causal linkages must be established for policy issues that give rise to problems that are detrimental to certain causes and stakeholders. These issues need to be addressed through deliberate public policy interventions at the most

appropriate level by the most appropriate agent. This is a typical systems model perspective, which assumes linear causal relationships between policy cause and effects. Models of complex or 'chaotic' systems and quantum dynamics deny that these relationships are possible, and assume that non-linear relationships exist between policy cause and effects most of the time. These non-linear causal linkages are normally very complex and difficult to identify, especially in policy situations related to social science (such as vandalism), which need multipronged policy remedies.

A second important aspect of problem definition is the way the problem has been structured (a need, an opportunity, a challenge or a threat). Each problem-structuring approach has its own influence on the contents and processes of policy programmes designed to solve such a problem. Policy agenda-setting is necessary because of the deluge of policy-related issues and problems faced by any government, normally with insufficient resources to address these problems effectively. A government must therefore first determine which policy problems should receive priority. How do governments prioritise policy issues and problems? Hogwood and Gunn (1984:73-74) provide insight into this process, as discussed below.

Undirected viewing

This method involves the collection of information with no specific purpose in mind. Governments use this method to maintain an up-to-date picture of political, social and technological currents in society. Central information and intelligence agencies frequently supply ministries with data and statistics about macroeconomic, social and political indicators for no specific reason except to take note of new developments and trends in different sectors of society.

Conditional viewing

This method involves a degree of purpose in searching for or collecting information. Here, the focus is to see how information can either reinforce or reject claims for priority treatment of policy problems. Officials may visit other departments or regions for a specific purpose and use such case study material to motivate or legitimise policy claims.

Informal search

In this method the government seeks information more actively. Public managers might be requested to collect certain types of information. For example, with the violation of copyright and the subsequent loss of revenue for both authors and publishers, inspectors visit tertiary institutions to look for specific cases. As a result of these information searches, tertiary institutions have started to put the issue of copyright on the agenda of faculty boards.

Formal search

This method involves the collection of specific information for a specific purpose. Formal searches take the form of research assignments, departmental investigations, commissions of enquiry or task teams.

Contextual issues

Public policy-making takes place within a given situation or context (Dubnick & Romzek 1999:190). Policy is about power and policy-making is equally about structuring the agenda of social and political life. Agenda-setting therefore cannot be studied in isolation from political, economic, social, technological, cultural and global factors. The forces in society that accumulate power determine the direction of the policy agenda. In reality, some forces in society wield more power than others when agendas are set. Ideologies also influence whether issues appear on policy agendas or not, and public policies develop out of a given sociopolitical context. Agenda-setting is therefore intrinsically linked to the nature of the political landscape. In open and democratic societies, the notion of open and equal access to the agenda stage is advocated. In closed and authoritarian states, the power to influence the policy agenda is largely, if not exclusively, in the hands of the party bosses or head of state.

The same problem occurs in societies that have an unequal distribution of resources. In order to access and influence the policy agenda, information, technology and money are required. In practice, this leads to a further marginalisation of the poorer sections of society.

Factors influencing agenda-setting

It is clear that the practice of agenda-setting differs from society to society. Despite this, some generalisations can be made about factors that influence agenda-setting in government. Hogwood and Gunn (1984:68) list the following factors, which determine whether or not policy problems appear on the policy agenda:

- The problem must reach *crisis* proportions and can no longer be ignored by the government (Grindle & Thomas 1991:73). This occurs when the continued existence of the problem poses a threat, either to society or the state as a whole.
- The policy must achieve *particularity.* Globally, the change in weather patterns and the effect of el Nino have reached this status on the world agenda and countries can no longer ignore these problems.
- Policy problems must have an *emotive* aspect, which attracts media attention. Issues of life and death are very often a driving force in agenda-setting.
- Issues with a *wide impact* have a better chance of reaching agenda status. One example is the global HIV/Aids epidemic, which has a devastating impact both nationally and globally, touching almost every aspect of human life. Yet another issue that has a wide impact is globalisation, with countries forming new economic partnerships with strategic regional governments.
- Such issues should raise questions about *power relationships* in societies. Those who have power in society have a greater ability to influence the policy agenda. The elite theory postulate that those with money, knowledge, skills and resources have more leverage and bargaining power as agenda setters. It is also true that governments tend to listen more attentively to their own political constituencies and to address issues raised by them.
- Some issues are fashionable for governments to address, due to their *symbolic value*. For example, governments support major sporting events like the Olympic Games and the Africa Cup of Nations as they give them worldwide exposure, stimulate local economies and provide a huge boost for the personal image of political leaders.

Policy decisions

Although all functions of management and administration are interrelated, decision-making has a specific significance for public policy-making. Policy-making starts with a decision and concludes with a final policy decision. Between the first and the last decisions, a multitude of different interrelated policy decisions are made. This does not mean that decision-making and policy-making are synonymous.

In order to execute administration and management, several accompanying functions (auxiliary processes or auxiliary functions) must be used, one of which is decision-making. The politicians and public officials involved in the Okavango basin will have to make many decisions while executing their daily tasks. Decision-making is therefore an aid that will be used in each of the administrative and management functions. However, policy decisions are the most significant, and should be based on the 'mission statement' or 'policy manual', and on appropriate values. Questions to be asked include whether the decision fulfils these criteria, and whether a new policy should be created, or an existing policy could be amended (Dawson 1994:30).

The nature of decision-making

There are several approaches to decision-making. For the purposes of this chapter, it is accepted that decision-making is no more than making a choice between alternatives at a given moment (Anderson 1979:9). When a choice has been made, that which has been chosen is not in itself a decision. For example, when a choice must be made between alternative objectives, the result is an objective, and when a choice is made between alternative policies, the result is a particular policy. In like manner, in the case of the Okavango basin, choices are made between alternative organisational and financial arrangements, work procedures and control systems for the management of the basin (Laver 1986:28).

Facts and values

Decision-making is also based on the consideration of facts and values. Officials in the Okavango River basin will supply facts to executive political office bearers, while values will be determined by the communities concerned and must be taken into account by politicians when making a decision. Facts therefore concern concrete data, while values cannot be measured or assessed accurately and depend on the discretion of the decision maker in deciding what is 'right' or 'wrong'. It is particularly due to the role of values that the decision-making process increases in complexity (Roux et al 1997:120).

Some authors have paid attention to the role of the computer in the decision-making process and have incorporated computer concepts into decision-making. In this regard, a distinction is made between 'programmed' and 'unprogrammed' decisions. The former usually emanate from a bureaucratic habit or prescription, while the latter derive from personal skilfulness, intellectual abilities, intuition and creative thought.

The decision-making process

The decision is the crux of administrative and management action. Decision-making comprises a choice between a preferred action from two or more alternatives. Choices can be active or passive, with decisions not taking a particular course of action regarded as passive decisions.

Decision-making processes are rational attempts by public managers to achieve the objectives of their institutions. The process commences with the setting of objectives in the early stage of planning. It usually includes the application of a measure of discernment, and requires creativity, capability and experience (see table 1). To improve decision-making skills, it is important to concentrate on the decision-making process instead of the decision. Focusing on the process will provide the confidence to make the best choice every time (Dawson 1994:14).

The decision-making process commences with the identification of a particular problem. As indicated in table 1, problem identification requires discernment by the public manager (the term 'public manager' includes politicians and public officials involved in the management of the Okavango River basin). Deviations are usually considered to be problems requiring corrective action to eliminate them (Anderson 1979:53). However, before corrective action can be taken, it is necessary to identify the problem, develop alternatives, analyse the alternatives and choose the best path of action. Defining the problems of the Okavango River basin and suggesting alternative solutions for the policy-making process can be referred to as 'agenda-setting' (Dye 1981:346). The term 'best' is value-oriented and is influenced in particular by the value system of the individual or the group, and human factors clearly influence decisions. Different decisions will also be made under particular circumstances. For

Table 1

The decision-making process and its requirements

Stage in the decision-making process	Requirement
Identification of problem	Discernment
Development of the alternatives	Creativity and experience
Analysis of the alternatives	Quantitative analysis
Choice of the best alternative	Discernment

Source: Robbins 1976:152.

example, the public manager and the private sector businessperson will act differently under the same circumstances.

Preventing certain conditions in society from becoming policy issues is also an important tactic. This occurs when influential individuals or groups, or the political system itself prevents the emergence of challenges to the dominant values or interests in society (Dye 1981:349).

The types of decisions and the decision-making models should not be confused. If it is accepted that decision-making is an intellectual activity comprising the making of a rational choice between alternatives, several types of decisions can be identified, including impulsive, intuitive, programmed, unprogrammed and single-choice decision-making ('go/no-go' decisions).

Quantitative aids, human factors and the milieu of decision-making

The decision-making process comprises, among others, an analysis of the alternatives. In the analysis of each alternative, quantitative techniques can be used, which must be seen as aids to ensure more effective decisions. However, they can never replace sound discretion in the decision-making process.

When the alternatives have been analysed, the process to choose the best alternative gets under way. However, this process is more complex than it may appear. It requires sound judgement and an awareness of the influence of human factors on decision-making. The quantitative aids that could be used, are linear programming, queuing theory, probability theory, inventory models, network analysis and simulation. These techniques can be used to guide decision-making, and even though powerful computers are available, they can never replace the decision maker. No machine or quantitative aid can replace sound judgement.

Human factors in decision-making

Since decisions are made by human beings, they are subject to the limitations of human behaviour that are determined by the individual's *value system*. Each decision is influenced by the public manager's attitude, prejudice and personal point of view. Furthermore, it is based on what the community considers to be 'right' and 'wrong', as well as on the interaction between the various subcultures and values. The content of a decision therefore comprises both factual and ethical elements. The correctness of the ethical component of a decision cannot be verified by empirical means.

Problems and solutions are like beauty, they exist in the eye of the beholder. That which people perceive, will determine how they will act. As stated earlier, discernment determines which problem is perceived and discretion determines which solution is eventually chosen. However, discernment and discretion are determined to a large extent by individual *perception*. Individuals' perceptions are influenced by their value systems, experience and ability to interpret what is occurring in their environment. This means that people perceive what they would like to perceive based on their individual backgrounds.

Decision makers seldom have all the information required for a decision at their disposal. On the contrary, decisions are made in an environment of bounded rationality. Decision makers gather the information they consider to be important from the environment, but it remains limited to or bounded by this particular area. This is not a negative reflection on the decision maker, but merely the reality of *human limitations*. Confident decision makers can move quickly in an environment containing ambiguity. In fact, the ability to make good decisions is directly related to the ability to handle ambiguity (Dawson 1994:21). A further limitation is that it is not always possible for decision makers to gather information directly. If decisions are made higher up in the hierarchy, the leading officials must usually rely on information supplied by subordinates. The higher decision makers are in the hierarchy, the more they must depend on subordinates for the supply of information. Since all information cannot be checked, decision makers must make decisions based on information filtered mainly by the perceptions of others.

Political power could also have an influence on decision makers who want to protect their own interests. This could have the effect that, as a result of political power, decision makers satisfy a need instead of taking the optimum decision. Although they may use quantitative techniques, the influence of political power will still be dominant (De Crespigny 1978:191). Furthermore, it is a good short-term strategy to furnish solutions to obvious problems. Managers who follow this strategy find favour in many institutions, and many of them are also promoted fairly rapidly. The critical problems must then be solved by those who succeed them. Sometimes managers must make decisions that could jeopardise their own positions. This may be one reason why many officials are opposed to change.

A further limitation is the *time limit* within which decisions must be taken. In several cases, decisions are taken on the grounds of partial information only. In most

cases, this is the result of time constraints placed on managers. Sometimes an official is also pressurised to make a decision (Robbins 1976:165-167).

The milieu (environment) of decision-making

Decision-making in public administration is an inescapably complex daily activity, and gives direction to the generic administrative functions. Dealing with and finalising every administrative and management function involve many decision-making actions. The decision maker and the decision-making process must take several roleplayers into account.

Besides the normative guidelines that operate in public administration, the leadership and accountability function of the *governmental superstructure* cannot be ignored by decision makers in a specific institution. The representatives of the people, the cabinet, and approaches, points of view and preferences of individual ministers also cannot be ignored.

Controlling institutions and domestic service departments and agencies have been created to deal with specific aspects of generic administrative and management processes. In South Africa, for example, these institutions would be responsible for the provision and development of personnel (Commission for Administration), financing (Department of Finance, excluding the Treasury), organisation and methods (Organisation and Workstudy division), and control (Auditor-General). Other institutions have been created to render domestic services to other departments, for example Public Works, the Government Printer and the Government Garage. These institutions must be consulted in respect of any decision that affects them. As a matter of fact, most of these institutions are based on legal provisions approved by parliament to regulate the relations between themselves and the other government departments.

Although a great deal of care is taken in the departmentalisation and compartmentalisation in the public sector, it is nevertheless possible that overlapping or areas of 'no man's land' may occur in the normal course of activities. In such cases, it is necessary to be aware of the *functional fields* where other departments operate. It may be that one department cannot deal with the total functional field or particular problem, and that either parallel, joint, complementary or competitive decisions may then be taken.

The *external milieu* involves a broad spectrum of factors. The concept is used to denote those factors that fall outside the public sector, but of which the decision maker must take cognisance (Roux et al 1997:130-132).

Creativity in decision-making

In the discussion of the decision-making process thus far it has been stated that it requires discernment, discretion, knowledge and creativity. The importance of creativity in public administration is often underestimated, particularly with respect to unprogrammed decision-making.

Creativity is one of those abilities that differentiate good decision makers from poor decision makers. It enables managers to develop alternatives, to extend the alternatives and to visualise the results. It is self-evident that before a solution can be implemented, it must first be developed. An issue that is often overlooked, is that any particular solution is only one of a number of alternatives. No administrator can therefore assume that only one solution to a problem exists.

