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Thematic Section

Transboundary Water Resources in Southern Africa: Conflict or cooperation?

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ABSTRACT *Literature suggests a linkage between internationally shared water resources and conflict potential. Anthony R. Turton, Marian J. Patrick and Frédéric Julien examine transboundary water resource management in southern Africa, showing that empirical evidence indicates a propensity to cooperation. They use the Hydropolitical Complex concept to explain why states might choose cooperation over conflict where a critical shared resource could limit future development potential.*

KEYWORDS *hydropolitical complex; water wars; southern African development community; river basin management*

Introduction

The linkage between natural resources and conflict has become part of the literature on development (Biswas, 1978; Falkenmark, 1989; Starr, 1991; Bulloch and Darwish, 1993; Frey, 1993; Betts, 1994; Amery, 1997; Ashton, 2000, 2002; Diehl and Gleditsch, 2001; Phillips *et al.*, 2006). While this appears at first to be an intuitively correct assumption, experiences from the management of transboundary river basins in southern Africa seem to suggest a different position (Turton *et al.*, 2004; Turton, 2004, 2005). We present the case for a strategic natural resource – water – that happens to be shared in almost all cases between two or more sovereign states in southern Africa, showing that in this specific set of circumstances, the joint management of such a resource is a driver of cooperation rather than conflict. This case will be presented in light of current empirical studies using the concept of a southern African Hydropolitical Complex (Turton, 2003; Ashton and Turton, 2005, in press) as a possible explanation for the phenomenon.

The current situation

One of the unintended consequences of the colonial legacy in Africa is the large number of international river basins that exist. Given that rivers were used to demarcate the borders of countries, these became artificial barriers in the post-colonial era. For this reason, Africa has a large number of international river basins. Of the 263 known international river basins that exist globally (Wolf *et al.*, 2003), 63 are found in Africa (Turton *et al.*, 2005; Ashton and Turton, in press) (Figure 1).

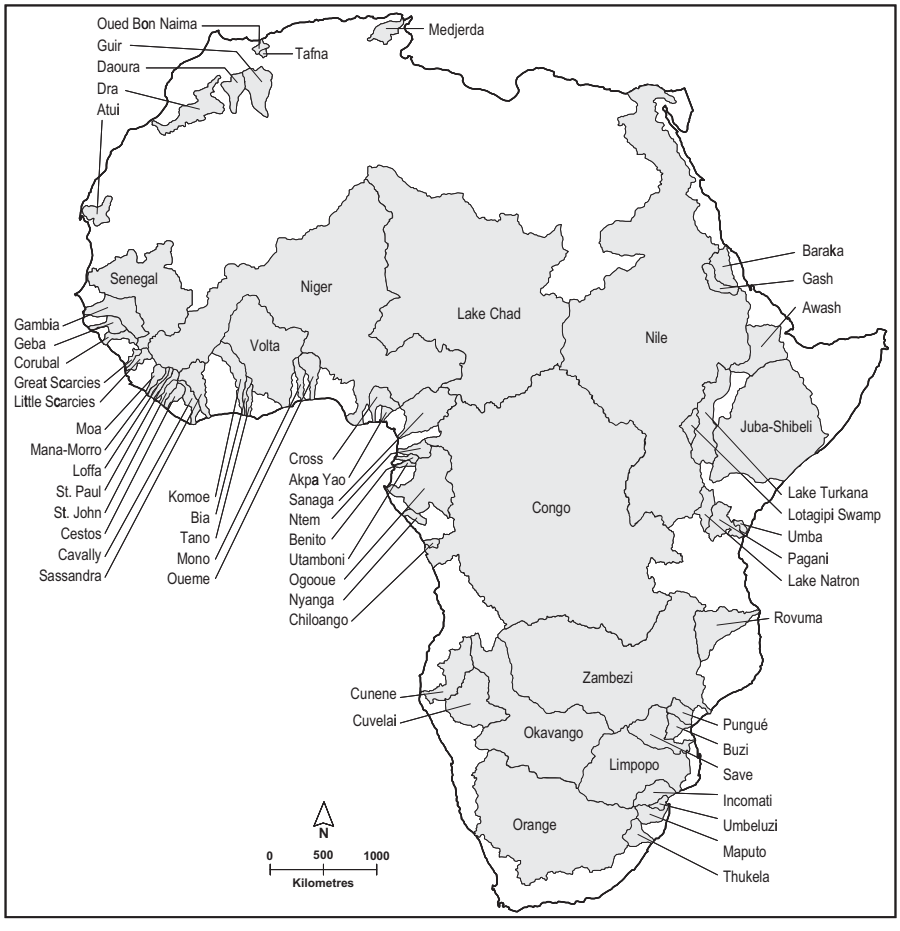

Figure 1: Africa has 63 river basins that cross international borders as a result of the colonial history of the continent (Ashton and Turton, in press)

