An Overview of Key Strategic Issues in the Okavango Basin

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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 a vital source 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 co-operation 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 dependant on 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, whilst 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. However, until recently, 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 (Pallet, 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 minimize conflicts between human and ecosystem needs for water (Shela, 1996; Ashton, 2000b). This change in emphasis is particularly important for trans-boundary systems shared by more than one country.

The sustainable management of “trans-boundary” 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, 2002a). 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 trans-boundary 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, 2002b). As a result, the Okavango River and Okavango Delta system remains largely intact from an ecological viewpoint whilst the need for water remains acute, or is worsening, in many surrounding areas.

The extraordinarily rich biological diversity 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 (e.g. 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. Whilst many individuals, organizations 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 (e.g. Ashton, 2000a, b; 2002b), 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 paper 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 paper 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.

The geographical and hydrological context

The Okavango system forms part of the Makgadikgadi Basin, which drains portions of four countries (Angola, Namibia, Botswana and Zimbabwe; Figure 1) and is one of the driest and most sparsely populated catchments in southern Africa. The basin is endorheic (internally draining), and receives inflows from one perennial river system in the northwest (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, 2002b).

![Sketch map of the Makgadikgadi Basin showing the extent of the four sub-basins plus the Okavango Delta and the Boteti River drainage basin, and the different tributary rivers. Ephemeral and episodic rivers are shown as dashed lines, whilst perennial rivers are shown as solid lines. Map redrawn from UNDP/GEF (2001).](image)

**Figure 1:** Sketch map of the Makgadikgadi Basin showing the extent of the four sub-basins plus the Okavango Delta and the Boteti River drainage basin, and the different tributary rivers. Ephemeral and episodic rivers are shown as dashed lines, whilst perennial rivers are shown as solid lines. Map redrawn from UNDP/GEF (2001).

Based on its topographic and hydraulic characteristics, the Makgadikgadi Basin can be segmented into four distinct sub-basins or catchments that seldom have direct hydraulic contact with each other, and a small river basin (the Boteti River) that directs occasional outflows from the Okavango Delta to the Makgadikgadi Pans. Ntswetwe and Sowa Pans comprise the Makgadikgadi Pan system in the east, whilst 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; Figure 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 ground water aquifers (MGDP, 1997). However, the full extent of these possible ground water 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 km², 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 km² (in Angola, Botswana and Namibia), with an additional 15,844 km² 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 comprise approximately 59% of the Makgadikgadi Basin (Table 1).
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. (See Figure 1 for position of each sub-basin).

<table>
<thead>
<tr>
<th>Sub-Basin</th>
<th>Country Contribution (km²)</th>
<th>Total Area</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Angola</td>
<td>Namibia</td>
<td>Botswana</td>
</tr>
<tr>
<td>Okavango River</td>
<td>200,192</td>
<td>153,783</td>
<td>59,575</td>
</tr>
<tr>
<td>Okavango Delta</td>
<td>0</td>
<td>0</td>
<td>15,844</td>
</tr>
<tr>
<td>Boteti River</td>
<td>0</td>
<td>0</td>
<td>10,920</td>
</tr>
<tr>
<td>Deception Pan</td>
<td>0</td>
<td>11,241</td>
<td>153,302</td>
</tr>
<tr>
<td>Ntwetwe pan</td>
<td>0</td>
<td>0</td>
<td>74,028</td>
</tr>
<tr>
<td>Sowa Pan</td>
<td>0</td>
<td>0</td>
<td>26,389</td>
</tr>
<tr>
<td>Totals</td>
<td>200,192</td>
<td>165,024</td>
<td>340,058</td>
</tr>
<tr>
<td>Proportion (%)</td>
<td>27.60</td>
<td>22.75</td>
<td>46.89</td>
</tr>
</tbody>
</table>

Direct rainfall onto the Okavango Delta contributes approximately one quarter (3,205 Mm³ = 24.5%) of the total annual water budget, whilst the Okavango River inflows provide 76.5% (McCarthy et al., 1998, 2000; Ashton & Manley, 1999). For the period 1932 to 2001, the annual Okavango River inflow at Mohembo has averaged 9,863 Mm³. Overall, the Angolan portion of the Okavango catchment provides some 94.5% of the total runoff in the Okavango River, whilst 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 (413,550km²), whilst the remainder (53.4%) contributes almost nothing to the catchment’s surface water resources (Table 2).

