WATER SECURITY FOR MULTI-NATIONAL RIVER BASIN STATES: THE SPECIAL CASE OF THE OKAVANGO RIVER BASIN

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Abstract

The Okavango River basin comprises portions of three sovereign southern African countries: Angola, Namibia and Botswana. Development levels within each basin state are dissimilar and each country has differing degrees of reliance on the Okavango River. Estimates of current and potential future needs for water in each country indicate that demands for water will continue to escalate as their populations grow and economies expand. Whilst Angola is currently in the grip of civil war and unlikely to require large quantities of water from the Okavango River in the short-term, the future needs for water in Namibia and Botswana will be difficult to meet from the limited water resources available within these countries. Nevertheless, both Angola and Namibia have acknowledged the need to exploit at least a portion of the water resource available in the Okavango River if they are to ensure social and economic development of their populations. Similar social and economic pressures face Botswana.

The situation has been complicated by prolonged periods of drought: regional water supplies have diminished and flows in the Okavango River have declined during the past two decades. The ecological characteristics of the Okavango Delta, as well as the associated social and economic benefits that are derived from this ecosystem, are highly vulnerable to decreases in water flow. Botswana residents are therefore very sensitive to the topic of projected demands by "upstream" states (Angola and Namibia) for water from the Okavango River, fearing that this may worsen the effects of regional droughts and cause irreparable social, economic and ecological harm to the "downstream" Okavango Delta in Botswana. This paper highlights some of the difficulties that must be overcome to balance the anticipated demands for water and help to resolve the apparent conflicts between human development interests and ecological interests.

Introduction

Southern African countries have long been aware that water scarcity has escalated progressively during the last century and has now reached the point where the availability of adequate water supplies poses the greatest potential challenge to further development (Falkenmark, 1989; Conley, 1995; Heyns, 1995; Shela, 1996). This state of affairs is particularly acute in the more arid regions of the sub-continent where water scarcity is also associated with increased water pollution and is linked closely to poverty, hunger and disease (Pallett, 1997; Falkenmark, 1999). The circumstances are complicated further where sufficient water is also needed to maintain the functioning of sensitive aquatic ecosystems and protect the integrity of water resources (SARDC, 1996; Falkenmark, 1999: Ashton, 2000a). These conflicting demands for water lead to increasing competition for progressively scarcer water resources. Where a river basin is shared by more than one country, the question as to who should be allowed to use how much water and for what purpose becomes particularly sensitive and difficult to resolve (Biswas, 1993; Ali, 1996; Turton, 1999; Ashton, 2000b).

The Okavango River provides an ideal example of a river basin shared by more than one sovereign state, where each country faces the challenge of retaining its individual water security interests whilst simultaneously having to cope with the conflicting demands for water posed by human development and ecosystem maintenance (Ashton, 2000b).

The geographical and political context

The Okavango River rises as two main tributary systems, the Cubango and Cuito rivers in the central highlands of Angola, and flows in a southeasterly direction along the border of northern Namibia before entering Botswana and emptying into the Okavango Delta in Botswana (**Figure 1**). During years of exceptionally high flows in the Okavango River, outflows from the Okavango Delta feed the Boteti River and, ultimately, these flows may reach the Makgadikgadi Pans (Wilson & Dincer, 1976). Several smaller tributary rivers rise in northeastern Namibia but have not carried surface flows into the Okavango River in living memory (Bethune, 1991; CSIR, 1997; Ashton & Manley, 1999).