When managers attempt to find solutions to a particular problem, they can depend on their experience, their knowledge of what has previously happened under similar circumstances, or their creativity in the search for alternative solutions. In most cases, experience will play the decisive role. Similar problems have usually occurred previously. A problem increases in difficulty when the solution differs from those that applied in the past. This is when creative alternatives are required. There are also cases where problems are handled based on experience and innovative solutions are not considered at all. These cases also require creativity.

A great deal of input is not required when using self-evident alternatives, but managers who also consider unique alternatives will make better decisions in the long term. It is found that, even though innovative alternatives have been developed, a 'self-evident' alternative is nevertheless chosen. However, it is often essential to deviate from the traditional solutions.

Creativity is generally considered to be the ability to combine or associate ideas in an unusual or unique manner. Since creativity is considered here in the context of decision-making, this definition is too general. From an administrative and management perspective, creativity is seen as the ability to find original alternatives for the solution of existing problems. But what makes an alternative creative?

The fact that an idea is unusual or different is not necessarily an indication that it is creative. It can also imply abnormality. An unusual alternative must therefore have a bearing on reality. On occasion, a distinction is made between the following types of creativity: *innovation* that generates something new; *synthesis* that combines unrelated information to form something new; *extension* that expands the boundaries of innovation; and *duplication* that merely imitates others. Upon closer inspection, it is clear that there is nothing that is really new. All creativity is probably as a result of synthesis (Robbins 1976:199-200). However, some syntheses are more unique than others. Nevertheless, all creativity is supported by or based on ideas that already exist.

It is not easy to be creative – to see things and relationships that others cannot see. As soon as someone discovers something new, he or she becomes a minority of one. In government institutions, it is often difficult for an individual to have unique perspectives. It is also difficult to be creative in environments that encourage homogeneity.

The question that now arises, is whether individuals who are creative are also different. And, is creativity inherent or is it learned? Scott and Cummings (1973) maintain that both determinants are necessary for creativity. Creativity is therefore a potential that all administrators have to a lesser or greater degree. What is essential, is that this potential must be stimulated within an institution. Several characteristics can

be attributed to creative persons, of which the most important is probably that they are able to adapt easily to changing circumstances. They do not therefore accept the status quo unquestioningly. The demands made upon officials in a new South African public service will therefore probably test their adaptability.

There are techniques to motivate individuals and groups to develop creative alternatives in decision-making. Some of these techniques are, for example, a list of characteristics, direct instructions, think-tanks and the so-called Gordon technique (Robbins 1976:201-205).

Public policy-making

This section provides a conceptual overview of the nature and role of public policy. Attention will be given to concepts, issues of definition, theories of policy-making, participation and public choice, as well as models for policy management.

For the purposes of a working definition, *policy* is defined as a statement of intent. Policy articulates basic principles to be pursued to attain specific goals and actions. As such, policy interprets the values of society and is usually followed by particular project and programme management actions. Several specific phases of the *policy process*, among others, initiation, design, analysis, formulation, dialogue, advocacy, implementation and evaluation are directly relevant. *Policy analysis* can be defined as a specific action to develop policy options, or alternatively, a systematic analysis of policy options. Policy is usually presented as a formal policy statement (for example, a white paper), although the interpretation and analysis of policy are often communicated verbally (in a press statement, for instance). *Policy management* is regarded as a comprehensive umbrella term that refers to a specific effort to improve policy implementation, as well as the capacity to manage and facilitate the policy process.

The term *policy studies* often indicates a descriptive or explanatory set of concerns (typically studies of policy content, policy process, policy outputs and evaluation measures). The term *policy analysis* is often (but not exclusively) used for prescriptive activities or knowledge in, rather than of the policy process (evaluation studies, information for policy-making, process advocacy and policy advocacy). The term *policy sciences* (see Brewer & De Leon 1983:9) is used by some writers as a synonym for (prescriptive) policy analysis and by others to include both policy studies and policy analysis. In general, the term policy studies is most often used for descriptive accounts and policy analysis for prescriptive exercises, with policy sciences as an umbrella term (see Hogwood & Gunn 1984:28-29).

Definitions of policy

Following the discussion of concepts, as well as perspectives on related fields, this section defines key concepts, including policy, policy process, policy analysis and policy management.

An analysis and assessment of definitions of policy reveal that no universally accepted definition, theory or model exists. An adequate framework of definitions (see Patton & Sawicki 1986:18; Wood 1985:347-371) can be used to explore the multidimensional nature of policy, to establish the key elements of definitions in the field and allow for a working definition to be developed. In early years, Ranney (1968:7) defined policy as "a declaration and implementation of intent." Easton (1953:129) defined policy as "the authoritative allocation through the political process, of values to groups or individuals in the society." Hanekom (1987:7) defined policy-making as:

> "the activity preceding the publication of a goal, while a policy statement is the making known, the formal articulation, the declaration of intent or the publication of the goal to be pursued. *Policy* is thus indicative of a goal, a specific purpose, a programme of action that has been decided upon. *Public policy* is therefore a formally articulated goal that the legislator intends pursuing with society or with a societal group."

Dye (1978:4-5) defined policy as "a comprehensive framework of and or interaction." Starling (1979:4) defined policy as "a kind of guide that delimits action", while Baker and others (1975:12-15) defined it as "a mechanism employed to realise societal goals and to allocate resources."

Hogwood and Gunn are of the opinion that several conceptions of the word policy are in use and discusses it in the context of policy as a label for a field of activity (economic, social or foreign policy); policy as an expression of general purpose or desired state of affairs (conservative policy in the case of the British Conservative Manifesto (1983)); policy as specific proposals; policy as decisions of government; as formal authorisation; policy as a programme; policy as output; policy as outcome; policy as a theory or model; and policy as process (see Hogwood & Gunn 1984:13-20).

Following the above discussion of conceptual approaches, Hogwood and Gunn (1984:23-24) define (public) policy as:

> "a series of patterns of related decisions to which many circumstances and personal, group and organisational influences have contributed. The policy making process involves many sub-processes and may extend over a considerable period of time. The aims or purposes underlying a policy are usually identifiable at a relatively early stage in the process but these may change over time and, in some cases, may be defined only retrospectively. The outcome of policies requires to be studied and, where appropriate, compared and contrasted with the policy-makers' intentions ... policy requires an understanding of behaviour, especially behaviour involving interaction within and among organisational relationships. For a policy to be regarded as a 'public policy' it must to some degree have been generated or at least processed within the framework of governmental procedures, influences and organisations."

The renewed interest in policy processes and policy management is especially evident in an increased focus on institutional arrangements. Especially African and Southern African experiences have shown that *institutional* and *management issues* have become important in policy analysis and policy processes.

Levels and types of policy

Recent paradigm shifts regarding institutional development and development management have shed a different light on certain policy issues.

Types of policy are often seen as reflecting three main categories of players on the policy scene – public policy, non-governmental (NGO) policy and private sector policies (see, for example, De Coning 1994b:267). Within public policy, further types may be identified, for example, political policy (or policy of political parties), or executive policy (or implementation policy as determined by the political office bearers assisted by or working in conjunction with high-ranking public officials). Administrative policy deals with the details of aspects incorporated in a policy, such as the income and expenditure of a particular government department, inclusive of stores, provision, development, utilisation and maintenance of personnel, and other factors. Many other types of policy may be distinguished depending on the players, for example, personal financial insurance policy or organisational, staff or corporate policies.

In addition to the above, *levels of policy* are seen as having two main dimensions of which the first is related to geographical levels, for example, local or district policy, subregional policy (intermediate level), regional or provincial policy, national policy, regional policy between national units (for instance, Southern African level) and international policy (see also Anderson 1994:9-22).

Participation and public choice

Since the mid-1990s, policy-making exercises require *participation* and *public choice* in which direct representation, empowerment and active decision-making are essential. If development is defined as the capacity to make rational choices, the participatory nature of policy processes is clearly of importance as opportunities to exercise choices and explore rational options should be utilised by policy-making processes.

Maddox and Fuquay (1981:155) define *public opinion* as "consisting of articulated group attitude and not the viewpoint held by society as a whole, but rather a conglomerate of attitudes as expressed by different groups" (see also Hanekom 1987:32-44). Mannheim (1950:142) defines the concept as "more than the sum total of effects produced by the media or by propaganda." He also defines public opinion as "composed of the moods and attitudes which are the result of contacts in groups, clubs or on the street and ... not produced through manipulation by the authorities." Of further importance is the emphasis on political issues in Anderson's (1979:15) definition of public opinion as "the formal articulation of the beliefs, the views held by

the public at large about political issues." Key (1961:14) describes public opinion as consisting of "those opinions held by private persons which government find it prudent to heed." Lastly, Ranney (1966:207) defines public opinion as "the sum of the opinions known to public officials and which will be taken into account by the authorities."

Policy process

Hogwood and Gunn (1984:4) found it useful to analyse the policy process in terms of a number of stages through which an (policy) issue may pass: deciding to decide (issue search or agenda-setting, deciding how to decide or issue filtration); issue definition; forecasting; setting objectives and priorities; options analysis; policy implementation, monitoring and control; evaluation and review; and finally, policy maintenance, succession or termination. The authors emphasise that this framework provides an aid in understanding how different kinds of analyses can be brought to bear at different stages of the policy process and stress that what is being advocated is not a simple analysis where one step follows the next (see Hogwood & Gunn 1984:5; Quade 1982:53). The interactive nature of policy processes is an important principle for a discussion of policy-making processes.

Dror (1990c:89-90) makes a clear distinction between the content of policy and process dynamics. He remarks that policy development can be improved in two ways:

> "One, upgrading policy making processes, which in turn involves improved policy process management and redesigning organisations. And two, establishing improved grand-policies, which guide the substance of discrete policies, which in turn involves application of policy analysis to grand-policies as well as process and organisation upgrading which serves policy development as a whole."

A process model that is generally regarded as representative of the international experience of policy-making, provided by Dunn (1994:15-18), shows that the phases of agenda-setting, policy formulation, policy adoption, policy implementation and policy assessment are fairly common (see figure 1). Dunn's comments on process model considerations are of note. He states (1994:15) that the process of policy analysis is a series of intellectual activities carried out within a process comprising activities that are essentially political. Dunn describes these political activities as the policy-making process and visualises the process as a series of interdependent phases arranged through time. He regards the phases identified above to:

> "represent ongoing activities that occur through time. Each phase is related to the next, and the last phase (policy assessment) is linked to the first (agenda setting), as well as to the intermediate phases, in a non-linear cycle or round of activities. The application of policy analytic procedures may yield policy relevant knowledge that directly affects assumptions, judgments, and actions in one phase, which in turn indirectly affects performance in subsequent phases" (Dunn 1994:15,16).

In essence, the generic process model both provides for a comprehensive set of phases, as well as propose specific requirements and key issues to be addressed during each of the phases. With regard to the first, the phases consist of policy initiation, policy process design, policy analysis, policy formulation, decision-making, policy dialogue and implementation, as well as monitoring and evaluation (see also Hughes 1994:152; Dye 1987:27; Henry 1992:307; Fox et al 1991:31; Wissink 1990:32).

An analysis and assessment of the definitions of policy and related concepts revealed that no universally accepted definition, theory or model exists. However, the variety of available definitions do provide adequate scope for working definitions. The discussion of participation and public choice concluded that policy-making processes can act as important catalysts to ensure participation in actual policy preparation and real decision-making. Process dynamics can ensure active participation during various phases of the policy process.

Once a policy has been formulated, the next critical and equally important phase is policy implementation. This is especially true for a possible policy in the Okavango River basin.

Policy implementation: The 5C protocol

Policy implementation is crucial, yet people have acted in the past as if it was not an important part of the policy process. This was especially the case in the early 1960s in the United States and during the 1970s in Western Europe. Early scholars of policy science were of the view that implementation was merely an administrative chore that, once policy had been legislated and the institutions mandated with administrative authority, would happen of and by itself. However, while the complexity inherent in implementation processes has been amply demonstrated, a widely accepted causal theory with predictive or prescriptive powers still remains absent.

More recently, a new wave of interest in policy studies, including policy implementation studies, has emerged from scholars in Southern Africa and also abroad.

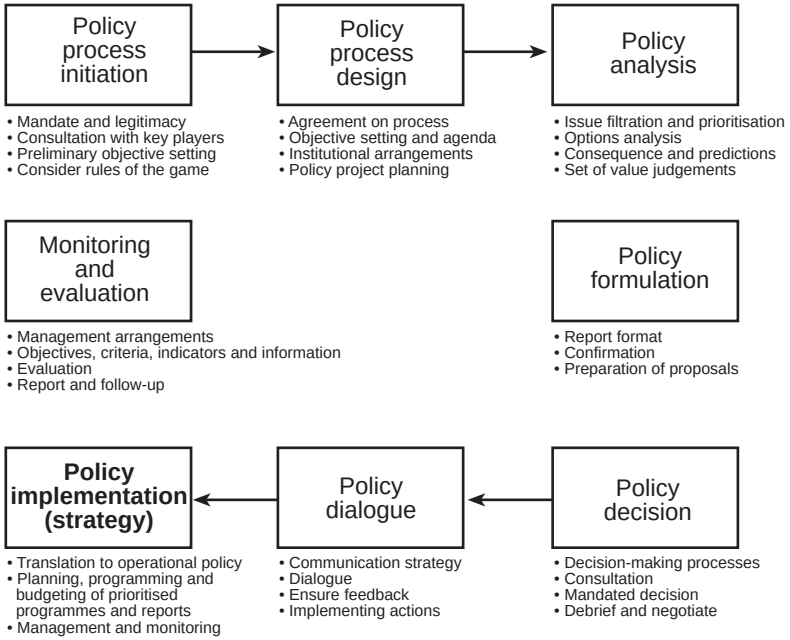
A survey of the literature shows that there is already a remarkable convergence on the critical explanatory variables identified by scholars of policy implementation. Moreover, researchers working in a number of different issue areas (e.g. environment, population, health and crime prevention) have consistently identified the same, or similar variables, as have scholars working in countries at various stages of economic development. However, a common theory on policy implementation still has to be constructed.