Furthermore, these basins cover two-thirds of the total land area, are home to three-quarters of the entire African population and account for a staggering 93 per cent of the total surface water resource base of the continent (Ashton and Turton, in press). In addition to this, there are at least 22 aquifer systems that are known to exist in the Southern African Development Community (SADC) region alone (Turton *et al.*, 2006). Therefore, in order to really understand a fundamental development-related issue in Africa, one needs to grasp the significance of transboundary water resource management, because it poses a constraint on future development potential of the continent as the situation now stands (Ashton and Turton, 2005).

So, for example, it comes as no surprise when it is revealed that the current thinking at the World Bank is that many of the least developed countries in the world are hostage to hydrology (Sadoff and Grey, 2006). This is an indictment of the situation as it now stands, suggesting that management intervention is needed. But what exactly must that intervention do? In the context of southern Africa, this hydrology is defined by one fundamental fact – there is on average only a 10–15 per cent conversion of Mean Annual Precipitation (MAP) to Mean Annual Runoff (MAR) (O'Keeffe *et al.*, 1992)

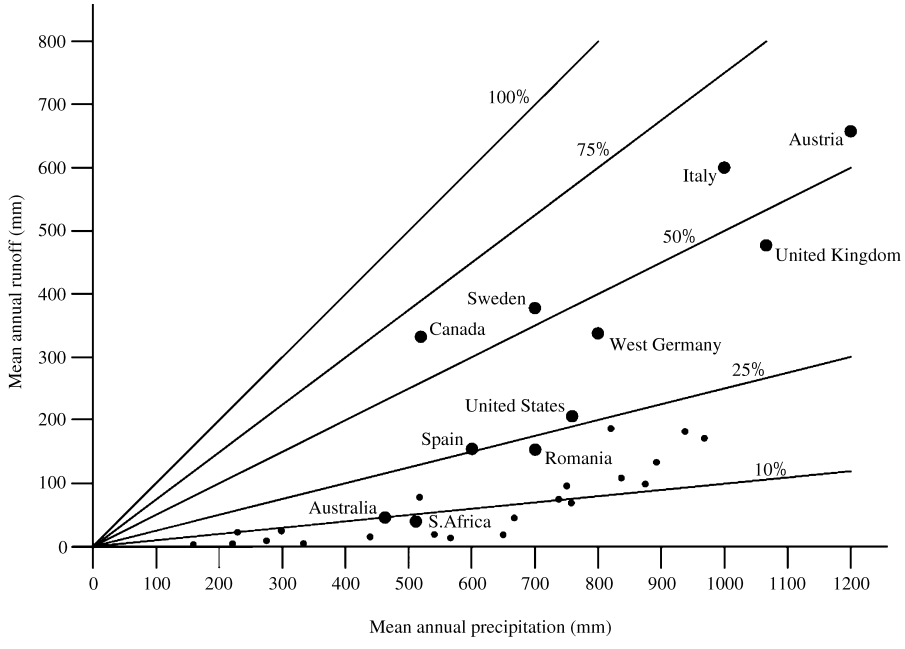

Figure 2: The conversion of MAP to MAR is the lowest in the world in south(ern) Africa and Australia, becoming a fundamental development constraint if incorrectly managed (redrawn from O'Keeffe *et al.*, 1992)

(Figure 2). This depends on the geographic location of specific basins, shown as unmarked dots in Figure 2. This is caused by natural variability in climatic systems in which drought is a normal occurrence, coupled with evaporative losses that are extremely high, often being two to five times the average precipitation rates. In fact, both south(ern) Africa and Australia have the lowest conversion of MAP to MAR in the world, and it is this aspect that is a fundamental determinant of the development potential of the region.

As a result of this set of facts, the findings of the large-*n* empirical study that was done by the Oregon School to determine the relationship between water resource management and conflict potential using multivariate analysis techniques (Wolf *et al.*, 2003; Yoffe *et al.*, 2003), suggested a specific set of causal relationships. In essence these were:

- Basins that are internationalized after the break up of a former unifying power have a higher propensity for conflict. In an African context, this is what Buzan (1991) and Buzan *et al.* (1998) would call the removal of 'overlay' in the wake of decolonization of the continent.
- Unilateral development of the water resources in a given international river basin in the absence of a treaty or functioning river basin commission have a higher propensity to conflict.