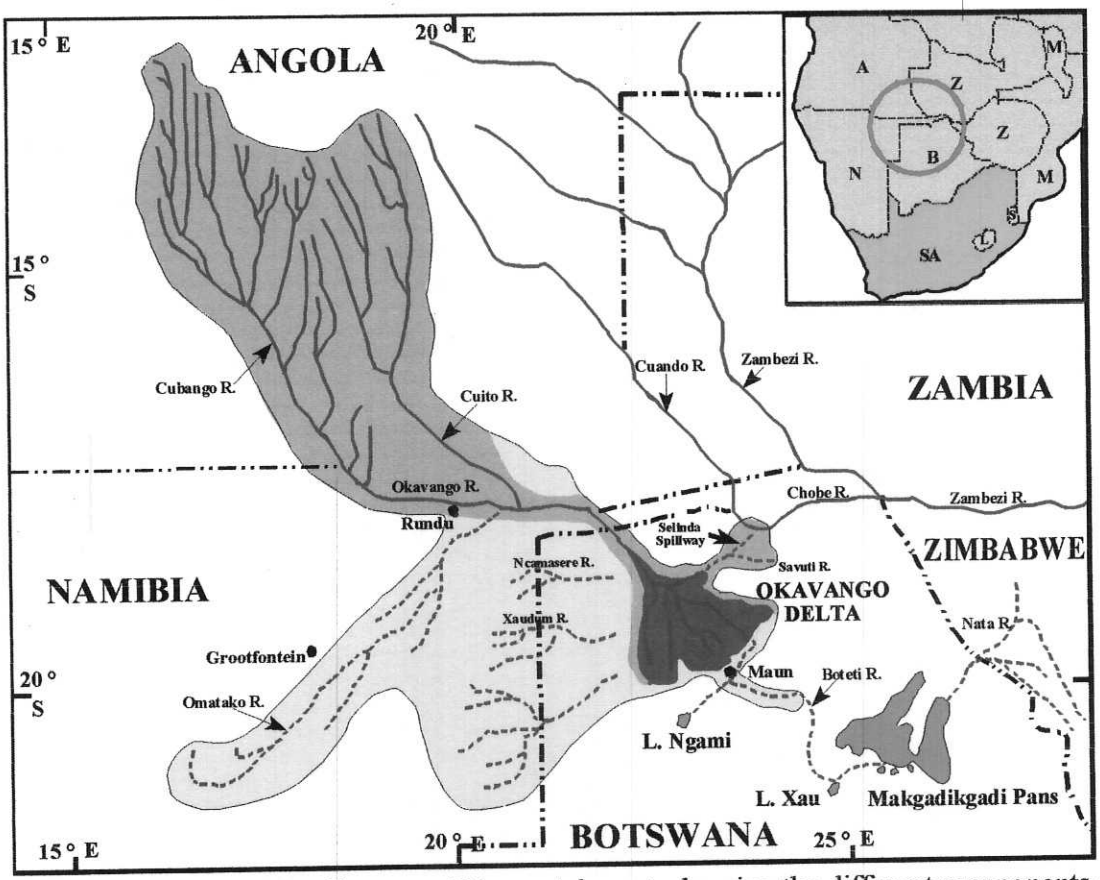

Figure 1: Sketch map of the Okavango River catchment, showing the different components of the system. The darker shaded areas provide surface runoff to the Okavango River and Okavango Delta, whilst lighter shaded areas provide no surface runoff. Inset shows the position of the Okavango River catchment in southern Africa.

Along its course from the Angolan highlands to the Okavango Delta, the Okavango River functions as a "linear oasis" in an otherwise relatively arid area (Bethune, 1991; CSIR, 1997). The quantity and quality of water that enters the Okavango Delta depends not only on climatic

factors (Wilson & Dincer, 1976), but also on any water development activities that take place upstream, outside of Botswana's sovereign control (Ashton & Manley, 1999; Ashton, 2000a). Under international law (ILA, 1966; ILC, 1994; Biswas, 1993), Angola and Namibia are technically entitled to withdraw water from, and develop, water systems to which they are riparian; this right is entrenched and confirmed in terms of the SADC Protocol on Shared Watercourse Systems (Heyns, 1995; SADC, 1995). As the lowermost riparian state, Botswana is therefore in an extremely vulnerable position and would clearly like to ensure that its interests are not unduly prejudiced by any developments that may take place in Namibia and Angola (SMEC, 1989; IUCN, 1993; CSIR, 1997).

Good inter-state co-operation between Angola, Botswana and Namibia to jointly resolve issues relating to the Okavango River is not only highly desirable, but is also essential if sustainable solutions are to be achieved in the long-term (Heyns, 1995; FAO, 2000). However, there are perceptions in certain quarters that the relative costs and benefits of such co-operation may be unevenly distributed between the three countries, which could heighten tensions between the riparian states (Ali, 1996; Ohlsson, 1995; Shela, 1996; Ramberg, 1997; Turton, 1999). Nevertheless, whilst the three basin states may not have the same economic resources at their disposal, there are firm indications that, within the limits of its means, each country has pledged itself to co-operate with its neighbours on the matter of water resources (Republic of Botswana, 1990; Heyns, 1995; Republic of Namibia, 1995, 2000; Bethune, 1996; SARDC, 1996; Pallett, 1997; Ashton, 2000b).