Table 2: Comparison of country contribution and relative proportion of the Okavango Basin contributing to average annual inflows at Mohembo.

<table>
<thead>
<tr>
<th>Country</th>
<th>Country Contribution to average annual river inflows (Mm³)</th>
<th>Country Contribution to average annual river inflows (%)</th>
<th>Area of Okavango Basin contributing to annual river inflows (%)</th>
<th>Area of Okavango Basin NOT contributing to annual river inflows (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>9,320.5</td>
<td>94.5</td>
<td>38.7</td>
<td>0.9</td>
</tr>
<tr>
<td>Botswana</td>
<td>256.4</td>
<td>2.6</td>
<td>3.8</td>
<td>36.7</td>
</tr>
<tr>
<td>Namibia</td>
<td>286.1</td>
<td>2.9</td>
<td>4.1</td>
<td>15.8</td>
</tr>
<tr>
<td>Total</td>
<td>9,863.0</td>
<td>100</td>
<td>46.6</td>
<td>53.4</td>
</tr>
</tbody>
</table>

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 2; McCarthy et al., 2000; Ashton, 2002b; 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 declining flows during the last twenty years and this pattern seems to be part of an eighty-year cycle of high and low flows (McCarthy et al., 2000). Declining inflows to the Okavango Delta have been matched by equally dramatic 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 demands for water to meet the needs of domestic and other water users in Botswana and Namibia (MGDP, 1997; Ashton, 2002b).
Figure 2: Annual variations from mean annual flow (100%) in the Okavango River at Mohembo for the period 1933 to 2001, compared with the 5-year moving average for the same period. Data for 1932-1974 were calculated from flows gauged at Mukwe a short distance upstream in Namibia (Ashton & Manley, 1999); data for 1975-2001 were flows measured at Mohembo, taken from McCarthy et al. (2000) and Ashworth (2002). Each hydrological year runs from 1 October to 30 September.

The international and national dimensions

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). Here, international water law, as well as treaties, protocols and specific national-level policies and legislation, provide critically important cornerstones for the effective and efficient management of shared water resources. However, whilst 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 briefly review the context in which international water law and the provisions of other international treaties and protocols may apply to the Okavango Basin.

The context of international water law

Importantly, international water law lacks the compulsory jurisdiction and enforcement that characterize domestic legal systems. Rather, it relies on its 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 the 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). Some key practical issues linked to the Helsinki Rules are listed in **Text Box 1**, below.

**Text Box 1: Practical aspects of the Helsinki Rules (IL.A, 1966).**

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

1. The geography of the basin, particularly the extent of the drainage basin in the territory of each state.
2. The hydrology of the basin, and the contribution of water by each state.
3. The climate affecting the basin.
4. The nature of the use of the water of the basin in the past, present and future.
5. The population dependent on the waters of the basin in each state.
6. The economic and social needs of each state and the comparative costs of alternative means of satisfying these needs.
7. The availability of alternative water resources and the comparative costs of utilising these resources.
8. The avoidance of unnecessary waste in the use of the water of the basin.
9. The possibility and practicability of compensation to one or more basin states as a means of resolving or adjusting conflicts between the basin states.
10. 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 Draft 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 organization that can equally represent the interests of each state (ILC, 1994). This approach has been adopted successfully elsewhere in southern Africa (Pallet, 1997) and is the basis for the Permanent Okavango River Basin Water Commission (OKACOM) agreement between Angola, Botswana and Namibia (OKACOM, 1994).
The context provided by 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.

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, whilst promoting the principles of sustainable development and the guidelines of Agenda 21. A specific Angolan Water Law that incorporates these features has been developed (Ministério das Pescas e Ambiente, 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 State (Government Department) is the formal custodian of the country’s water resources. Water resource management is decentralized 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 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, has to be co-ordinated 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 National 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 ground water 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, Botswana has a comprehensive National Water Master Plan that is regularly updated (SMEC/KPB/SGAB, 1992). All water resource developments in Botswana are now co-ordinated 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).