In understanding implementation as a complex political rather than a mechanical administrative process, the study of implementation becomes an attempt to:

- unravel the complexity of following policy as it travels through the complex, dynamic maze of implementation;
- understand how it changes its surroundings and how it is changed itself in the process; and

Figure 1

Key considerations for phases of the generic process model



Source: De Coning 1995

- most importantly, see how it can be influenced to accomplish the goals it set out of achieve.

While the maze through which policy travels in the course of its implementation is unique to each situation, the synthesis of the accumulated scholarship on the subject suggests that critical variables can be identified, which shape the directions that implementation might take. Consequently, five such variables emerge that are important causal factors for a multitude of scholars adhering to otherwise divergent perspectives (top-down or bottom-up), working on differing issues (environment, education, and others), in different political systems (federal, unitary, for example), and in countries at various levels of economic development (industrialised or developing). These variable are:

- the *content* of the policy itself: what it sets out to do (goals); how it problematises the issue (causal theory); how it aims to solve the perceived problem (methods);
- the nature of the institutional *context*: the corridor (often structured as standard operating procedures) through which policy must travel, and by whose boundaries it is limited, in the process of implementation;
- the *commitment* to the goals, causal theory and methods of the policy of those entrusted with carrying out the implementation at various levels;
- the administrative *capacity* of implementers to carry out changes; and
- the support of *clients and coalitions* whose interests are enhanced or threatened by the policy, and the strategies they employ to strengthen or deflect its implementation.

These five interlinked variables, also known as the 5C protocol, are all linked to and influenced by the others – though to varying extents depending on the specific implementation situation. For example, implementation capacity is likely to be a function of the remaining four variables: policy content may, or may not, provide for resources for capacity-building; the institutional context of the relevant agencies may hinder or help such capacity enhancement; the commitment of implementers to the goals, causal theory and methods of the policy may make up for the lack of such capacity, or vice versa; or the coalition of actors opposed to effective implementation may stymie the capacity that might otherwise have been sufficient – again, supportive clients and coalitions may in fact enhance capacity.

Top-down versus bottom-up policy implementation

A top-down view exemplified the earlier analytic models and has remained the more dominant genre. Typically, this perspective starts from the authoritative policy decision at the central (top) level of government and asks (Sabatier 1986:22):

- To what extent were the actions of implementing officials and target groups consistent with (the objectives and procedures outlined in) the policy decision?
- To what extent were the objectives attained over time?
- What were the principal factors affecting policy outputs and impacts?
- How was the policy reformulated over time on the basis of experience?

The bottom-up approach was largely a reaction to this model, based on identifying weaknesses and suggesting alternatives to address those weaknesses. It was suggested that "the notion that policymakers exercise – or ought to exercise – some kind of direct and determinary control over policy implementation might be called [a] 'noble lie'" (Elmore 1979:603). Analysis should focus "on those who are charged with carrying out policy rather than those who formulate and convey it" (Lipsky 1978:398), because "subordinate compliance does not automatically follow upon the issuance of orders and instructions … when managers die and go to heaven, they may find themselves in charge of organizations in which subordinates invariably,

cheerfully, and fully do as they are bid. Not here on earth" (Kaufman 1973:2). A few proponents of the bottom-up approach even suggested that "discretion at lower levels is not only inevitable, but also desirable … [because] it is necessary for policies to be 'reinvented' so that they better fit local needs" (Palumbo & Harder 1981:xi).

The big debate between top-down and bottom-up perspectives on implementation is not yet concluded. However, consensus seems to be emerging around the proposition that "it is not a question of choosing 'top' or 'bottom' as though these were mutually exclusive alternatives" (Hanf 1982:171). In fact, both perspectives provide useful insights into the implementation process, and both demonstrate significant explanatory strengths as well as weaknesses. Each may be more relevant to particular sets of cases than to others and, in some cases, both may be equally relevant, albeit at different stages of the complex and dynamic implementation process. Finally, there is a need to evolve new models of implementation that incorporate the strengths of both perspectives.

Conclusion

While policy could be defined in several ways, implementation moves from originally set political goals to results on the ground. The 5C protocol detailed above is proposed as a useful vehicle for making sense of these twist and turns. As has been highlighted, all five are likely to act together – often simultaneously and synergistically – and any change in one will produce changes in the others. The interconnectivity of the variables creates both a challenge and an opportunity.

The challenge is to appreciate the resulting complexity. In much of the literature on implementation, it is considered to be intrinsically complex. Although all implementation is expected to be dynamic and complex, not every episode of implementation is likely to be equally complex. Depending on particular situations, some variables are likely to be more manifestly complex in some situations than in others. Also, the set of variables proposed here is, in fact, more parsimonious than many alternative sets. Most importantly, it consciously sets out to define each variable in detail rather than introducing seemingly parsimonious black boxes. Even where the labels may seem all too familiar, the difference is in the level of detail: these may be seen as 'deep descriptors'. The complexity is not as much in the breadth of the variables as in their depth. Unravelling this complexity is imperative to unravelling implementation effectiveness. The opportunity is to use the five Cs strategically in their complex interlinkages to synergistic implementation.

It is in the space defined by such interlinkages between the variables that the negotiation, both explicit and tactic, between the various actors will take place. Here, the interplay between contending interests, strategies and power positions will ultimately define the effectiveness, or otherwise, of any specific implementation episode.

Frequently, the goal of the actors will be in direct conflict with one another and, consequently, the outcome of who gets what, will be determined by the strategies, resources and power positions of each of the actors involved. What is implemented

may thus be the result of a political calculus of interests and groups competing for scarce resources, the response of implementing officials and the actions of the political elite, all interacting within given institutional contexts.

What the interlinked dynamic 5C protocol implies is that implementation cannot be seen as an activity to be planned and carried out according to a carefully predetermined plan. Rather, it is a process that can only, at the very best, be managed. Managing and steering it towards a more effective outcome entail strategically 'fixing' those variables over which there is some direct or indirect influence in order to induce changes in those that cannot be influenced. The definitive variables – either in that they define the main stumbling block to effective implementation or in that they can be better influenced – will vary in each case. The strategic imperative is to identify those, among the five, that constitute the definitive variables and how they may best be influenced to arrive at the desired results. In essence, the management of implementation is akin to rewriting the music while in the process of performing the notes.

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CHAPTER 15

Decision support systems for equitable water-sharing: Suggestions for consideration in the *Water for peace Okavango pilot project*

Craig B Schultz

Abstract

The management, development and implementation of strategies for sharing and sustaining scarce water resources across international boundaries, nationally between administrative boundaries and locally between various water use sectors, including the environment, is an awesome responsibility that should be shared. Decisions should be made within adequate and achievable policy guidelines, legislation and institutional structures. They should be based on sound information and decision support systems with predictive capability. These systems provide a basis for processing and presenting information in a meaningful manner so that specialists, stakeholders and governing bodies are empowered to identify problem areas (current and future) and participate in debates related to 'what if' scenarios. The results should expose the interactive effects of projected future trends and the effectiveness of proposed strategies aimed at sustaining resources and development potential. This chapter focuses largely on selected water-related models that could be of benefit to the decision-making process.

Particular attention is given to a range of models of which the outputs can be converted into risk-based information and incorporated into a single risk-based information system from which results for a wide range of scenarios can be modelled with minimal additional processing time. The latter modelling can be undertaken with stakeholders involved in a workshop environment. Such modelling provides decision support systems for developing and testing reconnaissance level water resource planning options in relation to other studies such as environmental water requirements, demographic and socioeconomic trends. This capability is extremely important to sustainable water resource development and transboundary water-sharing when dealing with conflict mitigation for environmentally sensitive areas such as the Okavango Delta.

Introduction

Fresh water is intricately part of every aspect of the daily lives of humans. Whether it is for rural or household use, mining, agricultural production, manufacturing or recreation – everything uses water either directly or indirectly (after Breen & McKenzie 2001).

When considering the location of the Okavango Delta and its naturally occurring freshwater resources within the predominately arid and semi-arid country of Botswana, the continuous human pressures to exploit these resources are easily understood. This presents a massive challenge to those who not only appreciate that the region is a vital heritage site of ecological importance, but also recognise other responsibilities such as the need to provide clean water to local areas, as well as to resolve water problems in areas further afield.

The responsibility of sustaining the delta extends well beyond environmental managers. It also rests heavily on water resource managers, politicians, local inhabitants, inhabitants in the upstream catchment areas and all other interested and affected stakeholders, whether government agencies, private sector agencies or concerned international bodies.

Informed decision-making and the formulation of appropriate strategies for sustaining water resources, the ecology and any of the natural resources require:

- appropriate monitoring and acquisition of information from a wide range of relevant disciplines;
- participation of stakeholders supported by specialists with local knowledge from a wide range of relevant disciplines;
- a means of rapidly processing and presenting the information in an integrated manner that is easily understood and serves to highlight issues that need to be addressed;
- decision support systems that provide a basis for testing and interpreting 'what if?' scenarios so that strategies for future management, planning and development can be tested and the implications understood; and
- clearly defined laws and policies that essentially serve to provide further guidance to decision makers and stakeholders involved in evaluating the acceptability of proposed strategies.

These concepts are embodied in and expanded upon in several water resource management approaches including, for example, the National Water Act of South Africa (1998).

This chapter focuses on a small component of the process by providing suggestions for decision support tools for the management, development and conservation of water resources to achieve the sustainable utilisation and equitable sharing of water. It is important to emphasise that the equitable sharing of water implies the sharing of water between requirements for humans and for the environment, as well as locally between water-use sectors, nationally between administrative regions and internationally between countries with shared catchments.

Further, it must be stressed that there are no readily available software packages that serve as decision support systems that can provide total coverage of all interrelated components within a systems framework covering all relevant disciplines. A wide range of models, data management facilities and geographical information

systems, however, do cover some of the main components and can be used to make meaningful contributions towards the decision-making process.

The decision support processes and facilities presented in this chapter are not intended to be prescriptive for ongoing work in Botswana, but rather to serve as guidelines with examples of the types of decision support models that are available.

The following section briefly summarises a typical decision-making process so that the context within which hydrological models are used as decision support tools can be understood. Thereafter, a few selected models that may be of relevance to future studies of the Okavango Delta are presented.

A few engineering options are mentioned towards the end of the chapter. These options are controversial and are only listed to highlight the importance of good information and decision support systems in making informed decisions on the basis of an improved understanding of the implications involved. This will assist in contributing towards integrated water management aimed at ensuring that the ecology and natural resources are conserved in a manner that also sustains future socioeconomic development.

The decision-making process

Some components of a possible decision-making process for water projects are illustrated in figure 1. The figure depicts the decision-making process as a pyramid based on a foundation of information. The information is processed and simplified in a vertical direction towards decision and policy makers. Formulated policies and any decisions related to strategies, planning or management are again passed in a downward direction with detailed planning and implementation occurring in the central regions shown on the pyramid. This continuous upward and downward exchange of information and decisions is an essential part of the planning and management process. Scope for stakeholder involvement exists at all levels, however, the bulk of the opportunities for stakeholder involvement lies in the formulation of policies, reconnaissance planning, the provision of support to information-gathering phases and some opportunities to comment on or challenge the implications of final designs. Shown on the right-hand side of the pyramid are some of the hydrological models generally suitable for use as decision support tools in Southern Africa. Several of these models are not suitable for interactive use in the stakeholder participation process. This is largely due to the time needed to set up input information, run the models and prepare suitable outputs for presentation to stakeholders. This applies particularly to stochastic type systems models such as the *water resource yield model* (WRYM) and the *water resource planning model* (WRPM) (DWAF 1998), but also to the historical time series-based models (for example, the ACRU model – Schulze 1995; and the WRSM90 model – Pitman & Kakebeeke 1991). They can be used to generate reasonable results for water resource studies, however, provided that results are not needed within a very short space of time (a few minutes in a public participation forum).

An example of a model that is specifically designed as a decision support system for interactive use with stakeholders at reconnaissance planning stages is the *water situation assessment model* (WSAM) (Schultz & Watson 2002). Of relevance here is that the scope for stakeholder participation and high-level decision-making is very limited in the final detailed planning phases of project designs for construction purposes. More reliance is placed on the skills of a few professionals working within the constraints of policy guidelines set at higher levels. Stakeholder opportunities for revising policies and decisions generally decrease as the design processes move closer towards implementation phases. The importance of providing adequate information and facilities to derive suitable planning solutions at an early stage therefore cannot be overemphasised. Associated capacity-building must aim not only at professionals dealing with project details, but also at providing sufficient information to high-level decision makers so that they are empowered to make responsible decisions, particularly when dealing with policy formulation and approving management strategies or the implementation of specific projects. Some items for consideration in decision-making, policy formulation and capacity-building within the context of integrated water management are illustrated in figure 2.

The decision-making process is relatively complex and the philosophy of integrated catchment management is difficult to achieve in practice. For the purposes of this chapter, the process is simplified into quantifiable water balance, geographical and institutional aspects. The focus of this chapter is mainly on quantifiable water balance aspects, but other aspects that are also of importance will be mentioned where applicable.