Prior to the formal ratification of the SADC protocol on shared river basins (SADC, 1995), Botswana and Namibia had a relatively long history of inter-state co-operation on matters relating to their shared water resources (Taylor & Bethune, 1999). The first, mostly informal, instances started in the early 1950s and were expanded over time to include joint flow-gauging exercises on the Okavango, Chobe and Kwando rivers, as well as concerted efforts to control the invasive aquatic weed *Salvinia molesta* that infested rivers shared by the two countries (Taylor & Bethune, 1999).

In 1994, the Governments of Botswana, Namibia and Angola jointly launched the Tripartite Permanent Water Commission on the Okavango River basin (OKACOM, 1994). This Commission seeks to investigate ways in which the legitimate water needs of each of the three countries can be accommodated in a sustainable manner without prejudicing the needs of neighbouring riparian states (Heyns, 1995). This Commission also intends to develop an integrated water management strategy for the entire Okavango River basin and has launched several investigations to provide the basis for estimates of water availability and patterns of use (OKACOM, 1995).

Water resources and water demands

Recent estimates indicate that the Angolan portion of the Okavango catchment provides some 95% of the total runoff in the Okavango River, whilst approximately 2% originates in Namibia and the remaining 3% in Botswana (CSIR, 1997). The long-term average annual flow in the Okavango River as it enters the upper Okavango Delta amounts to some 10.134×10^9 m^3 per year (McCarthy *et al.*, 2000). These river inflows are supplemented each year by an estimated annual average rainfall of 3.2×10^9 m^3 that falls directly onto the Okavango Delta (CSIR, 1997; Ashton & Manley, 1999). Prolonged periods of severe drought during the 1980s and 1990s reduced average annual flows in the Okavango River by between 15% and 45% (McCarthy *et al.*, 2000).

Various estimates have been offered for the quantities of water that are lost each year from the Okavango Delta via evapotranspiration, seepage to local ground water and outflows to the Thamalakane River (Wilson & Dincer, 1976; IUCN, 1993; Gieske, 1996; CSIR, 1997; Ramberg, 1997; Ashton & Manley, 1999; McCarthy *et al.*, 1998, 2000). Whilst all of these estimates reflect the high degree of uncertainty and variability that surrounds each component of the Okavango Delta water balance, there is general agreement as to the relative magnitude and importance of the different components (IUCN, 1993; Ashton & Manley, 1999; McCarthy *et al.*, 2000). The components of the Okavango Delta water balance are shown in **Table 1**.

Table 1: Summarized annual water balance for the Okavango Delta, Botswana, showing relative contributions for each component. (Data taken from Ashton & Manley, 1999).

Water Balance Component	Relative Contribution (%)
Inflows: • Okavango River • Direct rainfall onto the Okavango Delta	 76 % 24 %
Outflows: • Evapotranspiration • Local ground water and riparian vegetation • Outflows to the Thamalakane River	 84 % 13 % 3 %

The inter-annual variability in river inflows and erratic regional rainfalls across the Okavango catchment has given rise to a highly variable pattern of flooding in the Okavango Delta. The precise pattern of flooding each year is dependent 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 *et al.*, 1998, 2000; Ashton & Manley, 1999). In turn, the flooding pattern determines the spatial extent of the different ecosystem components within the Okavango Delta (Ellery & McCarthy, 1994; Ashton & Manley, 1999). The approximate average extent of these different ecosystem components is summarized in **Table 2**.

Table 2: Approximate average area of the different flooded ecosystem components within the Okavango Delta. (Data taken from Ashton & Manley, 1999).

Ecosystem Component	Average Area	
	km^2	%
Perennially flooded swamp	4,885	30.8
Regularly seasonal flooding (once each year)	3,855	24.4
Occasional seasonal flooding (once in three/five years)	2,760	17.4
High floods only (once in ten years)	2,502	15.8
Dry land (islands that are never flooded)	1,842	11.6
Total area of Okavango Delta	15,844	

The seasonally inundated portions of the Okavango Delta comprise two major categories or vegetation types, namely: "seasonal swamps" characterized by *Phragmites* and *Miscanthus*, and "seasonally inundated grasslands" that consist primarily of flooded terrestrial grasses and sedges (IUCN, 1993; CSIR, 1997). Variations in the spatial extent of flooding caused by inter-annual

variations in rainfall and river flow are most easily seen in these two vegetation categories, rather than the "permanent swamp", which remains far more constant in area. Nevertheless, marked differences between "wetter" and "drier" periods are reflected in the extent of each vegetation type, with each type showing a pronounced decline during the recent prolonged droughts (**Figure 2**).