The large-*n* study then concluded that these could be called 'basins at risk', of which six were identified in the SADC region (Wolf *et al.*, 2003). These consist of the Incomati, Cunene, Limpopo, Okavango, Orange and Zambezi (Figure 1).

Empirical research in Southern Africa

Using the Basins at Risk study as a point of departure (Wolf *et al.*, 2003), a number of empirical studies were launched in southern Africa (Turton *et al.*, 2004, 2005; Turton, 2005; Ashton *et al.*, 2006) to test the hypothesis that the likelihood of conflict rises as the rate of change within the basin exceeds the institutional capacity to absorb that change (Wolf, 2005). The southern African

empirical studies found that the level of institutional development in the international river basins was much greater than originally anticipated, and certainly much more robust than reported by Wolf *et al.* (2003) and Yoffe *et al.* (2003). The southern African pattern is also at variance with the global norm, in which river basins that have more than two riparian states tend to have bilateral regimes, by a ratio of 2:1, thereby excluding all riparian states from the resultant agreement (Conca, 2006). In fact, South Africa as one of the Member States of the SADC is signatory to no less than 59 international freshwater agreements (Ashton *et al.*, 2006). Furthermore basin-wide agreements exist in all of the so-called basins at risk (Turton, 2005). In addition to this, it is known among regional water resource management professionals that in general there is little significant tension arising from the management of the various transboundary river basins that form the hydrological foundation of the SADC economy. This observation is remarkable given the known history of intense conflict that was associated with the Cold War-era in southern Africa (Turton, 2003, 2004, 2005; Turton and Earle, 2005; Ashton and Turton, in press).

The question that this poses is why, in the face of wide-spread regional conflict during the Cold War-era, when endemic water scarcity potentially constrains the economic growth of the four most developed countries in SADC (South Africa, Namibia, Botswana and Zimbabwe), is there such a high level of international engagement over water resource management?

The answer to this perplexing question can be found in a number of diverse concepts and studies to which we now turn our attention.

Water and conflict under scrutiny

An interesting insight into the *problématique* of water and conflict came from a separate empirical study by the Oslo School. With a basic point of departure being the Water Wars literature (Irani, 1991; Klare, 2001a, b), a large-*n* study on inter-state conflict was initiated (Toset *et al.*, 2000). Initial analysis of this data set showed that sharing a river increases the probability of a militarized inter-state dispute in a pair of countries (called a dyad). Preliminary analysis also indicated that water scarcity was associated with conflict, with the physical geography of the river basin playing a key determining role. In this regard, it was found that a river forming a border was most frequently associated with conflict (Gleditsch *et al.*, 2004). This is significant because it matches many of the circumstances found in contemporary Africa (Turton, 2005). A new study was launched to determine whether these findings were spurious or not (Furlong *et al.*, 2006). This resulted in the generation of a more sophisticated data set on international boundaries, but it was found that the relationship between shared rivers and conflict was not spurious with respect to boundary length (Furlong and Gleditsch, 2003). More significantly however, a highly nuanced understanding of the core problem became evident as a direct result of this work.

With respect to the Water Wars literature, this research suggested that the finding by Homer-Dixon (1999) that war is most likely to occur over non-renewable resources, but where renewable resources were concerned, water had the greatest potential for violent conflict, became the accepted output. Noting that the Water Wars literature is divided into two broad camps, the research programme at the Oslo School was designed to test the various hypotheses that underscored the logic within each approach (Gleditsch *et al.*, 2004). Neo-malthusian authors foresee a growing level of water scarcity in a number of countries, which they hypothesize, will increase competition in the face of growing population, eventually becoming a trigger for a resource conflict (Homer-Dixon, 1990, 1991, 1994a, b, 1996; Irani, 1991; Starr, 1991; Klare, 2001a, b). The Cornucopian authors argue that cooperation over water is more common than conflict (Wolf, 1999a, b; Turton, 2000; Wolf *et al.*, 2003).