From an institutional and implementation perspective, the decision-making process should consider the:

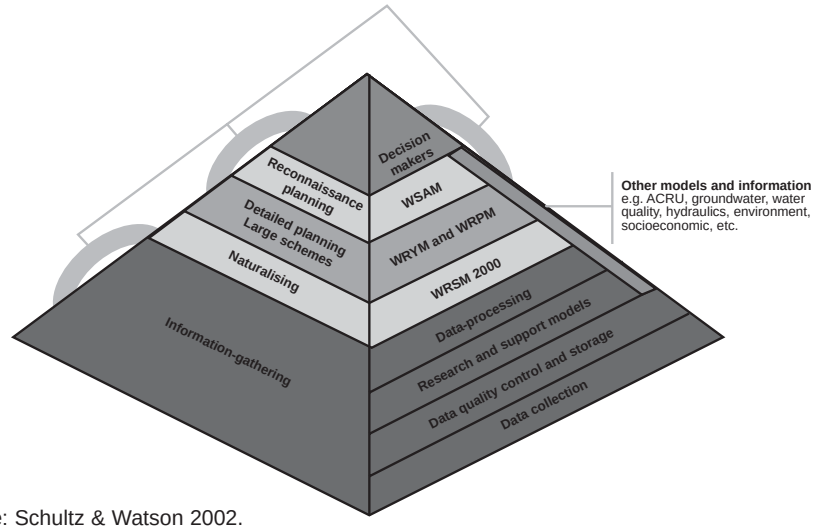
- institutional framework;
- information management;
- policy and strategy development;
- water-use regulation;
- auditing processes;
- stakeholder involvement;
- capacity-building;
- sustainable development for all sectors; and
- physical implementation and water availability.

From a geographical perspective relevant to the Okavango Delta, the following areas can be distinguished:

- The catchment draining towards the delta: this area can be subjected to land and water-use changes, affecting the inflow to the delta. The relevant rivers cross international boundaries. Most of the water originates in Angola, but contributions from other areas such as Namibia and Botswana also occur.
- The Okavango Delta itself: this area has its own environmental and human water requirements and is situated mostly in Botswana.

Figure 1

Simplified decision-making process



Source: Schultz & Watson 2002.

- Other catchment areas: water resources in various parts of Botswana and neighbouring areas are or may become inadequate, resulting in pressure being applied to consider water transfers out of the Okavango Delta.

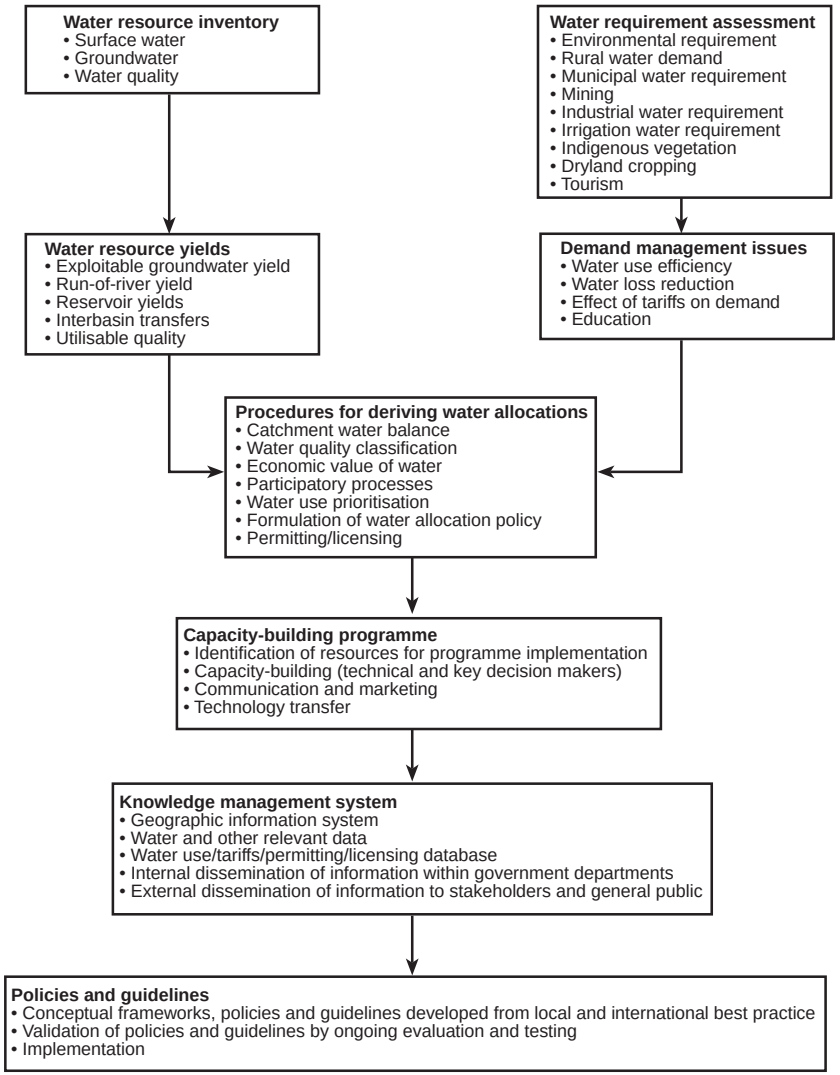
The natural climate and main water balance components that need to be considered include:

- the natural climate and hydrology;
- water requirements (natural and human purposes);
- water resources (natural as well as for present and future development options);
- water distribution systems, losses and water conservation effects;
- streamflow reduction and enhancements due to land-use changes;
- return flows;
- water quality;
- sediment; and
- climate change.

The natural variability of streamflow affects the levels of supply assurance in the water balance. This variability is influenced largely by climate. Recent concerns about

Figure 2

Integrated water management



climate change introduce uncertainties in the present understanding of natural variations. Possible climate change impacts in the study area should therefore be investigated. Socioeconomic and demographic trends must also be studied as they affect the land and water-use requirements. These impacts on the future water balance need to be understood relative to scenarios of water-related strategies for dealing with the changes. Strategies need to be developed for proactive planning and revised as the validity of projected trends become more apparent in time. Hydrological models provide a means of quantifying and identifying imbalances between water resources and water requirements.

Selected hydrological models are therefore presented below. They focus on relevant water-related components and were selected because of their suitability for applications in the geographical areas mentioned above. One of the models can use information extracted from the other models after it has been reduced to probable water yield relationships. This model has rapid scenario definition facilities and output generating capability so that it can be used together with stakeholder involvement for presenting, developing or revising strategies for local, regional and international water resource management, sharing and development.

Hydrological models

The ACRU model

The development of the Agricultural Catchment Research Unit (ACRU) model first commenced in 1981 at the University of Natal in Pietermaritzburg, South Africa. The first version of the model was released after five years based on a report by Schulze (1984). Research, model development, testing and refinement efforts have been ongoing since then. This process has been funded largely by the Water Research Commission (WRC) of South Africa. The model provides a sound basis for quantifying the impacts of land-use changes on runoff.

ACRU is a distributed, conceptual, physically based, multipurpose model outputting, among others, daily runoff elements (stormflow, baseflow), soil moisture, seasonal crop yields, sediment loads, and more. The model inputs comprise measurable information describing climatic, pedological, land-use, hydrological and spatial characteristics, which are accounted for in a logical manner representative of the dominant physical processes affecting rainfall runoff relationships. This ability enables the model to provide reasonable answers for ungauged catchments and predictive capabilities for flow-related changes due to changes in land and water use within a catchment. Alternative models such as the Pitman type monthly models (e.g. WRSM90 – Pitman & Kakebeeke 1991 – and WRSM2000 – Pitman et al 2000) can also be used to predict some land-use change impacts (e.g. irrigation), but the predictive capability of the ACRU model to deal with issues such as overgrazing, afforestation, eradication of alien vegetation, and others, is superior to that of the latter models. ACRU has the added advantage of also modelling sediment loads.

Outputs of runoff and sediment from the ACRU model can also be used in the Hydrological Simulation Program-Fortran (HSPF) model to provide capability for in-channel hydraulic and water quality modelling (Jewitt & Gorgens 2000). The main processes included in the ACRU model are shown in figure 3.

The ACRU model could be considered as an option, together with the HSPF model, for predicting the impacts of any future land and water-use activities in the catchment areas upstream of the Okavango Delta. Such impacts could result, for example, in a reduction of inflows to the delta. The hydrology of the Okavango Delta should only be modelled after quantifying the inflows based on various scenarios of upstream development.

Wetland models

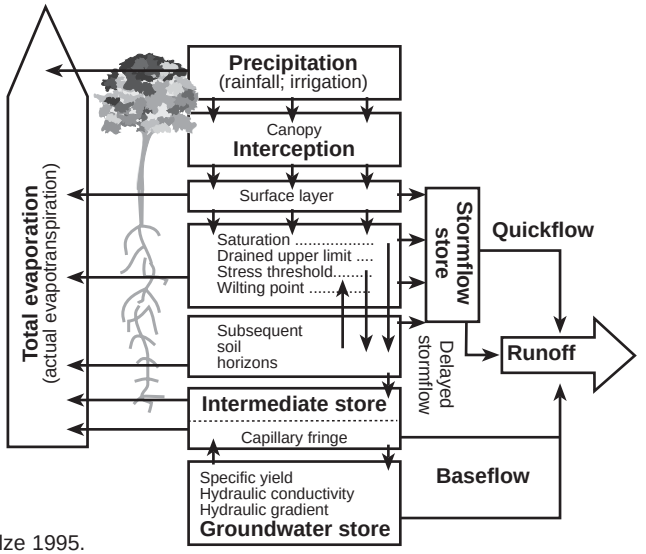
The volume of water in the Okavango Delta at any point in time reflects the ongoing changes in its mass balance as a result of inflows (natural runoff and rainfall) and outflows (evaporation, seepage losses, water-use abstractions, among others). The areas inundated with water depend on the surface morphometry, and the attenuation effects of the natural channels on inflow hydrographs as affected by channel size, shape, roughness and gradient. The actual characteristics of the natural streamflow entering the dendritic configuration of channels in the delta are significant to the ecology and surrounding vegetation, not only in terms of the flow magnitude, but also the frequency and variability of flow occurrences. Associated characteristics include individual flood hydrographs, seasonal variations in flow, occurrences of droughts and floods, as well as variations in other factors such as sediment loads and water quality.

The *ACRU model* provides a wetland component capable of dealing with most of the hydrological aspects affecting the mass balance of water in a wetland. This component includes features such as inflow hydrograph attenuation, evaporation from open surfaces, transpiration from riparian vegetation, rainfall onto the wetland area, and losses to or gains from underlying aquifers and outflows from these features. The morphology of the wetlands and associated effects of increases in ponded surface areas are also accounted for. From a hydraulic perspective, the model development focused on a single channel rather than a dendritic pattern of channel networks. This is not ideal for the Okavango.

Very similar features are included in the purpose-built *Mauritian wetland model* (Schultz & Dube 2002). When studying large flood events, unit hydrograph type models such as *HEC-HMS* in combination with *HEC-RAS (*Haested methods) are better suited for dealing with the open channel hydraulics and the off-channel storage areas that control the extent of the flooding. This latter modelling approach has been shown in various projects to provide reasonable results relative to measured water depths along river reaches and also of the extent of flooding over adjacent floodplain areas as measured by satellite images. This was confirmed in recent studies of large

Figure 3

ACRU agrohydrological model



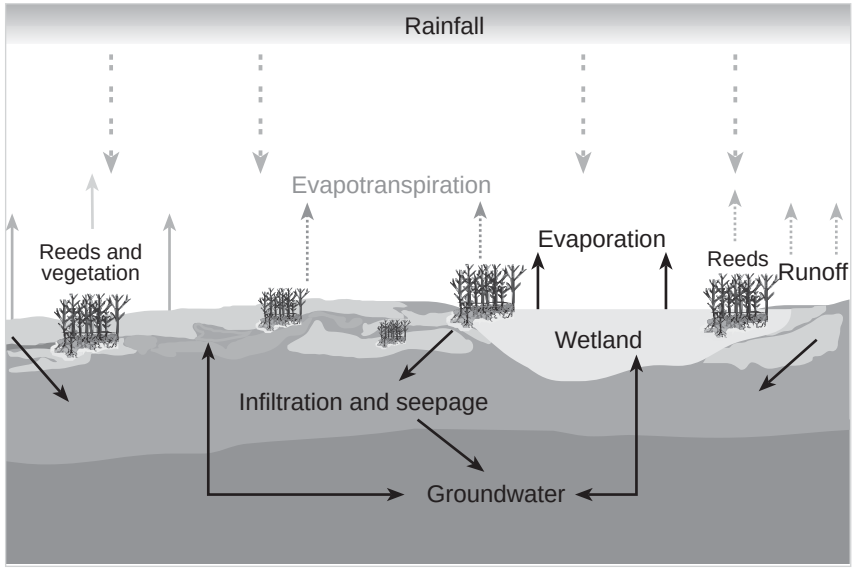
Source: Schulze 1995.

flooded areas along the lower reaches of the Limpopo River in Mozambique (Barnes et al 2001). It is suggested that the Mauritian wetland model could be used in conjunction with hydraulic models to understand the hydrodynamics of the Okavango area in response to the characteristics of the inflow hydrograph and local climate. The hydraulic modelling provides an important means of estimating the spatial distribution of water as it flows into the swamps. The wetland models provide information relevant to dynamic changes in the mass balance. Complexities associated with changes in sediment loads and shifting channel morphometry, especially in the delta areas in the northern parts of the swamps, present major challenges to any modelling efforts.

Changes in the inflow characteristics are sensitive to the climate and the extent of changes in land and water-use practices within the catchment areas draining towards the delta. As mentioned earlier, these can be modelled using ACRU. Another important component of the mass balance of the swamps is the volume of water abstracted for human purposes. Particular concerns are related mostly to the

Figure 4

Schematic representation of the Okavango swamps



Source: Schultz & Dube 2002.

possibility of future developments of large water transfer schemes. The possible need for and the magnitude of future abstractions or water transfers out of the swamps can be predicted using systems models. These models can also provide a powerful basis for evaluating alternative schemes so that abstractions can be avoided or minimised.