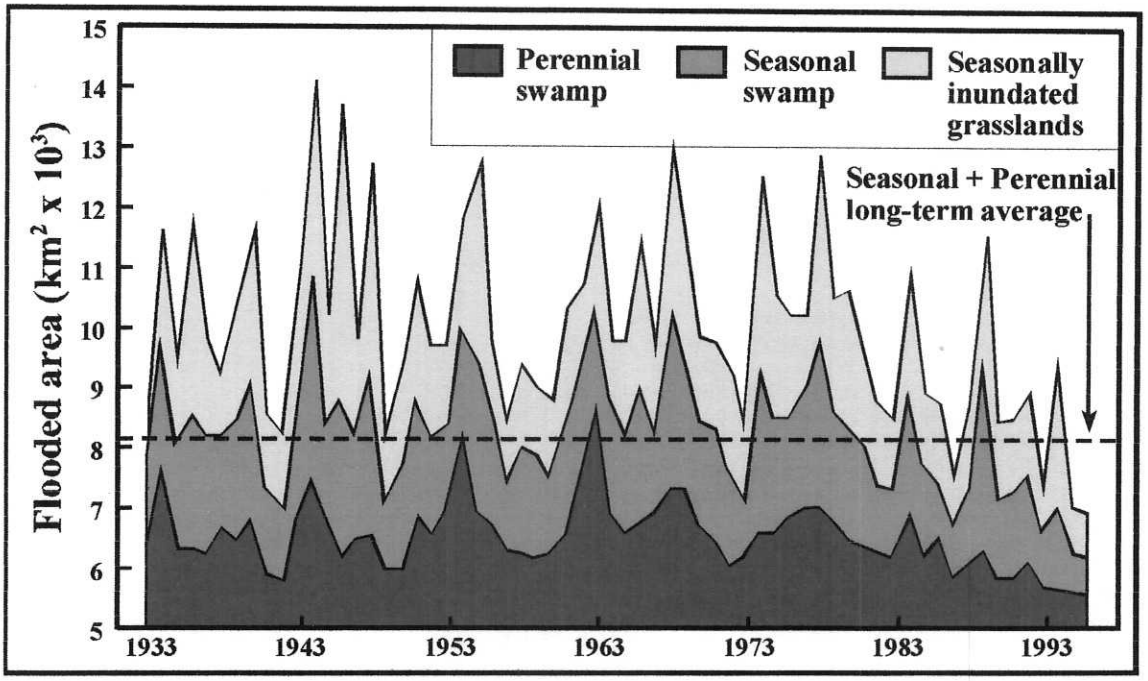

Figure 2: Simulated area of the three main vegetation categories in the flooded areas of the Okavango Delta from 1933 to 1995, with the long-term annual average extent of the perennial plus seasonal swamp components. (Data taken from Ashton & Manley 1999).

The civil war in Angola has long prevented any form of formal or large-scale water resource development in the upper reaches of the catchment (Pallett, 1997). Similarly, the northern border regions of Namibia are relatively remote from the main centres of development and population, and Namibia currently uses very little water from the Okavango River (CSIR, 1997; Ashton & Manley, 1999; Ashton, 2000a; **Table 3**). However, prolonged periods of drought during the 1980s and 1990s progressively impoverished many rural communities along the lower reaches of the Okavango River. In response, many people migrated to urban centres along the Okavango River and the periphery of the Okavango Delta seeking drought relief (Bethune, 1996; Pallett, 1997).

Based on data from 1996 surveys, Namibia presently (2000) uses some 5.2 Million m^3 of water per year from the Okavango River (CSIR, 1997). This usage consists of some 41% for domestic purposes, 56% for agricultural developments (including small-scale irrigation) and 3% for tourism operations (**Table 3**). Water taken from the Okavango River is supplemented by an additional volume of approximately 0.3 Million m^3 of water that is withdrawn from boreholes and hand-dug wells each year (**Table 3**).

Table 3: Daily quantity of water used by each water user group, from different water sources, along the Okavango River in Namibia. (Data taken from CSIR, 1997).