In Namibia, the control, conservation and use of water 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 finalized (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 do not 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. Ministry of Lands, Resettlement and Rehabilitation, Ministry of Environment and Tourism, Ministry of Works, etc.) can have major impacts upon the country’s water resources and these activities are co-ordinated 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 up to the year 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 co-operation 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 in the future by the basin states concerned. The key provisions of the five international conventions (Table 3) and the respective responsibilities that they place on those states that have agreed to comply (or who may in future agree to comply) are briefly reviewed, below.

Table 3: Dates of ratification of key international conventions by the three basin states (Angola, Botswana and Namibia) comprising the Okavango Basin.

<table>
<thead>
<tr>
<th>Country</th>
<th>Ramsar</th>
<th>UNCBD</th>
<th>UNCCD</th>
<th>UNCSW</th>
<th>UNFCCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>N/P</td>
<td>01-Apr-1998</td>
<td>30-Jun-1997</td>
<td>N/P</td>
<td>17-May-2000</td>
</tr>
</tbody>
</table>

N/P: not yet party to convention (Based on available information).
Note #2: Namibia has signed the United Nations Convention on Non-Navigational Uses of International Watercourses, but has not yet ratified it.

THE RAMSAR CONVENTION ON WETLANDS OF INTERNATIONAL IMPORTANCE

The Ramsar Convention on Wetlands of International Importance seeks to promote international awareness and co-operation in the conservation of threatened wetland ecosystems, particularly where these ecosystems support unusually large numbers of specific species or support 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 (Table 3), whilst Angola (together with four other southern African countries) is still considering its position. Amongst the key provisions embodied in its charter (Ramsar, 1971), the Ramsar Convention requires each contracting party to:

- Designate at least one wetland to be included in the ‘List of Wetlands of International Importance’;
- 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 extends 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 ‘Wetlands 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 km²) makes it the largest designated Ramsar Site in the world. The site encompasses the 15,844 km² 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 recognized the unique and valuable nature of this 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, whilst the Okavango Delta is physically located in Botswana, Namibia, as a Contracting Party to the Convention, is also obligated 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. Nevertheless, the fact that Angola is considering its position in this regard is a promising prospect.

**UNITE 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 (Table 3). The articles of the Convention on Biological Diversity clearly affirm that states (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 within this Convention that refer explicitly to trans-boundary resource use, oblige Contracting Parties to:

- Cooperate with other Contracting Parties, either directly or through competent international organizations, in respect of areas beyond national jurisdiction and on other matters of mutual interest, for the conservation and sustainable use of biological diversity, and
- Introduce appropriate procedures requiring environmental impact assessment of its proposed projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimizing such effects and, where appropriate, allow for public participation in such 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 biological diversity 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 biological diversity of the Okavango River or the Okavango Delta should be agreed to by all basin states.

**THE 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 United Nations Convention to Combat Desertification (Table 3). 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 sub-regional, regional and international cooperation; and
- Co-operate in the preparation of sub-regional and/or regional action programmes to harmonize, complement and increase the efficiency of national programmes (to combat the effects of desertification).

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

Because the Makgadikgadi Basin is one of the driest catchments in southern Africa, land use patterns within this 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 add emphasis to demands for additional water from the Okavango system to supply the growing needs of domestic, agricultural or industrial water users (Ashton, 2002b).

**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 to have ratified this Convention to date, though Namibia is also a signatory (Republic of Namibia, 2000c). Other southern African countries are considering their positions with regard to this Convention and given the large number of shared river systems in southern Africa, this is a welcome development. To date (July 2002) too few countries have ratified this Convention and it is therefore not yet in force.

However, despite the fact that this Convention is not yet in force, several important provisions of the Convention (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 utilization 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 those 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 shall, individually and, where appropriate, jointly, protect and preserve the ecosystems of international watercourses; and
• 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 did not cause deterioration in the goods and services derived from the system by the other basin states. Similarly, the provisions of this Convention also require Contracting Parties to share information on possible plans to 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 stabilization 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). The three basin states (Angola, Botswana and Namibia) have ratified this convention (Table 3). Although this convention is not directly related to the issues of water consumption and resource management, it plays a significant role in countries, such as the basin states, where water scarcity is an on-going concern. Amongst the key articles within this Convention (UNFCCC, 1992), the UNFCCC requires each Contracting Party 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 each other and with other neighbouring states. Whilst these agreements and protocols may not be accorded the same status as global-scale treaties, they still represent important strategic accords or contracts that formalize, assist and promote international co-operation between the respective Signatory States. The different agreements are reviewed briefly below for completeness.
BI-LATERAL AND MULTI-LATERAL COMMISSIONS