It is important to emphasise that systems models as presented below are not intended for use in understanding the water resources of the swamps themselves. This must be done using the hydraulic models discussed above in combination with the dynamic mass balance type wetland models. The latter models should be used in combination with ecological studies to understand the criteria under which certain voumes of water can be transferred out of the swamps and the extent to which upstream water use should be prevented. System models provide a basis for evaluating water resource development options in surrounding areas and ascertaining whether it is actually necessary to transfer water out of the swamps.

Systems models

The Okavango Delta contains vast volumes of water. However, the water is spread over a relatively large flat area and the resultant depth of water is seldom more than one or two metres. Abstractions could therefore have a significant impact on the spatial extent of this ecologically important area. The ongoing and increasing need for water in surrounding countries, however, is significant. Strategies for meeting water requirements to alleviate poverty, accelerate development and sustain development potential are required. Specific areas that could be served by water from the delta include Namibia (especially Windhoek), the central and southern portions of Botswana, as well as the rapidly developing eastern portion of Botswana. The eastern portion of Botswana contains multiple dams and water transfer schemes as depicted in figure 5. Some examples of viable alternative water resource options include the already proposed Lower Shashe Dam, groundwater resources and surface water resources from rivers further away such as the Orange and the Congo rivers.

The costs of developing large transfer schemes and dams are often excessive and optimal solutions need to be sought, especially if several countries are involved. The optimisation of development strategies and the operational sharing of water can be achieved using systems models. Ecological water requirements must be clearly understood and allowances for this must be included in the modelling approach. Systems models are well suited for dealing with complex schemes consisting of multiple reservoirs, interlinked water transfers and a large number of water-use abstraction sites. Typical examples include the WRYM (DWAF 1998) and the WRPM. These examples are based on the ACRES reservoir simulation model (ARSP) and are described briefly below.

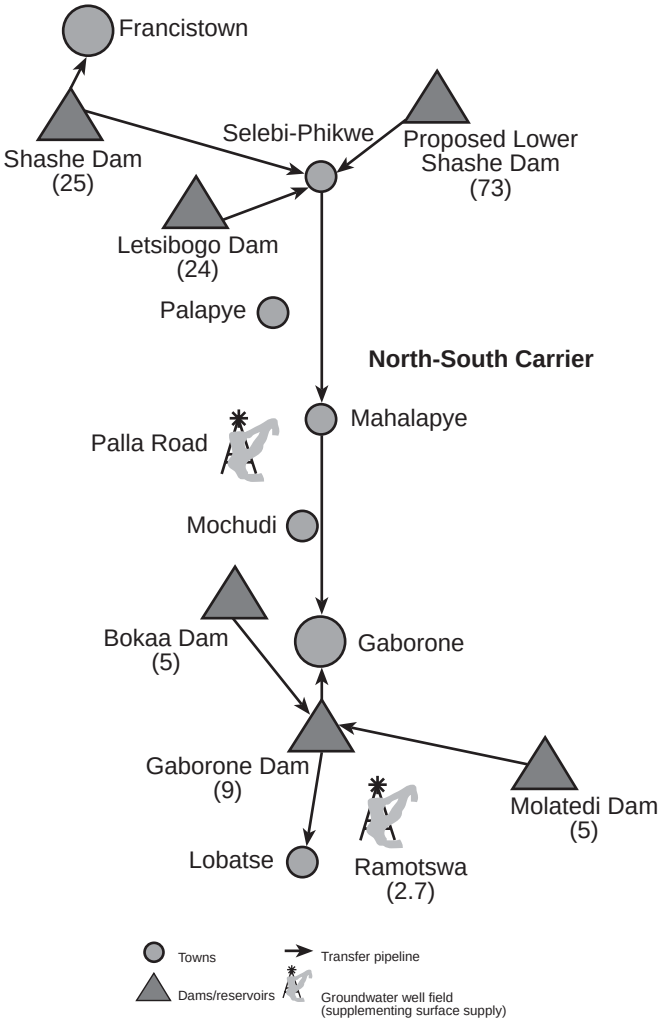
The WRYM model is designed to assess the long-term yield capabilities for an assumed constant level of development. Operating rules for managing water resources are defined in a manner that prioritises allocations according to volumes of water available at each source, criteria for introducing water restrictions and criteria for preferential allocations of water to certain users. The operating rules and (if applicable) the systems infrastructure are adjusted in order to devise strategies for supplying water at acceptable levels of assurance.

The WRPM model is similar but more complex and accommodates changing water use and systems configurations in time. It also focuses on short-term yields, as well as water quality. These two models can utilise historical or stochastic flow information. Model results are interpreted relative to water supply yields, as well as the associated levels of supply assurance or risk of failure to supply.

The significance of systems models to the water resources of Botswana is that they can assist in determining the yields and operating procedures for dams such as the Shashe and Gaborone dams and any potential future dams such as the Lower Shashe. By incorporating groundwater yields into the system as well, the required additional water from other sources can be understood relative to projected future yields for various

Figure 5

Integrated water supply system of eastern Botswana (schematic layout)



Source: Lillie 2002.

scenarios of future growth that impact on water requirements. This would provide an indication of the necessity to obtain additional water from other sources such as water transfers from neighbouring countries or (possibly?) the Okavango Delta. This process requires regular updating as socioeconomic and demographic trends continue to evolve. The Department of Water Affairs (DWA) of Botswana have adopted similar strategies in the past using other models such as the Monash model used in the development of the Botswana National Water Master Plan (SMEC, WLPU, SGAB, 1991).

A disadvantage in the use of systems models is that they are time-consuming and expensive to apply. The results are also difficult to interpret and to explain to stakeholders who have not had specialist training or have acquired experience in the use of these models. However, once established, the information from the systems models can be expressed in terms of levels of supply assurance for yields from dams and levels of supply assurance for run-of-river yields. This information can then be incorporated into mass balance models intended for use in communicating with stakeholders.

One example of a method of empowering stakeholder involvement at an early stage of water resource planning and the development of strategies for equitable water-sharing, is the *water situation assessment model (WSAM)* (Schultz & Watson 2002). This model is specifically intended for use in a workshop environment together with stakeholders so that reconnaissance-level 'what if' scenarios of future growth and development can be tested relative to user-defined strategies for meeting future requirements. Its application necessitates prior application of other models such as the monthly Pitman type or daily ACRU models to understand land-use impacts followed by systems models to define stochastic yield relationships. WSAM is summarised below.

Water situation assessment model

The water situation assessment model (WSAM) provides a means of simulating, at a reconnaissance level, options for local and interregional water resources development, as well as interstate water-sharing. The model was developed by the Department of Water Affairs and Forestry (DWAF) of South Africa with support from several consultants, including ARCUS GIBB (Pty) Ltd.

Existing models used for detailed planning and water resource management are time-consuming to apply and results are difficult to interpret. As such, the models are not well suited for reconnaissance-level evaluations with stakeholder involvement in a consultative workshop environment. Such workshops ideally require that results for 'what if' questions should be made available within a few minutes in response to the questions. This is particularly relevant to debates concerning present and future options for water resource development, management, planning and conservation. WSAM was developed to assist the DWAF in water resource planning and in contributing to the development of the National Water Resources Strategy. It serves as a decision support tool to quantify surpluses and deficits at local, regional and national scales, as well as to undertake scenario analyses. While the model is user-friendly and

based on state-of-the-art software technology, the challenge of producing and interpreting results for a large number of catchments and sub-models still necessitates that model users should preferably undergo short training courses. This does not imply that persons who have not attended the courses cannot meaningfully participate in workshops in which the model is used.

The model uses a database representative of water-related information for a whole country and any adjoining drainage areas in neighbouring countries. It is able to address questions related to scenarios of future conditions and strategies for water resource development, planning and management. Effective involvement of stakeholders is possible because the model is capable of providing rapid feedback to questions that could arise during a consultation process without the need to resort to further lengthy studies.

The model is structured to accommodate an interlinked flow system consisting of catchments and water transfer schemes. Outflows from upstream catchments form input into the next downstream catchment. This water, together with runoff originating in the catchment, imports into the catchment and supplies from groundwater, determine the total water resources of the catchment. Water-use abstraction requirements, ecological water requirements, streamflow reduction activities and exports from the catchment are the main water-use components impacting upon the catchment's water resources.

Once all the demands and available resources of each catchment have been quantified, a risk-based balance is done in terms of water resource yield capability and water requirements. This provides a spatial indication of surplus and deficit conditions for a particular level of supply assurance.

The manner in which various sub-models and flows are linked within a single catchment in the model is described below and summarised in figure 6.

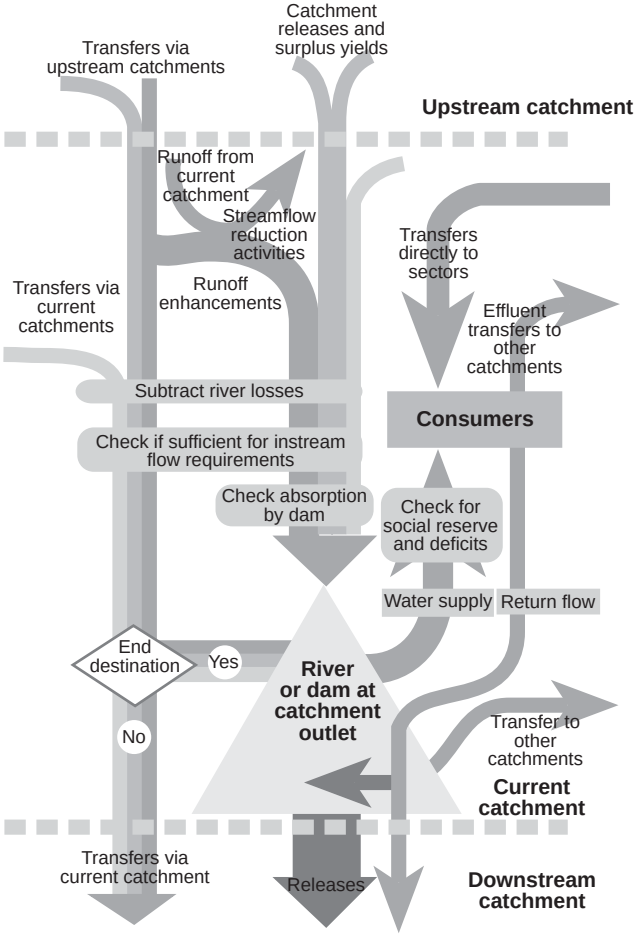
Model calibration is not required as the model relies heavily on inputs from other models. However, users do have the opportunity to alter model parameters via change list functions, should they disagree with the results presented. Facilities are also provided for adjusting parameters to reflect scenarios of future conditions.

In WSAM simulations, consumer water requirements are supplied from groundwater, rivers or dams, but can also be obtained directly from imported water. Allowance is also made for maintaining a human and ecological reserve. Natural and infrastructure-related losses are also accounted for where relevant. The following water requirements are included in the model:

- The *human reserve* provides for maintaining a minimum per capita daily water supply for meeting basic human needs as a first priority.
- The *ecological reserve* also receives priority in the WSAM allocation of water resources. The modelling provides a means of identifying the water resource impacts of maintaining the ecological reserve.
- The allocation of water resources to those *bulk users* that are of strategic importance in maintaining the economy of a country, for example, power stations, are the third

Figure 6

Model structure



Source: Schultz & Watson 2002.

priority considered in WSAM. The requirements of the remaining water-use sectors receive equal priority in the model's allocation of water resources.

- The *urban* water-use sub-model distinguishes two major components of urban water use: direct urban water use, which is mainly driven by population and levels of service, and indirect urban water use, which is the total of industrial, commercial, institutional and municipal water uses.
- *Irrigation* water use is determined by factors such as climate, leaching requirements, conveyance losses, irrigation efficiency, crop type, among others.
- *Rural* water use is driven primarily by population and per capita water requirements. It also includes components for water used by livestock (including game) and subsistence irrigation.
- *Return flows* from water demands are calculated individually for each sector. The volumes are adjusted in cases where water demands cannot be fully supplied. The return flows can be reused within the catchment of origin, or allowed to flow to the downstream catchment.
- *Hydropower* is incorporated, where relevant, to reflect the volume of water released from dams for the purpose of generating hydropower.
- *Streamflow reduction and land-use related impacts* include those land-use activities that reduce runoff. Examples include forestry, dry-land agriculture, alien vegetation, groundwater abstraction (which reduces base flow) and evaporation from farm dams. Natural river losses are also accounted for.
- *Water resources* include three main components of water supply. These are surface water, groundwater and interbasin transfers. Benefits are also obtained from the reuse of return flows.
- The utilisable *surface water* in a catchment is affected by the surplus yield available from upstream catchments and the contribution to yield from natural runoff generated within the catchment after adjustments for streamflow reduction activities.
- *Groundwater* resources are modelled to supply water directly to water demand sectors (rural, urban, etc). These resources are based on the exploitable groundwater potential, which takes into account the characteristics of aquifers as well as the influence of hydraulic conductivity.

Issues addressed in the water situation assessment model

In developing the WSAM, several challenges were encountered. Some of these are briefly described below.

Hydrological timeseries problem

The estimation of available water resources for a particular area at a given level of assurance necessitates the use of long-term timeseries data. In the case of South

Africa, this has been done in separate studies for more than 2,000 catchments using approximately 80 years of flow data. Simulations of this nature, however, are simply not possible within the timeframe of a few minutes in a boardroom and the data constraints of an average desktop computer. It can only be done if the statistics of the timeseries information alone are used in the simulations. This is achieved by replacing the conventional modelling of the natural hydrological timeseries with a method of gross yield accounting. In this process, the gross yields are presented as percentages of mean annual runoff using catchment specific storage-draft-frequency characteristics. Further, the run-of-yields are reflected by the flow duration frequency characteristics of rivers. Only the parameters describing the relevant relationships for various levels of supply assurance are stored in a model.

