REGIONAL CLIMATE CHANGE PROGRAMME
SOUTHERN AFRICA

# Africa's Water

## Driver of conflict or source of cooperation?

### Introduction

In comparison with the remainder of the world, where approximately 50% of available fresh water is shared by two or more states, an estimated 93% of the African continent's fresh water is transboundary in nature (runs across at least one recognised national border) (UNEP, 2002). More than three-quarters of the population depends on this shared water (Figure 1). Some rivers are shared by many countries: the Zambezi has eight riparian states and the Nile River basin is shared by eleven.

While some studies have suggested that cooperation between states around transboundary fresh waters (including both rivers and underground aquifers) is generally more common than conflict, there is no universal agreement that this will continue in the future. Access to fresh water has arguably contributed to past conflicts in the Middle East, South America and elsewhere (Phillips *et al.*, 2006), while the supply of adequate water of appropriate quality is becoming a greater challenge as populations continue to rise, especially in the more arid regions of northern and southern Africa. Several of the Millennium Development Goals (MDGs) are linked directly or indirectly to the availability of fresh water, and recent estimates suggest that few, if any, African countries will meet the 2015 MDG targets.

It is now well established that national economies are linked closely to fresh water availability, and this is especially relevant in arid and semi-arid regions and countries relying heavily on hydropower. While the devastating effects of droughts are widely documented and understood, fresh water availability has much more subtle and far-reaching effects that determine economic progress (Benson and Clay, 1998). In this context, the extent of the transboundary water situation in Africa throws up special challenges, particularly in the northern and southern parts of the continent.

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**This publication should be cited as follows:**
Phillips, D.J.H., 2011. *Africa's water: Driver of conflict or source of cooperation?* Policy Brief No. 3, Regional Climate Change Programme for Southern Africa (RCCP), UK Department for International Development. OneWorld Sustainable Investments, Cape Town.

### Policy recommendations

- The availability and use of fresh water in northern and southern Africa in particular should be a continuing active focus of national and international efforts, with whole-basin efforts and attempts to forge inter-state agreements being accorded priority. The agreements should be flexible to allow changes over time, in response to altered economic and climatic circumstances.
- Specific attention should be accorded to mechanisms which promote inter-state cooperation. These include various organisations for regional dialogue; shared transboundary water management institutions; scientific efforts spanning several countries; and large-scale cooperative monitoring programmes.
- Support to climate-related research is vital if predictions of future changes are to improve.
- Scenario planning on the use of water should be supported in the interim, such that states can adjust as well as possible to any future trend in climate change that may occur. This should emphasise effects amongst rural communities, which are believed to be particularly vulnerable.
- Greater attention should be accorded to the intimate links between fresh water, energy, food, trade and health.


**Figure 1. Map of Africa, showing the locations and names of the continent's international river basins. (Based on UNEP, 2002.)**

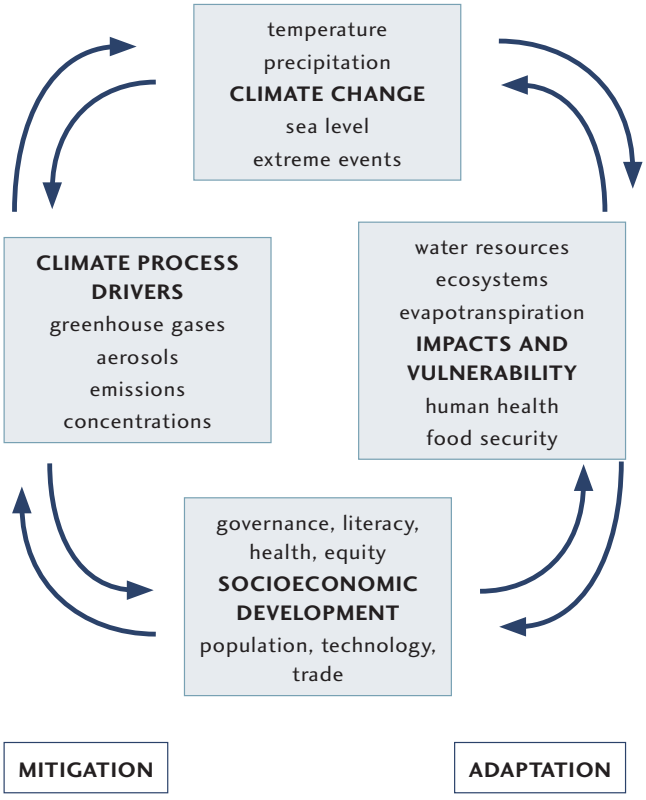


**Figure 2. A framework representing the linkages between climate change, its drivers and its impacts. (Simplified from IPCC, 2007.)**