Angola, Botswana and Namibia have entered into several bi-lateral agreements with each other and with their neighbours to co-ordinate the management of trans-boundary water issues in river basins that they share (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 and the years they were formed 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 Kwando-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 Vioolsdriif and Noordoewer Joint Irrigation Scheme (1992);
- Permanent Okavango River Basin Water Commission (OKACOM) between Angola, Botswana and Namibia (1994). Further details on this important Commission are provided below; 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 the earlier version of this Protocol. 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 to the entire southern African region. Key provisions of the Revised Protocol on Shared Watercourse Systems in the SADC Region 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 lying 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 regarding the study and execution of all projects likely to have an effect on the regime of the watercourse system; and
- 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 with a view to attaining optimum utilisation thereof and obtaining benefits therefrom consistent with adequate protection of the watercourse system.
Clearly, the provisions of the Revised Protocol on Shared Watercourse Systems in the SADC Region (SADC, 2001) are very similar to those contained in the United Nations Convention on the Laws of Non-Navigational Uses of an International Watercourses (UNCWSW, 1997).

The provisions of the Revised Protocol on Shared Watercourse Systems in the SADC Region 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 minimized. As the lowermost State in the Okavango catchment, Botswana is most vulnerable to any upstream developments in Angola or Namibia. Given the virtually “pristine” state 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.

THE OKAVANGO BASIN COMMISSION (OKACOM)

In 1994 Angola, Botswana and Namibia established the Permanent Okavango River Basin Water Commission (OKACOM) to investigate ways in which the legitimate water needs of the three countries could be accommodated in a sustainable manner and to collaborate on the management of the basin’s water resources in general (OKACOM, 1994). The objective of the Commission is to act as a technical advisor to the three contracting parties on matters relating to the conservation, development and utilization of water resources. Each of the three parties has appointed a commissioner to represent their 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 utilization of water resources in the Okavango River Basin;
- Investigations, separately or jointly by the Contracting Parties, related to the development of any water resources in the Okavango River Basin, including the construction, operation and maintenance of any water works;
- 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 (OKACOM, 1994) specifically advocates the use of the 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), and 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 developmental policies, and they 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.
- Environmental issues are best handled with the participation of all concerned citizens, at the relevant level.
- Environmental impact assessment, 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 highlighted several key points in international water law and in regional and international conventions and treaties that can exert a complex influence on decision-making in the Okavango Basin (Figure 3). Importantly, international water law sets down the philosophy and tone for inter-state collaboration, and these principles are then further defined and explained in the specific conventions that deal with particular issues.

![Conceptual diagram showing the relationships between the three basin states (Angola, Botswana and Namibia) and the OKACOM Agreement, as well as other Bi-Lateral and Multi-Lateral Commissions, Treaties and Accords, and the framework provided by their respective National Laws and Policies, Regional Protocols and Treaties, and International Laws and Conventions.](image-url)

Figure 3: Conceptual diagram showing the relationships between the three basin states (Angola, Botswana and Namibia) and the OKACOM Agreement, as well as other Bi-Lateral and Multi-Lateral Commissions, Treaties and Accords, and the framework provided by their respective National Laws and Policies, Regional Protocols and Treaties, and International Laws and Conventions.
Here, it is important to emphasize 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 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 co-operation 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 co-operation 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, first: that each state is entitled to a fair and equitable share of the resource in question 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 co-operation between southern African states, whilst 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, whilst also recognizing that citizens and non-governmental organizations 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 on the ground (Ashton & Chonguica, 2002). In particular, the presence of a dual legal system in most southern African countries has often led to the trivialization of customary or traditional laws and practices, with the result that 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, marginalized or abrogated prior patterns of resource use by communities who 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 people as individuals per se.

Southern African countries have recognized 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 organizations at regional level (Pallet, 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 multi-lateral institutions. This is particularly difficult in the case of water resource management because it is a multi-sectoral issue that affects all aspects of social and economic development (Ashton & Chonguiça, 2002). An important consideration here 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 it is the collective actions of individuals and communities on the ground, rather than state ministries or institutions, which determine whether or not water resource management principles, policies and programmes are effective.