Multiple users

It is recognised that a wide range of users from different backgrounds and disciplines, and with varying levels of experience and competence are likely to use the model.

The model is therefore based on a Windows environment. Transparency of the model operation is provided by online displays of the model structure and the equations used to calculate output parameters.

Different users and user groups are likely to focus on different areas of interest and have their own output requirements. The model is structured to enable users to define, for output purposes, their own spatial areas of interest. They may also select parameter groups that are relevant to them and customise the appearance of their output tables and graphic results. Specified areas of interest and parameter groups can also be used in the definition of potential future conditions and the management of scenarios.

Stability of base data in a multi-user environment is ensured by means of change lists. Change lists allow users to modify model inputs in order to correct errors, update parameters with improved estimates, or perform sensitivity analyses by varying the input values and comparing run results. Multiple change lists may be included in a particular model run, and each list may be named and stored for later use. The change list facility enables independent studies to keep work comparable. It allows flexibility in model runs while maintaining an unmodified base dataset.

Area-type conversion

Users of water-related information often require outputs based on administrative boundaries rather than on catchment boundaries. Examples of such boundaries include international boundaries, provincial boundaries, water management areas and water boards.

The model accommodates such areas by apportioning parameter values between adjacent administrative areas for situations where the administrative border cuts across a catchment. Simulations are conducted on a catchment basis and parameter

values for an administrative area are derived according to the relative proportions of catchments occurring within the administrative area. These values are combined to produce a single value for the administrative area.

Data management

Data management is complicated by the use of a large number of parameters (about 400), numerous sub-catchments (about 2,000), and large variations in the quality of the data.

The number of parameters used in the model has been kept to the perceived minimum required to produce meaningful results for each modelled process. Considerable quantities of data are avoided by replacing timeseries data with parameters to describe relevant equations depicting the main characteristics of the data.

Data management is simplified by presenting a complete dataset for all parameters for only one predefined base year. Changes in data values subsequent to this year are defined by parameters describing annual growth rates rather than storing separate values for each year. This approach also facilitates the definition of future scenarios. Model outputs are therefore provided at user selected points in time. The use of a base year of predefined data provides a stable set of data for comparative purposes from which all users can make their own future projections. The base dataset can be updated by a coordinating body from time to time and redistributed to all users.

Access to information on meaningful parameter ranges and the significance of changes in these values in terms of the sensitivity of the model outputs assists the user in evaluating the data. This is further enhanced by documented guidelines for data preparation, as well as appropriate error-checking and warning messages for unrealistic values. The quality of the input data can be colour-coded in output tables to assist in identifying problem areas associated with poor quality data.

Inconsistencies in the accuracy of available data are easily accommodated in the model and poor quality information can be updated as improved information becomes available. All data values are accompanied by metadata that provides additional information on the source and accuracy of the information.

The metadata also makes it possible to report on the reliability of the parameter values together with the model results, and provides a structured way of improving the results. In particular, metadata may be used to identify which of the parameters have low reliability. These parameters may be targeted for use in sensitivity analysis or for re-evaluation.

Scenario-based analysis

Information related to future growth, supported by a library of planned schemes, enables users effectively to define and model scenarios of future conditions and to predict imbalances in water resources and water requirements. Examples of the types

of information that can be studied separately or jointly in combined scenarios are ecological instream flow requirements, streamflow reduction activities, water resources, water use, hydropower releases and water quality.

Scenario-testing can be aimed at evaluating the following:

- identification of water-stressed areas and areas with surplus water;
- strategies for water resource development (e.g. dams, water transfers, groundwater and run-of-river);
- water demand management (efficiency, recycling and waste reduction);
- land-use management (forestry, eradication of alien vegetation, dryland agriculture);
- effects of population changes;
- effects of upgrading housing and levels of water services and sanitation;
- changes in international water-sharing agreements; and
- environmental requirements.

Potential applications

The model has been developed for South African conditions as a decision support system for reconnaissance-level water resource management. It enables assessments of the present and future water situation by incorporating scenarios of growth, land-use and water-use developments, water resource planning, management and development. It can rapidly process large volumes of data and provide meaningful results from a wide range of data values of varying levels of accuracy. The parameters can be used to represent the majority of the land and water-use developments that are likely to be encountered in evaluating the status of water resources relative to water requirements.

The model provides a facility that could easily be applied to other countries or groups of countries, or even on a continental scale. For the Okavango study area, its largest benefit (if established for use in the area) would be in the provision of a decision support system for studying the entire water resource situation and development options for all countries involved. It provides transparency for all stakeholders to understand one another's needs and participate in the shared planning process. It is not a solution on its own and other ongoing studies, for example, of sensitive environmental issues and socioeconomic trends are essential.

Engineering options

While the primary purpose of this chapter is to discuss decision support systems related to water-sharing, this section briefly summarises some remedial engineering options for accommodating worst-case scenarios if the dynamic water balance of the Okavango area becomes disrupted in future. All of these types of options can only be considered after careful assessments based on sound information and a clear understanding of the consequences. The problem can be simplified into three key scenarios from a volumetric water perspective:

- *Scenario 1:* A reduction (or unlikely increase) occurs in inflow to the Okavango Delta and a change in the natural variability of the inflow. This can be caused by upstream developments (e.g. irrigation schemes) and climate change.
- *Scenario 2:* A decrease occurs in the volume of water stored in the Okavango Delta due to abstractions or transfers of water out of the delta to other areas such as Namibia, or central and eastern Botswana.
- *Scenario 3:* A change in the volume of inflow, as well as in abstractions and transfers out of the delta can be caused if the swamps are used as a balancing dam for future water transfer schemes. For example, water could be transferred into the swamps from the Congo River and then transferred to other areas such as towns in Namibia.

For the first two scenarios, with no benefits from a transfer scheme into the Okavango Delta, the following types of solutions could be considered (none of them ideal from an environmental perspective):

- Sacrifice part of the delta area in order to preserve a remaining portion by redistribution of inflows. For this type of approach, some channels in the dendritic river system can be blocked off using floating sluice gates. The gates can be designed to sink out of the way during extreme floods or close particularly during below average inflow periods, thereby forcing more water first into a few channels deemed to be of higher environmental priority. This would sustain some habitat areas but impact negatively on others.
- Artificially reduce the widths of some channel sections to force smaller volumes of inflow to travel significant distances along selected reaches in order to ensure that water can flow far enough southwards to continue to maintain ecological areas in the southern parts of the delta. This could entail building relatively low artificial berms within the main channel, thus narrowing the channel widths in some areas. The height of the berms could be designed to concentrate low-flow volumes into smaller channels, but larger flows would spill into the existing wider channel during flood periods. This could possibly also result in serious erosion or sediment problems if not managed or designed correctly.
- Construct an upstream balancing dam to provide storage for additional water to be released into the delta during periods when this is essential from an ecological perspective. This dam could be replenished with water transfers from other sources, for example, the Congo River. This dam would be subjected to sediment problems and impact on the natural hydrological and sediment changes in the swamps.

In the case of the third scenario, the acceptability of the solution is uncertain due to the need to manage the dynamic variability of water in swamps in an ecologically acceptable fashion.

As in all cases, the environmental consequences of tampering with the fragile ecology of the Okavango cannot be ignored. Other issues such as the impacts on water quality, tourism and local inhabitants also need to be studied.

Engineering solutions such as those mentioned above are highly controversial and should be considered as ‘last resort’ strategies. Potential impacts on other water users upstream of the swamps or transfers out of the swamps must be predicted in advance and thoroughly understood before proceeding or being prevented. The timely application of predictive tools to scenarios of future conditions is therefore essential. Under no circumstances should a gradual change in the hydrological regime be allowed to occur unnoticed until after the ecology has been disrupted and it is too late to initiate remedial water-use management or construct engineering solutions.

Climate change

The ongoing impacts of air pollution and large-scale land-use changes such as deforestation in the Amazon basin are generally seen to be the major factors contributing to growing international concerns about climate change. It is also possible, however, that overgrazing and the removal of trees for subsistence purposes could have a further influence on rates of climate change in various parts of Africa.

The future magnitude of climate change and the associated implications for the Okavango swamps are unknown at this stage. It is therefore strongly recommended that future water resource management of the Okavango basin makes allowance for the possibility of climate change. Attention should focus on changes that could impact on evaporation losses from the swamps, the natural variability and volumes of rainfall in the catchment areas, as well as the changes in the natural inflow to the swamps.

Conclusion

This chapter has focused broadly on a generic decision-making process that facilitates stakeholder involvement. The process advocates the need for adequate information and decision support tools that enable planners and stakeholders to address answers to typical ‘what if’ water-related questions. It is not intended to be prescriptive of specific approaches that should be used in Botswana, or other countries, but serves to highlight a set of models that could be considered for future use. An important point is that the type of decision-making approach described in this chapter often results in the decreased involvement of high-level decision makers and stakeholders as the planning stages of development and management move closer towards the final design and implementation. The latter phases are more closely controlled by locally focused officials and appointed professionals. This implies that an adequate understanding of the impacts (positive or negative) of development options should be sought at an early stage of the planning process so that they can be evaluated in time at all levels prior to detailed project design phases gathering momentum. This necessitates an integrated water management approach supported by tools with predictive capability and early implementation within a broader context aimed at sustaining and improving the natural environment, and socioeconomic

conditions, and ensuring that other issues such as climate change are also dealt with. Hydrological models can contribute towards this process by quantifying water resources relative to estimated water requirements for various scenarios. In order to provide meaningful results, the modelling must be supported by reliable and relevant data. The decision-making process, however, must focus wider than water-related models and information. The involvement of a diversity of relevant disciplines and ongoing monitoring are essential. Additional monitoring should focus on, among others, biodiversity, demographic trends, socioeconomic trends and climate change.

A difficulty generally encountered in attempting to involve the use of complex hydrological models as decision support tools in workshop environments is that these models are usually time-consuming to apply and very few scenarios can be dealt with adequately in one meeting. It is, however, possible to extract risk-based results from previous studies or purpose-oriented preparatory studies involving the use of a range of models. Output information can then be incorporated into a single risk-based information system that includes capabilities to process and present results rapidly for a wider range of scenarios of water resource management and development options, including the sharing of these resources between several water-use sectors and across several states. Examples were given in this chapter of hydrological models that can be used to simulate the inflow into the Okavango Delta, the mass balance of this wetland area and the water resources of other areas that could impact on future water requirements in the delta. The water situation assessment model (WSAM) was discussed as an example of an information system into which the risk-based results of these models can be incorporated. The WSAM has modelling capabilities that can be used in a workshop environment to assist stakeholders and professionals in evaluating scenarios of future conditions and options for sustaining water resources. It is well suited for rapid identification of present and future imbalances in water supplies and requirements. Reconnaissance strategies for resolving deficits and sustaining resources can conveniently be addressed with stakeholders at regional and national scales. A sound basis is provided for rapidly eliminating unsuitable options for water resource development. The model does not replace the need for more complex timeseries or stochastic modelling in detailed design and finalisation phases of developing operating rules for water schemes.

It is recommended that consideration should be given to the development of decision support tools, such as the WSAM so that stakeholders and high-level decision makers can participate meaningfully and timely in debates related to options for water provision for people and the environment. Once established, the model's database will provide a source of basic information related to water resource availability, consumer water requirements and environmental requirements with predictive capabilities for future water resource management. Models on their own are not management solutions and the implementation of appropriate solutions will depend on professionals, researchers, managers, politicians and all stakeholders.

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CHAPTER 16

Hydropolitical drivers and policy challenges in the Okavango River basin

Anthony Turton, Peter Ashton and Eugene Cloete

Introduction

This book has attempted to capture a range of ideas from different specialist disciplines, the data appropriate to these disciplines, and current knowledge of the Okavango River basin. These may all be used to develop a baseline on which future institutional and policy-related developments can be structured. It can thus be considered as an audit of the current state-of-the-art multidisciplinary knowledge on management issues confronting the Permanent Okavango River Basin Water Commission (OKACOM). The book started off by proposing three hypotheses. These hypotheses were discussed in some detail, and it was suggested that they could help to interpret the contents of the book. It was also suggested that the hypotheses could be tested to a certain extent, and refined where relevant, by means of the empirical nature of the case study material provided in chapters 2 to 15. What remains to be done is to assess the three hypotheses against the information provided by the case studies, as a first attempt to develop a model that can identify the underlying hydropolitical drivers, and possibly explain (or even predict) the probable future outcome. This output will then be offered to the next phase of the process, which is to commence with a more detailed hydropolitical assessment of the Okavango River basin in order to inform the process of policy formulation by the three riparian states concerned.

An assessment of the three hypotheses

The logic of this book is based on three hypotheses that were developed because of the lack of adequate hydropolitical theory. The primary purpose of the three hypotheses is to introduce more scientific rigour into the evaluation of case studies, with a view to refining the hypotheses for future use in Southern Africa and elsewhere.

First hypothesis: Southern African hydropolitical complex

This book has shown that a wide variety of factors are brought to bear on riparian states in managing transboundary river basins such as the Okavango. This is particularly relevant where some of the riparian states rely heavily on a given river

system. In the case of the Okavango River, it has been shown that all three riparian states have a high degree of reliance on the system and few viable alternatives are available.

In the case of Angola, the upper reaches of the Okavango basin are needed to support the resettlement of internally displaced persons and former combatants. Angola is relatively water rich, but economically impoverished, a condition that has been described as 'structurally induced relative water scarcity' (Turton & Ohlsson 1999; Turton 2000a; 2000b; 2002a; Turton & Warner 2002). In effect, this means that limited institutional capacity exists and, consequently, a limited range of viable policy options can be generated. The prognosis for this debilitating condition is not good, and if interpreted against the third hypothesis, suggests that there is a possibility of acute conflict at local level if the situation remains unmanaged. If such conflict occurs, it could spill over into the neighbouring states, possibly in the form of armed rebels or insurgents, who would then pose a security risk to the more peaceful Namibia and Botswana.