Type of Water User	Direct from River		Boreholes / Wells	
	m^3	%	m^3	%
Missions, Schools, Clinics, etc.	862	6	528	68
Government Water Schemes to towns and villages	4,823	34	189	25
Tourist lodges	474	3	0	0
Agricultural developments	7,754	55	4	1
Subsistence use along river	300	2	50	6

Based purely on population and land use data, approximately 4 Million m^3 of water are used in the Ngamiland sector of Botswana each year, primarily for domestic and agricultural use. This estimate does not include the water that will be needed if the proposed expansion of irrigation at Shakawe proceeds as planned. No estimates can be made for the Angolan portion of the catchment because of the lack of information from this war-torn area. To place this water use into perspective, Namibia currently uses some 0.05% of the mean annual flow of the Okavango River, whilst Botswana uses some 0.04% of the mean annual flow. Taken on their own, these volumes of water are extremely small in comparison to the mean annual flow of the Okavango River (10.134×10^9 m^3; CSIR, 1997; McCarthy *et al.*, 2000).

The Governments of Angola and Namibia see limited use of water from the Okavango River to be entirely legitimate from a territorial sovereignty viewpoint (Heyns, 1995; Bethune, 1996). Indeed, Namibia has stated publicly that it sees the country's border rivers as an integral part of that country's water resources (JVC, 1993; Heyns, 1995). In particular, the Okavango River is seen to offer the most cost-effective solution to the growing demands for water and has formed part of Namibia's National Water Master Plan for over twenty years (Heyns, 1995; Republic of Namibia, 2000).

It is highly unlikely that Angola will attempt to develop any form of large-scale water abstraction from the Okavango River until that country's civil war has been resolved. However, the worsening water supply situation in Namibia will eventually reach a point where water may well have to be taken from the Okavango River and possibly also from the other border rivers that Namibia shares with its neighbours. The projected growth in water demand within Namibia is shown in **Table 4**, whilst the array of water resources that may be available to Namibia is shown in **Table 5**.

The Namibian Government is acutely aware that it is inappropriate simply to withdraw water from a river that it shares with a neighbouring country without first demonstrating that all the viable alternatives for obtaining water from resources located within its own borders have been exploited to their safe limits (Heyns, 1995; Republic of Namibia, 2000). However, the available water resources located within Namibia appear to be too small to meet projected water demands in the medium-term (**Table 4**). The projected shortfalls can only be met by drawing water from perennial rivers located along the borders (Pallet, 1997; **Table 5**). If Namibia exploits its internal water resources to their safe limits (Van der Merwe, 2000), regional protocols will support Namibia's claim based on territorial sovereignty to meet the remainder of its water needs from perennial border rivers (Heyns, 1995; SADC, 1995). In these circumstances, Namibia would have to ensure that all the conditions of the SADC Protocol on Shared Watercourse Systems were

met, together with the international legal obligations "not to cause harm" to a neighbouring state (ILA, 1966; ILC, 1994; Heyns, 1995; SADC, 1995).

Table 4: Projected water demands for different consumer groups (water use sectors) in Namibia. (Data taken from Republic of Namibia, 2000).

Consumer Group	Water Demand (Mm^3/year)		
	2000	2010	2020
• Domestic	73	85	120
• Stock watering	77	80	80
• Mining	14	25	30
• Irrigation	136	250	390
Total :	**300**	**440**	**620**

Table 5: List of available water resources and the potential quantity of water that is available from each source. (Data taken from Republic of Namibia, 2000).

Water Resource Type	Potential quantity of water available (Mm^3/year)
Ephemeral rivers: • 95% assured safe yield	200
Ground water: • Sustainable safe yield	300
Unconventional sources: • Recycling, re-use and desalination	50
Perennial border rivers: • Cunene (at Ruacana) • Okavango (at Mohembo) • Kwando (at Kongola) • Zambezi (at Katima Mulilo) • Orange (at Noordoewer)	 5,000 10,000 1,500 40,000 11,000

The Botswana Government originally viewed the Okavango Delta as an important source of water for local communities and industries and commissioned studies to evaluate the feasibility of using water from the Okavango Delta (UNDP, 1976; SMEC, 1987). However, schemes to abstract water directly from the Okavango Delta attracted enormous criticism from both local and overseas environmental groups (e.g. Greenpeace, 1991). In response to these criticisms, and after thorough technical and environmental reviews (IUCN, 1993), the Botswana Government abandoned these schemes in favour of attempts to exploit available ground water supplies (MGDP, 1997). This choice has subsequently enabled the Botswana Government to adopt a strong position against any proposal to use water from the Okavango River and Okavango Delta (Ramberg, 1997).