In an effort to refine these empirical findings, a specific data set was developed using the 1978 study from the Centre for Natural Resources, Energy, and Transport of the Department of Economics and Social Affairs at the United Nations (CNRET, 1978). This attempted to distinguish between three specific categories of riparian rela-

tions: upstream/downstream rivers shared across an international border, rivers demarcating an international border and a mixed set. This proved problematic however, as only 9 per cent of all coded rivers had a clear upstream/downstream categorization, while 39 per cent ended up in a category that was not clearly definable (Gleditsch *et al.*, 2004). This ambiguity left open one major challenge to the Water Wars hypothesis – the fuzzy boundary scenario – in which countries sharing a common resource might fight over the political boundary being formed by the river, rather than the resource itself. In developing a data set that could test for this scenario, the CNRET database contained little information about either Asia or Africa. As a result, a new data set was created with four fundamental ambitions in mind:

- All principle river basins of the world were to be represented.
- The ratio between upstream/downstream and boundary-demarcating rivers was to be clarified with a high level of reliability.
- The magnitude of the resource was to be accurately captured in all cases.
- Non-contiguous basin-sharing dyads were to be accurately captured and represented.

In order to achieve this, a decision was made to test the Oslo data set (Toset *et al.*, 2000) against the most comprehensive data set then in existence – the Transboundary Freshwater Dispute Database (TFDD) at Oregon State University. There was thus a convergence between the work being done by the Oregon and Oslo Schools at this point in time. The first test indicated 51 missing basins from the Oslo data set, with many examples of different coding and names, adding to some degree of confusion. This resulted in the compilation of a new data set that was capable of showing minute detail of each tributary and sub-basin within each of the TFDD's 261 then known international river basins. Within each contiguous boundary-crossing river basin, the exact number of river crossings was measured, and the length of each boundary-demarcating river was assessed. This was processed into a Geographical Information System (GIS) for later analysis. Historic boundary data changes between 1944 and 1996 were sourced from O'Loughlin *et al.* (1998) and fed into the new data set. From this a detailed assessment was made using both bivariate and multivariate analyses, designed specifically to test both the Neomalthusian and Cornucopian views regarding water and conflict (Gleditsch *et al.*, 2004).

Some of the findings of this analysis were consistent with the Oregon School with respect to a history of peaceful interaction. In this regard, it was found that a history of peaceful interaction tended to be a good indicator of future peaceful resolution of disputes (Gleditsch *et al.*, 2004). The political make-up of the dyad was also found to be very important. What were identified as 'Inconsistent Regimes' were found to be the most likely to give recourse to violence (Hegre *et al.*, 2001; Mansfield and Snyder, 2002). The second most dangerous constellation was one involving a single democracy. Another configuration that was found to have a propensity towards violence was a dyad containing two autocracies. Significantly, there was no statistical indicator that the level of development in one country within a given dyad had any correlation with the possibility of conflict. This is possible because there is a correlation between the level of development and regime type (democracy, autocracy), so the resultant dynamics of this had been accounted for elsewhere in the analysis (Gleditsch *et al.*, 2004). Another important finding was the correlation between basin size and conflict, which statistically was more relevant than either the length of the river boundary or the number of river crossings within each basin. However, in contrast to the Neomalthusian literature, there was no statistical correlation between water stress and specific conflict events. While there is evidence to show that dry countries seem to have a higher risk of interstate conflict, which might indicate that where endemic water scarcity occurs in a shared river basin, there are substantial long-term incentives for the investment in water management measures that avoid conflictual outcomes (Gleditsch *et al.*, 2004).

The core message from the Oslo School is that there is little statistical evidence to support the Neomalthusian view that water and conflict are causally related. Stated differently, the Water Wars thesis does not stand up in the face of rigorous in-

terrogation *via* a statistical analysis of the real world. There is some statistical evidence to support the Cornucopian view however, specifically where shared rivers occur in dyads that have higher levels of economic development. This suggests that wealthier countries can afford to compensate for scarcities by means of either substitution or technological innovation. The strongest results were found where the overall importance of the given river basin was high – something that has been factored into the work by Ashton and Turton (in press).

Emerging from the Oslo School are two fundamentally important conclusions:

- A history of peaceful interaction is a good indicator of future peaceful resolution of disputes.
- Where endemic water scarcity occurs in a shared river basin, there are substantial long-term incentives to develop outcomes that avoid conflict.