The issue of climate change adds to the complexity. While there is a broad consensus around the reality of global climate change driven by anthropogenic greenhouse gas emissions (IPCC, 2007), precisely which parts of the world will be most affected, and at what rate these changes will occur, is still widely debated. The available evidence suggests that certain regions (including much of Africa) have low adaptive capacity and could be particularly severely affected (Boko *et al.*, 2007). As suggested by Figure 2, many climate change effects relate fundamentally to water. These include precipitation, evapotranspiration (the loss of water from plants), changes in river flow and aquifer replenishment, and sea level rise.

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) predicts that many semi-arid areas, including southern Africa, will suffer a decrease in water resources due to climate change, and that drought-affected areas will increase in extent, with adverse impacts on agriculture, water supply, energy production and health (IPCC, 2007).

African states are faced with two diverging options in relation to transboundary fresh water resources. Option 1 involves a narrow response based on perceived national interests, which ignores outside parties and aims to unilaterally develop own water resources. Option 2 involves a cooperative approach, leading to shared benefits arising from the availability and use of shared fresh water resources.

## Water scarcity: current and future

Which African countries are likely to be most affected by the currently increasing scarcity of fresh water, and what are the additional effects of potential climate change likely to be? Figure 3 shows Ashton's first order approximation of African countries under particular conditions of water availability (Ashton, 2002). This view is approximate, in that it only addresses 'blue water' (surface and groundwater), with no account of 'green water' (soil water derived directly from rainfall). Nevertheless, it is clear from the 2002 map (Figure 3) that in 2002 most of the equatorial belt of Africa had at least potential access to adequate fresh water, but that large parts of the north and south of the continent were already experiencing some degree of water scarcity. The 2025 map, by contrast, shows much higher levels of water scarcity throughout most parts of Africa. It should be noted, however, that this pattern is driven primarily by population increases, and that potential climate change is not taken into account.