In the case of Namibia, the only perennial rivers flowing on its national soil consist of short reaches of the Kavango and Cuando-Linyanti rivers that flow across the Caprivi Strip. Namibia is exceptionally arid, and water scarcity poses a fundamental limitation to its future economic growth potential. If the proposed Okavango pipeline could be developed, it would increase the security of supply for Namibia in a dramatic fashion, thereby enabling existing water sources to be used more efficiently, secure in the knowledge that if these sources failed, the Okavango River would provide a reliable backup. Namibia has also been described as an example of structurally induced relative water scarcity (Turton 2002a; Turton & Warner 2002), but it does have a greater range of available second-order resources than Angola. The conflict from the Angolan civil war has spilt over in the past into the Caprivi Strip (Meissner 2000), strengthening the case for the existence of a Southern African hydropolitical complex. In terms of international law, Namibia has the sovereign right to develop economically, and if it has no viable alternative source of water assured for future economic growth and national prosperity, it is difficult to foresee a situation where water from the Okavango River would not be needed.

In the case of Botswana, the Okavango is the only perennial river flowing on its national territory. Botswana is also more economically diversified than Namibia, and has been described as an example of 'structurally induced relative water abundance' (Turton 2002a; Turton & Warner 2002), because of its greater availability of second-order resources. This means that most of the available water is already earmarked to support rural livelihoods and ecotourism. The former is politically important for the government of Botswana, and the latter is strategically important because it provides a growing source of foreign revenue, creates jobs for rural dwellers, and is an example of extremely efficient and sustainable use of water.

From this brief overview, it is clear that the fundamental hydropolitical driver in the Okavango River basin is the high degree of reliance on the river by all three

riparian states, with no real viable alternatives. This fact alone becomes the independent variable in the overall hydropolitical equation and is presented graphically in figure 1. Herein lies the problem but, if seen through the conceptual lens of a hydropolitical complex, it can also contain an element of a possible solution to unintended ecological disturbances in the Okavango Delta. If the three riparian states choose to cooperate, it is in their mutual advantage for several reasons. For Angola, the presence of a basin-wide agreement would help the country to raise the necessary funding to pay for essential infrastructure development in the upper reaches of the Okavango basin. The notion of a hydropolitical complex embraces the linkages between shared river basins, but also enables a broader range of possible solutions to be considered and developed. As such, it is more than an analytical tool to be used by water resource managers to develop sustainable solutions to complex problems in semi-arid areas. Instead, it is considered to be a useful conceptual framework for analysing the hydropolitical dynamics of the Okavango River basin, because there are a number of linkages with other river basins: by virtue of dual riparian status of one or more of the riparians (Zambezi, Cunene, Orange and Limpopo); by virtue of proposed future interbasin transfer schemes (Heyns 2002); and because every country shares several crosscutting issues such as the need to grow economies in a sustainable manner using the limited water that is available.

Significantly, and in keeping with the hypothesised Southern African hydropolitical complex, potential future solutions can be developed in a peaceful and equitable manner, by seeking possible solutions that could include options located outside of the Okavango basin. It is hoped that this concept will be expanded and applied in future hydropolitical studies within the Southern African Development Community (SADC).

Second hypothesis: Expanded definition of hydropolitics

The broadened definition of hydropolitics as being the study of the authoritative allocation of values in society with respect to water (Turton 2002a) is capable of dealing with the complex range and multiple scales of issues that are evident in the Okavango River basin. Significant to this case study as a whole is the distinct difference in conflict potential when it is viewed as a function of scale. For example, conflict potential appears higher at the level of the individual in Angolan society than, for example, a similar individual in Botswana. This is caused in part because of the collapse of the Angolan economy, the fact that most men have been soldiers virtually their entire lives and know nothing else, and the fact that high levels of poverty can become drivers of future low-intensity conflicts around certain hotspots. The need to deal effectively with this situation is self-evident. But the expanded definition of hydropolitics also allows a broader range of issues to be included in the analysis. Central to this is the identification and examination of three interceding variables as shown in figure 1. It is instructive to dwell for a few moments on these variables.

The primary interceding variable is important because, in essence, there is little that can be done to influence outcomes, other than to develop policy that recognises these issues as a key factor. In figure 1, this is presented as one variable, but it consists of four individual and clearly discernible factors that interact in unison:

- The first is the natural pattern of climatic oscillation that occurs in a cyclical fashion between relatively wet and relatively dry years. In reality, it seems that several different oscillation patterns are superimposed on one another (Ashton 2000a; 2000b; Gumbricht et al 2002), but for purposes of simplicity, it is assumed that these all result in natural climatic variability, which has become one of the primary stimuli driving almost all ecological functioning in the Okavango River basin. In terms of periodicity, McCarthy and others (2000) refer to this as having at least an 18-year oscillation in the case of the Okavango basin, while records from the Zambezi basin suggest that there may also be a longer 80-year cycle of periodic climatic change.
- The second is related to what is known as the 'flood pulse concept', which is the result of climatic variability where periods of high flow appear to become the fundamental or most important ecological driver in the functioning of downstream wetlands (Junk et al 1989; Davies et al 1993; Puckeridge et al 1993; Davies & Day 1998; Turton 1999; McCarthy at al 2000; Gumbricht et al 2002). If the flood pulses are interfered with, for example, by the construction of a dam or the abstraction of water before the flood peak has passed, then this almost always results in the alteration or destruction of wetland habitat, particularly those habitats that are located in seasonal wetlands around the fringe of permanent wetlands such as the Okavango Delta. Clearly, such an event could lead to the loss of livelihoods of people who may be located in places where they depend on such systems.
- The third factor is related to the natural tectonic activities that occur within the Okavango basin and, in particular, around the rift trough occupied by the Okavango Delta (Hutchins et al 1976; McCarthy & Ellery 1993; Scudder et al 1993; Ellery & McCarthy 1994; Turton 1999; Gumbricht et al 2002). In recorded memory, flows entering the Okavango Delta have shifted slowly north-east as a direct result of this tectonic activity combined with plant-induced blockages of the western-most channels (e.g. Thaoge), away from the Lake Ngami region in the south-west, towards the Jao and Maunachira channels north of Chief's Island (Ellery & McCarthy 1994; Ashton 2002b). A field trip to various villages on both sides of the Okavango Delta in September 2002 (Turton and a BBC camera crew) revealed that different villagers in Gumare Village on the west of the Okavango Delta blame this shift on a variety of factors including the government (village chief), the 'Germans' (alluding to the time when Namibia was a German colony known as German South-West Africa) and the 'Herero people' (two village elders).
- The fourth factor is related to the long-term impact of global climate change of which the probable impacts in the context of the Okavango River basin are largely unknown at this stage (see chapter 2).

Plate 1

A view of the (western) Thaoge channel, October 2002

Note: The Thaoge channel is close to the village of Gumare. The water has shifted to the opposite (eastern) side of the Okavango Delta as a result of tectonic activity and channel blockages. However, village elders blame a variety of people for this condition. This provides an illustration of how natural forces can become hydropolitical drivers if left unmanaged.

While these factors are entirely natural occurrences over which humans have no direct control, they do have potential political consequences because they combine to cause a highly dynamic and variable set of parameters that determine water availability over time. It is human nature to remember things as they were in the past via oral histories, and change is seldom ascribed accurately to natural causes. In most cases, change is ascribed to human actions, often linking known rivals or past enemies to the perceptions that it is the actions of these people that have caused the river to dry up or change its course. The case of the Kasikili/Sedudu Island dispute illustrates this

tendency well (Ashton 2000a). As such, this has political ramifications because it can provide the genesis for future disputes as more people rely on the same resource for their livelihood, and as increasing numbers of developments impact on the already dynamic nature of the Okavango River system.

There are two secondary interceding variables, which have been selected because of their impact on the hydropolitical dynamics of the Okavango River basin. They are neither fundamental drivers in their own right, nor are they of such a nature as to be considered a primary interceding variable:

- This first *secondary interceding variable* relates in broad terms to the fact that the Okavango has become an 'internationalised' river, largely because the Okavango Delta was declared a central part of a Ramsar wetland by the government of Botswana, which allegedly hoped "to increase international pressure on Namibia" about the proposed pipeline, as suggested by Ramberg (1997). This process of internationalisation started after the planned dredging of the Boro River (UNDP/FAO 1976) as part of the Southern Okavango Integrated Water Development Project, which was shelved in 1991 due to massive public pressure (Scudder et al 1993). Linked to this is the unique biodiversity found in parts of the Okavango Delta system, making this region one in which the international community has a keen interest, to the extent that the sovereign aspirations of the three riparian states have been challenged by powerful foreign special interest groups. Typically, funding institutions are targeted in this process in an attempt to cut off the supply of money for proposed developments and hence prevent an 'undesirable' project (as defined by the special interest group) from being developed. Clearly, these individuals seldom take note of the specific needs and interests of the residents in the riparian states, but follow their own perceptions of the importance or value of their 'conservation' agendas (Ashton 2002).
- The second *secondary interceding variable* relates in broad terms to the existing normative value systems that are associated with the management of the Okavango River basin. The most important of these is arguably the high level of goodwill that exists between the so-called 'hydropolitical elite' from all three riparian states, particularly among OKACOM commissioners. Despite media rhetoric to the contrary (Weekly Mail & Guardian 1996; Ramberg 1997; Swatuk 2000), there is considerable goodwill within OKACOM, and this acts as a strong stabilising force in the face of potential (external) accelerators or promoters of conflict. The need for a basin-wide agreement as a prerequisite to secure international funding for specific development projects is also a potentially powerful mediating factor.

If these are fundamental drivers and mediating influences on the overall hydropolitical dynamics in the Okavango River basin, then the dependent variable must be related to the different national development priorities that currently exist.

For Angola, the most pressing need is that of post-war reconstruction. This includes the urgent repatriation of large numbers of internally displaced persons who

cannot be fed, clothed or housed in existing camps, and who need to plant their crops before the next rain cycle commences if a serious famine is to be averted. On top of this already complex problem, is the need to demobilise former combatants and provide them with sustainable livelihoods to prevent them from resorting to banditry for a living. If this happened, it could destabilise the whole region and possibly spill over into neighbouring Zambia, Namibia and Botswana if left unmanaged. Namibia, in turn, has a pressing need to develop a strategic water reserve if it is to sustain economic growth and development, particularly around the Windhoek area where existing industrial activity is clustered. Given the unusual geography of the country, the Okavango basin is the only readily exploitable source of water, with the Zambezi River far more difficult to develop for reasons noted above. Botswana is diversifying its economy away from its heavy reliance on mining activities by encouraging the lucrative ecotourism market, which generates much needed foreign currency.

Central to each of these national development priorities is the issue of territorial sovereignty, in which each state has the right to develop as it sees fit. The reason why these have been classified as dependent variables is because each government has several choices that it can make. One choice would be to retain the right to prioritise development as they see fit, thereby exercising their sovereign control over water within their territorial boundaries as an absolute right. Another alternative choice would be for each of the riparian states to negotiate and agree on a position where each riparian government is sensitive to the development goals and aspirations of its neighbouring states and acts accordingly. In the case of the former option, sovereignty becomes the core problem, whereas in the case of the latter, sovereignty becomes a key element of the solution. Given the fact that the so-called 'hydropolitical elite' can influence the outcome of such issues, these have been categorised as the dependent variables (as opposed to the primary interceding variable over which human control is impossible).

If viewed in this way, the results of the dynamic interaction of the fundamental hydropolitical driver in the basin (independent variable), mediated directly by the primary interceding variable, and indirectly by the two secondary interceding variables, finally being 'filtered' through the processes inherent in the dependent variable, two broad outcomes are theoretically possible. These are shown in figure 1. The conflict potential scenario is based on sovereign rights interpreted as an absolute, resulting in demands to claim a given volume of water. Demands for water could become excessive in this scenario, because a policy of national self-sufficiency in food tends to drive the development of irrigation projects, which are usually unsustainable and use huge volumes of water with return flows polluted by agrochemicals. In this scenario, conflict would seem to be inevitable, environmental damage to the Okavango Delta highly probable, and the sovereignty aspirations or demands of each state are seen to be a problem. The cooperation potential scenario, on the other hand, is based on needs rather than rights, with an emphasis on equity in the form of benefit and water-sharing rather than water-sharing alone. Irrigation

demand is reduced to a minimum through the implementation of a regional food security policy that includes trade in virtual water, based on the foreign currency revenues generated by high-value water-related activities such as ecotourism. Local economies in Angola can even be stimulated in this scenario by allowing naturally well-watered parts of the upper basin to grow and provide the food for downstream arid countries. In this scenario, territorial sovereignty is part of the solution because the respective governments agree to cooperate and develop the necessary reciprocal institutional arrangements to support this policy, while also providing the necessary sanction for non-compliance.

The expanded definition of hydropolitics inherent in the second hypothesis has meant that the dynamics of water for peace can be better analysed. If peace is to be the prevailing future condition in the Okavango basin, then it is imperative that OKACOM must be supported in its task of developing viable and sustainable solutions. The urgent need for the development of a comprehensive basin-wide dataset is a prerequisite for the development of appropriate policy.