Botswana residents have been highly critical of Namibian proposals to abstract water from the Okavango River to alleviate water shortages during the recent droughts (e.g. Ramberg, 1997). Unfortunately, much of the heated criticism appears to have been based on erroneous perceptions of the likely downstream effects on the Okavango Delta. Simply put: the projected impacts quoted by Ramberg (1997) are inaccurate and greatly over-estimate the true extent of the possible

impacts (CSIR, 1997; Ashton & Manley, 1999; Ashton, 2000a). Whilst these criticisms may be considered to be misguided, they nevertheless clearly demonstrate the enormous sensitivity that surrounds the issue of taking water from the Okavango River or Okavango Delta (Ashton & Manley, 1999).

To date, none of the large-scale water abstraction schemes that have been proposed within Namibia or Botswana have been implemented; each country continues to rely on existing (small-scale) run-of-river abstractions (CSIR, 1997) and localized ground water supplies (MGDP, 1997). However, there should be no doubt that the potential future economic and social development that must take place in these two riparian states will be accompanied by escalating demands for water. These new demands for water will only be able to be met by withdrawing water from one of the perennial rivers located along the borders of the countries concerned. Whilst Namibia and Botswana are fortunate in being able to abstract water from other perennial rivers (Bethune, 1996), and need not take water from the Okavango River, these "alternative" rivers are also shared by other riparian states. Therefore, whichever perennial river is selected, the Governments concerned will have to reach consensus on the acceptable levels of water exploitation.

Charting the way forward

The Okavango Delta has long been recognized as a unique and valuable ecosystem and has been cited frequently as being extremely vulnerable to external influences (Wilson & Dincer, 1976; IUCN, 1993; Ellery & McCarthy, 1994; Gieske, 1996; CSIR, 1997; Pallett, 1997; McCarthy *et al.*, 1998, 2000). The Botswana Government has also recognized that the Okavango Delta is a unique and valuable resource, particularly in terms of its conservation and tourism value (MGDP, 1997; Ramberg, 1997), and through the provision of a wide variety of ecosystem services to local residents (FAO, 2000).

Local and international concern to conserve the unique and delicate ecosystems that make up the Okavango Delta has provided strong support for Botswana's opposition to earlier Namibian plans to abstract water from the Okavango River. It can be argued that this support from the local and international environmental lobby has greatly strengthened Botswana's otherwise unfavourable position as the lowest riparian state in an international river basin (Ashton, 2000b).

The Botswana Government's opposition to water abstraction from the Okavango River and Delta ecosystem is widely seen as a strong "pro-environment" stance that will counter future attempts to exploit the water resources of the Okavango River system. However, whilst this position has enabled Botswana to argue effectively against water abstraction, it has also reduced the range of development opportunities and options that were open to Botswana (Ashton, 2000a). If Botswana maintains its present position, it will find it very difficult to justify withdrawing water from the Okavango Delta to meet the growing needs of its own citizens. Instead, these needs will have to be met by water transported from other, more distant, sources such as the Zambezi River.

Understandably, the Botswana Government remains wary of promoting the conservation of the Okavango Delta at the expense of local development needs. Accordingly, Botswana has adopted conservation and tourism policies that maximize the economic benefits to be gained from tourism, whilst minimizing adverse environmental impacts (Republic of Botswana, 1990; Shela, 1996). These policies also have important implications for Botswana's future negotiations around water security. In particular, the process of actively embracing the concepts of sustainability

whilst simultaneously promoting conservation of the Okavango Delta has enabled Botswana to strengthen its bargaining position within the Okavango River basin and has thereby improved its water security situation (Ali, 1996).

Despite these very obvious "moral" advantages for Botswana, the pressing regional water scarcity problems continue to require solutions that are both socially acceptable and environmentally sustainable. Such solutions can seldom be derived or implemented by a single country. Instead, they have to rely on co-operative actions that are, in turn, based on a shared understanding, agreement and recognition of the needs, aspirations and responsibilities of each basin state. Inevitably, these co-operative actions will require each country to incorporate trade-offs between future water security, meeting the legitimate needs for water posed by growing populations and economies, and conserving the ecological integrity of the Okavango River and Delta ecosystem.

Another important point is that the Okavango River basin is widely seen to be a "test case" for the SADC Protocol on Shared watercourse Systems (SADC, 1995). If the three riparian states of the Okavango River basin cannot reach consensus on the most appropriate "balance" of options, this could have unfortunate, and perhaps as yet unforeseen, consequences for other shared watercourse systems in southern Africa.

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