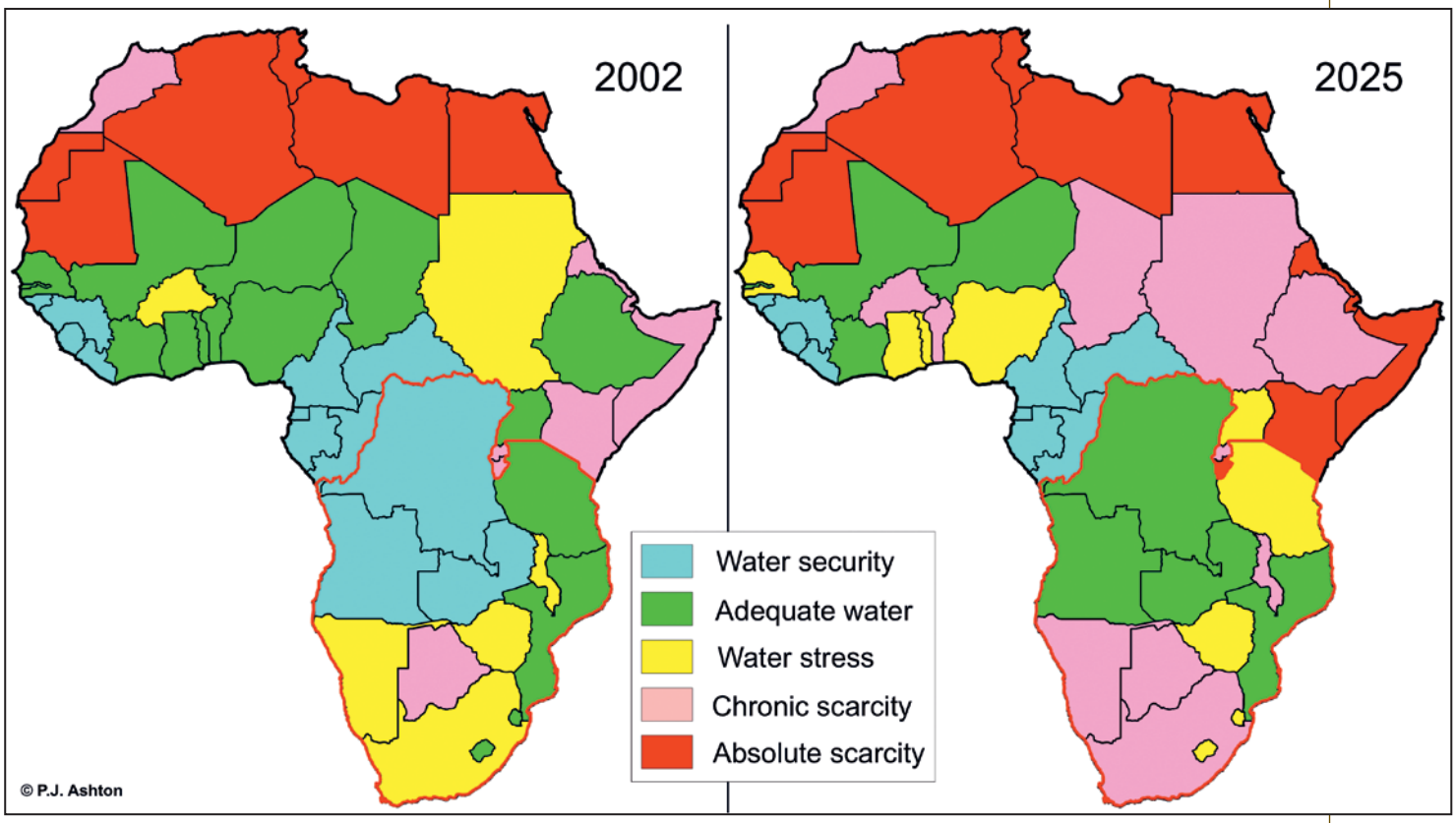


**Figure 3. Average per capita levels of availability of renewable fresh water in African countries, in 2002 and as estimated for 2025. The red border denotes the boundary of the SADC. (After Ashton, 2002.)**

A different form of analysis, relating to water availability in Africa, is shown in Table 1. This reveals several features of considerable importance. Significantly, many African countries have far more fresh water available on a renewable basis than is actually used (Falkenmark and Widstrand, 1992).

Two countries (Libya and Egypt) use more water than their respective renewable resources, while several others use appreciable percentages of their total annual renewable water resource. In southern Africa, the situation is rather better, although early signs of water stress are evident for South Africa, Lesotho, Malawi and Zimbabwe.

High dependency ratios for a country imply that much of their water is derived from external sources – and is therefore at least potentially at risk. Egypt, Mauritania, Niger, the Sudan, Botswana and Namibia are notable in this regard.

## How will climate change affect water availability?

Climate change predictions are widely known to carry significant uncertainty, and there is no way that any of the predictions can be tested in a truly robust fashion as yet. The problem is unusually severe in Africa (IPCC, 2007).

Notwithstanding these modelling difficulties, most authors concur that the impacts of future climate change will be felt mainly in the northern and southern regions of Africa, rather than in the equatorial belt. As shown in Figure 3 and implied by Table 1, these are the two regions of the continent that are estimated to experience the greatest problems, even without climate change effects intervening. Thus, the evidence points to a strong likelihood that climate change effects will worsen water scarcity. This will have significant effects, given that many of the transboundary water systems in both northern Africa and at the southern tip are already either fully committed to use, or nearly so. The obvious conclusion arising from this is that competition and possible conflict over the scarce fresh water resources is likely to increase, over time.

## Adhering to national interests, or sharing benefits?

The attitudes of states sharing transboundary waters towards each other differ considerably, as shown in Figure 4. Judged according to the benchmark of interstate dialogue and the creation of basin-wide management entities, cooperation amongst African riparian states is generally moderate, although relatively few basin-wide agreements exist.