Third hypothesis: Conflict potential and policy option relationship

OKACOM commissioners consciously refrain from using the word 'conflict' in their deliberations. Partly, this is due to the perception that the word implies at least a physical (if not military) interplay between participants. Instead, the word 'dispute' is used to express more clearly the differences of opinion and perceptions that have occurred between individuals and organisations based in the three riparian states. If the many sensationalist media reports are to be believed, there is a relatively high conflict potential within the Okavango River basin, particularly at the local level. Invariably, these media reports provide little information of any accuracy or utility to the participants concerned. At best, they are inaccurate and, at worst, they consist of little more than frivolous and unsubstantiated speculation or personal opinions. As a result, they merely aggravate any dispute or disagreement by serving up incomplete, inaccurate and biased opinions that help to perpetuate ignorance of the bigger picture (see Mail & Guardian 1996; Weekly Mail & Guardian 1996a; 1996b; Electronic Mail & Guardian 1997; Jenvey 1997; Mkone 1997; Rake 1997; Ramberg 1997). If conflict (rather than a 'dispute') is indeed a potential reality as suggested in figure 1, it is clear that the dynamics of conflict prevention and mitigation must be better understood. This is where the third hypothesis has particular relevance.

The multidisciplinary case studies presented in this book clearly show that policy development (and implementation) is a key issue if lasting peace and cooperation are to be assured. When analysed through the conceptual lens of the third hypothesis, two distinct loci of potential conflict become evident. At the subnational level, conflict potential is seen to be highest and, given the context of the case studies, is most likely to occur in Angola. It is therefore imperative that the Angolan government should be

Figure 1

Interactions between known variables in the hydropolitical equation of the Okavango basin

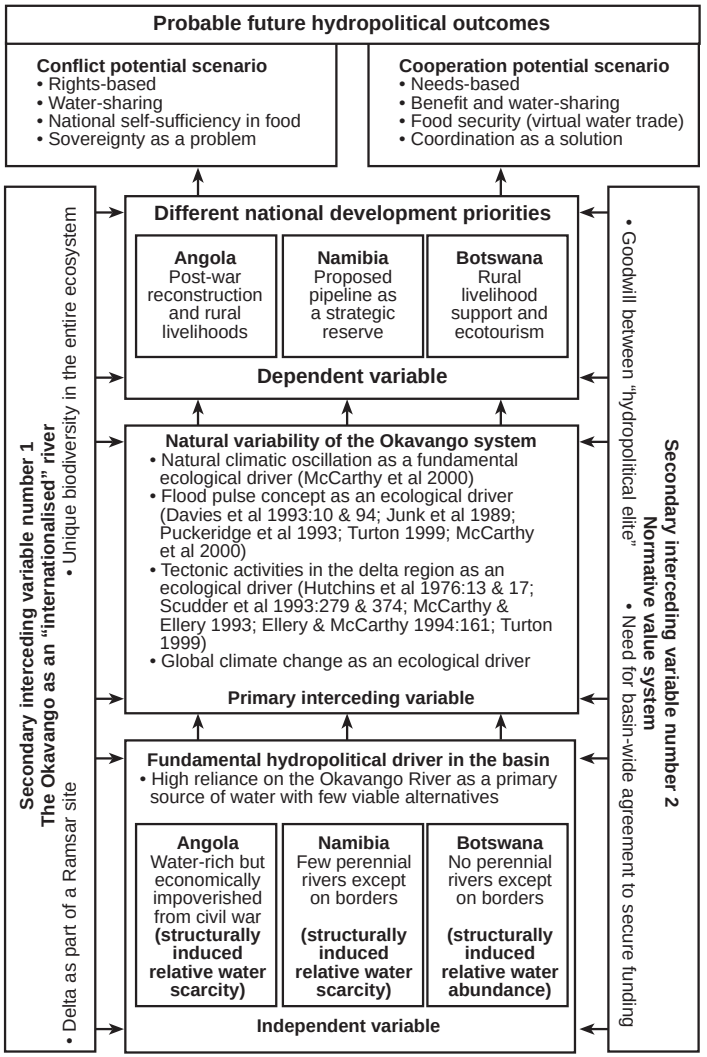
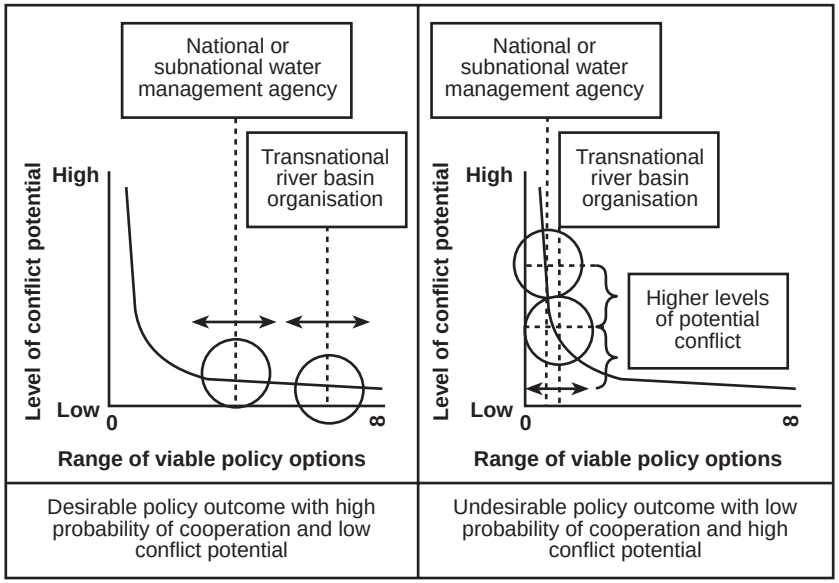


Figure 2

Variations of the third hypothesis showing theoretically possible policy outcomes



assisted to develop and implement viable national policy. If this is not done, and assuming that OKACOM is unable to develop the necessary policy options at the international level, then the situation shown schematically in the right-hand element of figure 2 has a higher probability of occurring. Under such conditions, the positions of the critical conflict or cooperation threshold points are controlled by the limited range of viable policy options available, with a high likelihood of acute conflict occurring. This likelihood would increase in times of environmental stress such as drought or famine. The converse situation also holds true, however, where OKACOM is able to negotiate and implement effective agreements. Importantly, these should be based on the different needs of each riparian state, centred on the notion of benefit-sharing rather than an insistence on a rights-based approach. This would shift and separate the critical conflict or cooperation threshold points to a position where conflict is no longer a real likelihood. This condition is shown schematically in the left-hand element of figure 2.

Seen in this light, policy-making and its subsequent implementation are critically important processes if the inherent conflict potential is to be averted, and the cooperation potential is to be fully harnessed in the Okavango River basin. The mere presence of appropriate policy is insufficient to achieve this goal. Policy must always be translated into effective implementation programmes where all stakeholders are able to participate equitably.

Towards effective policy development in the Okavango River basin

Having used the three hypotheses to develop a conceptual map of the existing hydropolitical dynamics in the Okavango River basin (figure 1), it now becomes instructive to compare the key elements of this map with the five strategic issue groups that were isolated in figure 3 of chapter 2:

- The independent variable (fundamental hydropolitical driver in the basin) shown in figure 1 consists of elements from two strategic issue groups. The external geographic characteristics of the basin, particularly with respect to current and looming water shortages, and the non-availability of alternative water sources in the basin are relevant components of this variable. The socioeconomic drivers and impacts, particularly with respect to existing social and economic development priorities, along with the proposed water abstraction and hydropower generation projects, are also relevant components of this variable.
- The primary interceding variable (natural variability of the Okavango system) shown in figure 1 consists of two distinct strategic issue groups. The first is related to an element of the external geographic characteristics of the basin in the form of global climate change. The second is related to system characteristics, in particular, to patterns of water inflow, sediment inflows and ecosystem structure, function and integrity. The first secondary interceding variable (Okavango as an 'internationalised' river) shown in figure 1 consists of an element of only one strategic issue group, that of external groups.
- The second secondary interceding variable (normative value systems) shown in figure 1 consists of elements of three strategic issue groups. From external groups there are two elements – international water law and international conventions and treaties. From socioeconomic drivers and impacts there is one element – traditional and customary laws and practices – while from basin states, there are two elements, that of regional political interactions and economic interdependence, and bilateral treaties between the basin states.
- The dependent variable (different national development priorities) shown in figure 1 consists of elements from two strategic issue groups. From the basin states issue group there is the element of territorial sovereignty, which can either be seen as being absolute (water as a right and water-sharing based on a negotiated formula), or seen as being cooperative (water as a need and benefit-sharing based on a

negotiated formula). From the system characteristics issue group, there is the element of planned catchment management activities.

Seen in this way, it seems evident that the approach used in developing the three hypotheses is somewhat consistent with the identification of the five strategic issue groups by Ashton and Neal (chapter 2), with the added advantage that these groups have been further divided into specific categories of variable. As such, they can form part of the policy-making process in the form of draft policy briefs for discussion by stakeholders and for consideration by OKACOM.

Transboundary rivers, sovereignty and development: Problem or solution?

This book has shown that there are really three broad factors that are relevant in the Okavango River basin. The first of these is the transboundary river system that has been sculpted over millions of years by natural physical and hydrological processes. The second factor is the relatively 'new' (when expressed in the timescales by which river morphology is measured) superimposition of political boundaries over the naturally occurring hydrological boundaries of the Okavango basin. Linked with this is the notion of sovereignty and, in particular, the belief that all states have the right to control the natural resources on their territory. Water challenges this assumption, however, because it is a fugitive resource, here today and gone tomorrow, moving through the landscape while obeying the forces of nature. The third factor is linked to sovereignty, and relates to the desire by legitimate governments to develop the economy of their countries in such a way as to benefit the citizens (and therefore voters) of their respective countries.

Herein lies the dilemma. Which of these three factors has (or should have) the highest priority? The answer to this depends largely on issues of scale. If it is accepted that the earth is constantly being sculpted by basic forces of nature, including continent-building and erosion where water plays a fundamental role, then hydrological borders are the logical unit for management. In this approach, timescales are measured in millions of years. On the other hand, if it is accepted that political power is more important, and that the earth consists of a number of states, each of which has sovereign control over its tiny piece of the globe, then another perspective emerges. In this approach, timescales are measured in considerably shorter periods, often no longer than the next election cycle. Hydropolitics deals with the clash between these two major perspectives and seeks to provide a balance between opposing viewpoints.

Is sovereignty therefore a problem and, if so, for whom is it a problem? The answer to this rhetorical question also depends on the specific perspective being taken by whoever poses the question. Most water resource managers have been schooled in the engineering and management (rather than natural) sciences, and would typically

not see the rationale behind any attempt to remove or eliminate national boundaries and their attendant governments. After all, most water resource managers are public officials employed by governments or government-controlled agencies. To consider doing away with government would not make any sense. The position taken here on this issue is that sovereignty is important, but it need not necessarily be a major problem or impediment to effective water resource management of a shared river basin. The work by Wolf (2002) lists a range of options that can be considered by policy developers. One of these options relates to the choice between coordination and integration. Turton (2002b) deals with this issue in more detail, where the parallel national action approach is presented as it could apply to the Zambezi River basin. The significance of this option is that the thorny issue of sovereignty is bypassed by emphasising coordination of activities rather than their integration, and no conscious effort is made within such an approach ultimately to lead to integration and unification. This approach can be considered in the Okavango River basin, where it has the possible advantage of adequately dealing with the dual issue of subnational and international policy that is inherent in the third hypothesis. Seen from this conceptual viewpoint, state sovereignty becomes part of the solution (because it is recognised as existing with no attempts at its erosion) rather than a problem, allowing the different development aspirations to be met by all riparians in a transboundary river system. In other words, negotiated agreements to coordinate national policy between three sovereign states, each recognising the sovereignty of the other, rather than unilateral development plans, bypasses the sovereignty 'problem', and allows it to be viewed as being part of the solution instead. After all, in international relations theory, the international system is regarded as being one of structural anarchy with the absence of a supreme authority over states, but as Wendt (in Bayliss & Smith 1997:118) says, "anarchy is what states make of it." Negotiated agreements are therefore one way of structuring this anarchy in a manner that reduces uncertainty in an otherwise very uncertain world.

Conclusion

As noted in the introduction to this book, the material presented should be seen as a departure point rather than a final destination. To assist in this process, three hypotheses were developed to provide a framework for subsequent analysis of the various specialist inputs. In keeping with this analogy, the concluding chapter has attempted to integrate some of the loose ends by providing a preliminary 'map' of the underlying hydropolitical processes that are evident in the Okavango River basin at this time. By isolating key elements of these dynamics and segmenting them into specific categories, a start has been made to the process that will need to reveal even finer levels of detail in future.

Importantly, the independent variable in the overall hydropolitical equation cannot easily be changed because it consists of the network or pattern of crosscutting issues

as they interact at this moment in time. The primary interceding variable contains elements that drive basic hydropolitical processes beyond the control of individual riparian states. In other words, these elements happen on their own, with humans being impacted without having a realistic chance of changing the outcome.

Two distinct sets of secondary interceding variables have been isolated. The first set consists of the Okavango as an 'internationalised' river. This affects hydropolitical processes, is driven in part by historic factors relating to past and current development plans, and challenges the sovereign independence of action that each riparian state may choose to develop. The second set relates to normative value systems that exist at different places within the Okavango system, and which tend to mediate outcomes by reducing the inherent conflict potential.

Finally, the dependent variable consists of the different national development priorities that are controlled by each national government. As such, two broad sets of future outcomes are seen to be possible in this analysis. The conflict potential scenario is based on riparian rights where states seek to share water as a commodity, and where the desire for national self-sufficiency in food drives the development of irrigated agriculture. In this scenario, sovereignty is a problem. In contrast, the cooperation potential scenario is based on needs rather than perceived or legally defined rights, with an envisioned equitable sharing of benefits, with national policies of food security based on a trade in virtual water. Given the fact that this is a cooperative model, sovereignty becomes part of the solution because it is based on negotiations, agreements and goodwill between participating states. Central to the latter is a set of basin-wide data that is uncontested and shared equally by all riparian states, with the resort to self-help being reduced by the institutionalisation of a set of rules and procedures that are designed to build confidence and minimise potential conflict when it arises. This assessment is offered to the policy development phase that will need to commence in the near future.

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