Hydropolitical Security Complex as a concept

These two conclusions have great significance for southern Africa, because of the history of violence during the Cold War, coupled with the fact that water scarcity constraints are known to be present across large parts of the SADC region. It was therefore interesting to discover that in separate studies (Turton, 2003; Ashton and Turton, 2005, in press) completely unrelated to the work by the Oslo School, the existence of what has been described as an emerging Hydropolitical Complex was found in southern Africa. The core rationale of this complex is that the four most economically developed states within SADC – South Africa, Namibia, Botswana and Zimbabwe – are all reaching, or have already reached, water constraints to future growth and development. This suggests that the water and conflict scenario is a highly likely one for southern Africa, a fact made more credible when one analyses the regional violence that was associated with the Cold War-era (Turton, 2005). These four countries were therefore called Pivotal States, because water-related issues are of strategic significance in light of the potential consequences of future development-related constraints that might arise. Closer examination of these four Pivotal States indicated that they all shared two transboundary river basins – Orange and Limpopo – that were approaching the point of closure where all readily available water had been allocated to some form of economic activity, making future demands on the system excessive. In addition to this, a third river basin is of strategic importance to the regional hegemonic power – South Africa – and is also shared by two other riparian states whose future economic growth potential might well be impacted by this fact. This is the Incomati River, which together with the Orange and Limpopo systems have been labelled Pivotal Basins. Noting that geographic proximity is an important fixed variable in inter-state relations, with particular significance where endemic water scarcity is the prevailing norm, riparian states that share these Pivotal Basins with Pivotal States have been labelled Impacted States. They are impacted because they do not have freedom of choice when it comes to develop the water resources to which they might feel they have a right. Furthermore, river basins that are not yet approaching a point of closure, but in which a Pivotal State is a riparian, can be thought of as being Impacted Basins. They are impacted because the less-developed states are unlikely to be given a free hand to build infrastructure from which to abstract the resource, if this is deemed to potentially threaten the future viability of the Pivotal State within the basin configuration.

This gives us an analytical configuration known as a Hydropolitical Complex, which is presented in Figure 3 for the southern African case. From this theoretical construct, one can now start to determine the extent to which the inter-state behaviour of various riparian states is evolving with respect to the management of shared water resources. From this analysis, a number of key findings start to become apparent:

- Firstly, one would expect the regional hegemon to display a history of unilateral behaviour. In reality however, despite the intensity of the Cold War and the so-called Liberation Struggle, there

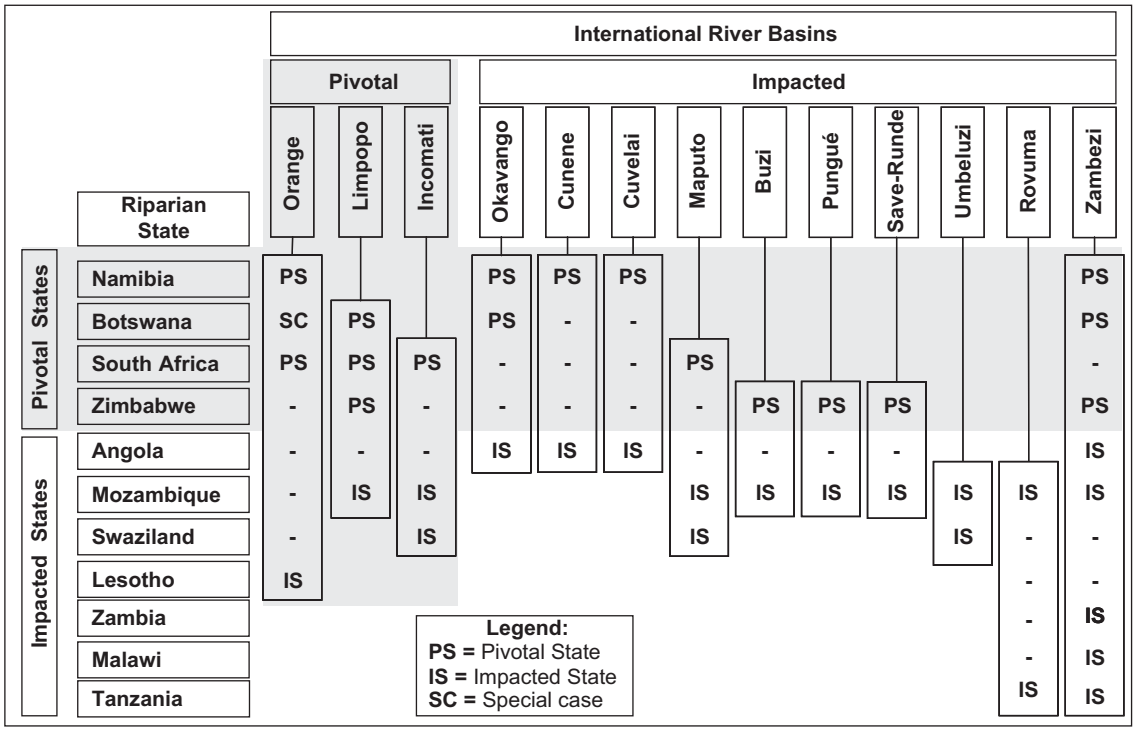

Figure 3: The southern African Hydropolitical Complex as envisaged by Ashton and Turton (in press)