States sharing international watercourses, whether surface waters, aquifers or both, face decisions as to whether to adhere to narrow national interests or espouse cooperative approaches, commonly

Table 1. The total annual renewable water resources $m^3$ per capita (TARWR, PC), compared to the volumes of fresh water actually withdrawn annually, per capita. Dependency ratios (% volumes derived from outside each country) are also shown. (Data from AQUASTAT files, Food and Agriculture Organisation – FAO)

| African country | TARWR ($m^3$ per capita) | Withdrawals ($m^3$ per capita) | Dependency ratio |
|---|---|---|---|
| Sudan | 1 560 | 1 020 | 77 |
| Swaziland | 3 861 | 946 | 41 |
| Egypt | 702 | 937 | 97 |
| Madagascar | 17 634 | 907 | 0 |
| Libya | 95 | 777 | 0 |
| Mali | 7 870 | 594 | 40 |
| Mauritania | 3 546 | 581 | 96 |
| Zimbabwe | 2 558 | 514 | 39 |
| Morocco | 917 | 427 | 0 |
| Tunisia | 452 | 296 | 8.7 |
| South Africa | 1 007 | 271 | 10 |
| Senegal | 3 177 | 213 | 34 |
| Niger | 2 288 | 200 | 90 |
| Algeria | 339 | 196 | 3.6 |
| Guinea | 22 984 | 186 | 0 |
| Zambia | 8 336 | 159 | 24 |
| Namibia | 8 319 | 158 | 65 |
| UR Tanzania | 2 266 | 144 | 13 |
| Guinea-Bissau | 19 683 | 128 | 48 |
| Botswana | 6 372 | 109 | 80 |
| Gabon | 113 260 | 101 | 0 |
| Ethiopia | 1 512 | 80 | 0 |
| Nigeria | 1 893 | 79 | 23 |
| Cote d'Ivoire | 3 941 | 78 | 5.3 |
| Malawi | 1 164 | 77 | 6.6 |
| Kenya | 792 | 72 | 33 |
| Cameroon | 14 957 | 58 | 4.4 |
| Gambia | 4 819 | 51 | 62 |
| Ghana | 2 278 | 48 | 43 |
| Burundi | 1 553 | 43 | 20 |
| Chad | 3 940 | 41 | 65 |
| Mozambique | 9 699 | 39 | 54 |
| Equatorial Guinea | 39 454 | 31 | 0 |
| Togo | 2 276 | 30 | 22 |
| Lesotho | 1 475 | 26 | 0 |
| Rwanda | 977 | 18 | 0 |
| Central African Republic | 33 280 | 17 | 2.4 |
| Congo | 230 152 | 14 | 73 |
| Uganda | 2 085 | 13 | 41 |
| DRC | 19 967 | 12 | 30 |

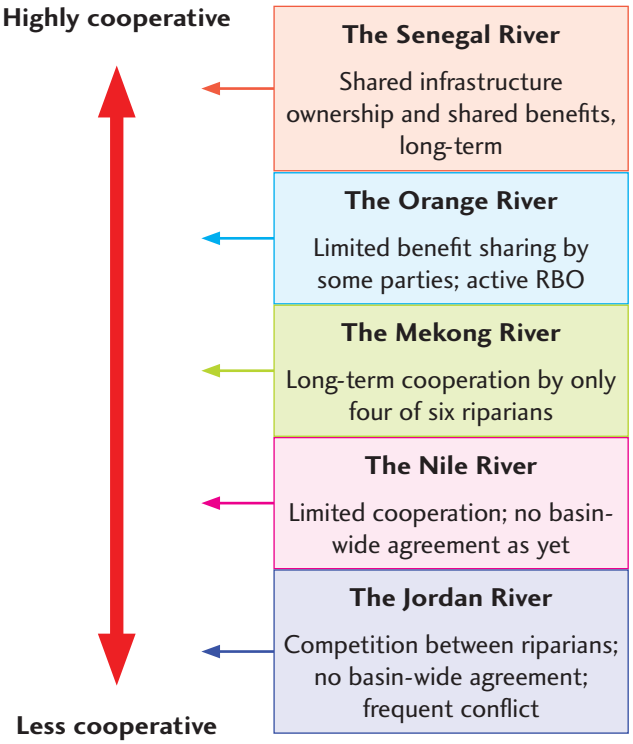


Figure 4. A continuum of degrees of cooperation on water management in transboundary basins, with selected examples.

encapsulated under the framework of 'shared benefits' (Sadoff and Grey, 2002). In effect, states must decide where they want to be located on the 'continuum' (Figure 4).