The need to involve communities in decision-making processes is widely recognized 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 on 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). Also, since there are no mechanisms whereby citizens can hold states accountable for these commitments, it is 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 utilize 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, then 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 trans-boundary 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 bi-lateral 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 co-operation that are needed to achieve 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 & Chonguiça, 2002). Experience gained in Africa and elsewhere has shown that an independent organization (such as a river basin organization, or RBO) 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 RBOs tend to regard water development purely as a hydrological problem. Indeed, the staff complement of most RBOs comprises technical experts from the water sector, with little or no representation from agriculture, mining, forestry, finance and planning sectors. This
hampers appropriate consideration of the multi-faceted, 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 & Chonguïça, 2002).

The creation of such a ‘trans-boundary institution’ requires each state within the river basin or management unit to accept and support the roles and responsibilities of its partner countries, whilst committing itself to the maintenance of a spirit of harmony and good will amongst 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 realization that each party’s rights and obligations are mutual and reciprocal, rather than unilateral (Wolf, 1999; van der Zaag and Savenije, 2000). In the specific case of an RBO, the basis for any agreement on the quantities 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, b, 2002a).

In relative terms, Angola has abundant water resources whilst 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 their future needs for water (Ashton, 2002b). Accordingly, each will place different degrees of emphasis on water resource management issues in their 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 ending of its 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 the year 2000. Approximately 76% of the Okavango Basin population lives in Angola, whilst the Namibia and Botswana segments of the basin contain 13% and 11% of the basin population, respectively (Ashton, 2000b, 2002b). 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 the year 2020 (Ashton, 2002b). By combining the population estimates for 2000 with data on current land use patterns (FAO, 2000), the total quantity of water needed within the catchment during 2000 was estimated to be 23.2 Mm$^3$/year (Ashton, 2000b, 2002b). Angola would require approximately 13.8 Mm$^3$ (60%) of this total, whilst 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, 2002b).

Estimates of the future water needs for the Okavango Basin countries will depend on population growth rates and the development trajectories that each country follows. 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, 2002b), the combined water requirements of the three countries in 2020 would be equivalent to some 3% (300 Mm³/year) of the mean annual runoff of the Okavango River at Mohembo. Of this amount, Angola’s consumptive needs would be approximately 40%, whilst those in Botswana and Namibia would amount to 18% and 42%, respectively (Ashton, 2002b).

Given that natural flows in the Okavango River have varied between -45% and +65% of the mean annual flow (McCarthy et al., 2000; Ashton, 2002b; Figure 2), 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 inter-annual 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. Whilst 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 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 to base decisions regarding the 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), whilst 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. Whilst 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 jeopardize the achievement of their respective national and regional goals for social and economic development. Ultimately, Angola, Botswana and Namibia share responsibility for effective management of the water resources within Okavango Basin and for maintaining cordial relations with each other.

Whatever decision is taken regarding 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 met promptly. 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, ground water 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 ground water 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 a 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 and scales, whilst 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 4. 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 4, 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 Mkgadikgadi 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 the regional and bi-lateral 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 retains its ability to deliver the ecosystem goods and services that are required of it. 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, though they will influence decision-making.

Figure 4: Conceptual diagram showing the components and inter-relationships between groups of key strategic issues that influence decision-making in the Okavango Basin and Okavango Delta.

This conceptual systems 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 the states is a highly significant achievement and should be supported by all parties who 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-function responsibilities of single government departments if it is to be effective. Therefore, if in the future OKACOM evolves into a River Basin Organisation it will be appropriate to review the existing structure of OKACOM 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.

Whilst the territorial sovereignty of each state is normally recognized 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. Whilst 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 reflect the wide variety of flooding regimes that occur on annual and longer time scales. The information available indicates that the natural range of variation in river inflows far exceeds the likely 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, Gumbrecht and his co-workers at Witwatersrand University (Gumbrecht et al., 2002) 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.

Acknowledgements

Sincere thanks are due to Malcolm Ashworth of Water Resources Consultants, Gaborone, for providing flow data from the Okavango River at Mohembo for the period October 1994 to September 2001, enabling Figure 2 to be brought up to date.

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