was a remarkably high level of cooperation in the southern African water sector (Turton *et al.*, 2004; Turton, 2004, 2005; Turton and Earle, 2005; Ashton and Turton, 2005, in press; Ashton *et al.*, 2006). This supports the Oslo School finding that where endemic water scarcity occurs in a shared river basin, there are substantial long-term incentives to develop outcomes that avoid conflict, but the data set is simply too small to draw generalized conclusions at this stage.

- Secondly, while states interact in a situation of structural anarchy, it is possible to structure that anarchy in a way that is conducive to plus-sum outcomes (Wendt, 1992a).
- Thirdly, current studies in the field of hydropolitics tend to be biased towards basins in conflict (Turton, 2002) and are almost always conducted using the basin configuration as the unit of analysis. This might be too fine a resolution to give a strategic overview of the different nuances encountered by states in the real world, in light of the complexities *vis-à-vis* basin configuration that was revealed by the Oslo School (Gleditsch *et al.*, 2004) and might therefore give a skewed result. In this regard, the level of analysis and unit of analysis has been identified by key International Relations scholars as being critical (Wendt, 1992b; Buzan *et al.*, 1998). It is therefore not unrealistic to assume that a unit of analysis above the level of the individual river basin, but not necessarily at the level of a regional political structure such as SADC, might be appropriate. If this is so, then it can be assumed that a Hydropolitical Complex exists where international relations between states become coherent enough in the quest for management solutions to significant transboundary resources to the extent that a discernable pattern of amity or enmity can be detected over time. This is apparently the case in southern Africa where a Hydropolitical Com-

plex seems to exist at a level above the river basin but below the level of SADC.

Prognosis for the future: conflict or cooperation?

Arising from this as yet incomplete study of southern Africa, it is still too early to predict either a conflictual or cooperative outcome. Tentative conclusions suggest, however, that the propensity to cooperation seems to be the most likely outcome for two fundamental reasons. Firstly, there is empirical history of cooperation in the water sector, even during the height of the Cold War conflict that engulfed the entire southern African region. Secondly, because of the existence of water scarcity constraints to future economic development within basin hegemonic states, this might be sufficient inducement to seek future cooperative solutions. Both of these factors are supported by the Oslo School findings, and both have some credence in the context of SADC, suggesting that a Hydropolitical Complex might well be a useful analytical tool for development studies. Regarding the question of what must be done to change the *status quo* that was described by Sadoff and Grey (2006) as a fundamental development constraint, the answer seems to lie in the area of institutional development. It is therefore significant to note that in SADC, relatively sophisticated international agreements exist for surface water, but as yet hardly any specific agreements exist for the management of groundwater (with one exception in the Caprivi Strip). This is important because many of the groundwater aquifer systems are transboundary in nature, most of which sustain rural livelihoods in areas that are characterized by endemic poverty, yet the exact geographic extent of these systems is still largely unknown (Turton *et al.*, 2006; Ashton and Turton, in press).

Conclusion

The linkage between water and conflict is a highly nuanced debate. While the logic seems seductively simple, empirical studies with large-*n* samples suggest that this allure is not reflected in the real world. Southern Africa certainly seems to be a case where water scarcity is already driving cooperative behaviour, and has the potential to become a driver of future regional integration under the auspices of SADC. The jury is still out on this, however, as the southern African empirical studies are not yet sophisticated enough to draw generalized conclusions. One must also bear in mind that although conflict at the international scale is unlikely, this does not mean that conflict cannot occur at the sub-state level. Conflict between groups of people and between internal administrative boundaries at a more localized level can and does occur, especially where resource access is vital to survival. Issues of scale are therefore relevant during the analysis of potential for conflict or cooperation. It does seem realistic to assume that the river basin is not necessarily the most useful level of analysis when it comes to determining patterns of amity and enmity between sovereign states sharing a significant transboundary water resource. To this end, it seems that a Hydropolitical Complex is a potentially useful analytic tool because it enables a more nuanced assessment to be made of real-world situations in the realm of hydropolitics.

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