While upstream states may theoretically elect to ignore the rights of those downstream, this approach has generally been rejected (McCaffrey, 1996) in favour of the 'equitable and reasonable use' of shared watercourses. This is customarily included in international water law as one of three key principles, alongside the need to avoid significant harm to co-riparian states, and for prior notification of works that may affect a shared watercourse. While the precise meaning of 'equitable and reasonable use' and the relative importance of the various factors determining such use continue to be debated, the majority of water managers support this approach.

## Options for benefit sharing

Recent work on benefit sharing by riparian states has begun to shed light on the options available. These include co-ownership of major infrastructure on a river (Yu, 2008), and a 'positive-sum outcome' (Phillips, 2011) in which equitable and reasonable use of surface waters is attained over time, within a framework of the development of 'new water' (water made available from non-conventional sources, such as desalination, re-use, or inter-basin transfers). The development of 'new water' is an important component of benefit sharing frameworks (SADC, 2010).

**The large fluctuation of water levels of Lake Mutirikwe in south-eastern Zimbabwe is a result of irrigation demands and variable seasonal rainfall.**

Benefit sharing may also assist in 'climate-proofing'. For example, since most of Africa's fresh water is used for growing food, and since transboundary waters are often used sub-optimally by upstream basin states, improvements in the economic efficiency of water use could arise through international agreements requiring waters to pass downstream to more fertile areas. Obviously, transboundary arrangements such as these would require a significant degree of cooperation by the states involved. Climate change is of particular importance in this regard, as increased temperatures are forecast to greatly affect the yields of many crops. Lobell *et al.* (2008) predict an average 30% reduction in maize production in southern Africa, while wheat, soybean and sugar may be similiarly impacted.

Trade in 'virtual water' (water utilised to grow crops and produce industrial goods) allows at least some countries to escape from water scarcity, and this may also be in the global interest because it can lead to 'global water savings' (Allan, 1998). Very few states have appreciated the importance of this strategy as yet, and there is significant scope for further consideration of virtual water in the agricultural and trading sectors of African nations.

Ashton (2002) has remarked:

> "Normally, water allocation and distribution priorities within a country are aligned with national development objectives. Greater emphasis needs to be placed on regional efforts to ensure that the available water resources are used to derive sustainable long-term benefits for the peoples of Africa as a whole. Ideally, each country's water resource management strategy needs to be aligned with that of its neighbours if peace and prosperity are to be maintained and conflict is to be avoided in the region."

## Institutions to support improvements

Many of the states in the SADC region and elsewhere in Africa have sought to establish river basin organisations (RBOs) of one form or another to address the issues pertaining to transboundary waters. While experiences have been mixed (Pegram *et al.*, 2011), it may be argued that this method for addressing fresh water issues, that reaches beyond the narrow domains of state interest, is to be preferred. The establishment of robust trans-national institutions addressing shared fresh waters will be an important component of future efforts in Africa.

## Fresh water and connected concerns

Water availability is closely connected to other sectors of concern, including agriculture, food production, trade, energy supply and health. Contemporary approaches to water management are beginning to exhibit a trend towards a more holistic consideration of all of these sectors in concert, driven in part by the international debates on benefit sharing and climate change effects (Pegram *et al.*, 2011; SADC, 2010).

## Acknowledgement

Thanks to Phoebe Luwum for the African Ministers' Council on Water (AMCOW) institutional appraisal.

REGIONAL CLIMATE CHANGE PROGRAMME SOUTHERN AFRICA

## The Regional Climate Change Programme Southern Africa (RCCP)

The RCCP aims to contribute to the achievement of southern Africa's climate change adaptation needs, socioeconomic development and poverty alleviation objectives, including the Millennium Development Goals.

By synthesising the relevant climate change science, developing strategic research and strengthening science-policy-governance-finance dialogue, the RCCP will build an evidence base for appropriate transboundary responses, strengthen the region's voice on international platforms and negotiations, and enhance its ability to equitably access the necessary finance for effective climate change adaptation.



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