INTEGRATING CLIMATE CHANGE ADAPTATION INTO INTERNATIONAL RIVER BASIN MANAGEMENT IN SOUTHERN AFRICA

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Climate change impacts on water resources in the Southern African region are likely to have significant consequences for social and economic development, and for land-use practices. The science linking climate change predictions for the region with water resource responses is still uncertain. However, consensus is emerging from the six GCMs and downscaling undertaken by the University of Cape Town, amongst others, that the SADC region will experience warming in mean annual temperatures of 1 – 3oC by 2050, with resultant increases in evapotranspiration from crops and natural land-cover. Greater uncertainty exists on the impact of these changes in temperature on rainfall, with certain areas likely to receive greater rainfall and more intense rainfall events, while other areas are likely to experience drying.

Scientific uncertainties aside, it is clear that a number of water resource changes will be experienced across the region that can be described as either sudden, extreme events or gradual, persistent change. In the former category are the flood events associated with the increases in high intensity rainfall events, and drought periods associated with greater variability in rainfall within a season and between seasons. The latter category refers to general decreases in rainfall, and resultant decreases in runoff and groundwater recharge. Based on these changes, the key vulnerabilities within the Southern Africa, as in many developing country regions in the world, centre on food production (particularly subsistence dry-land agriculture) and human health associated with extreme events and malnutrition. Both of these vulnerabilities are underpinned by availability and quality of water for productive and domestic use.

The key consideration for water resources managers, given the possible changes anticipated and the key vulnerabilities is the need to build adaptive capacity into management systems. Such adaptive capacity must cope with both sudden, extreme events (floods and droughts) and slower, longer term change in available water resources. A further key motivation for adaptive capacity is the need to deal with information uncertainties, given the inherent difficulties associated with predicting the impacts of future climate on water resources and the difficulties of detailed and definitive predictions on intra-seasonal rainfall and water resources availability. The obvious question arises as to what adaptive capacity in water resources management entails.

Adaptive systems are built around the four pillars of (i) knowledge and learning; (ii) diversity; (iii) necessary institutional arrangements; and (iv) appropriate infrastructure, implying a mix of structural and non-structural measures.

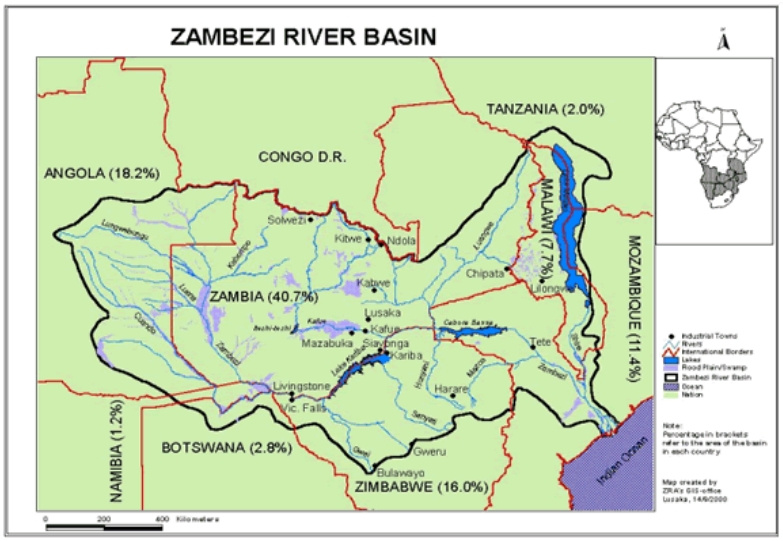
- Knowledge and learning are related, but separate elements of a knowledge system. Knowledge implies a certain level of information and certainty, and in particular an understanding and interpretation of information that supports decision-making. Learning is an ongoing process of accumulating knowledge through experience and suggests an adaptive approach. Learning enables a dynamic response to changing conditions.
- Diversity implies a range of different options that respond in differing ways to changing circumstances (some respond negatively, while others respond positively). Diversity builds into a

system a certain degree of flexibility or elasticity, enabling the system to absorb shocks and stresses.

- Necessary institutional arrangements refer to cohort of institutional mechanisms – from legislation and policy all the way through the organisations, people and practices – that facilitate or empower appropriate emergency responses or adaptive management. It implies a framework that enables decision-making and the deployment of management interventions in response to a diverse set of external circumstances.
- Appropriate infrastructure refers to technical flexibility and engineering capacity within the system that enables responses to extreme events or changing environments through engineered adaptation.

The four pillars of an adaptive system can easily be applied to the water management environment. Knowledge and learning relates to the scientific and technical understanding of the resource and an understanding of how a socio-economic system responds to water stresses. Diversity implies a range of water management approaches linked to diversity in water use. Diversity also pertains to the protection of the resource through maintenance of some level of environmental flow, with the natural environment providing resilience and buffering through assimilative capacity and flexibility. Appropriate institutional arrangements for an adaptive system inherent approach an IWRM paradigm, which reflects the strategic and dynamic nature of water resources within the natural, social, economic and political environment. A final element of the adaptive system is the role of water resources infrastructure and the development of appropriate infrastructure to build resilience and adaptive capacity, linked to infrastructure management approaches that support that adaptive capacity.

From a transboundary water management perspective, the four pillars of an adaptive system introduce some significant complexity. This complexity is the particular challenge that transboundary water management must engage and deal with in order to respond appropriately to a changing climate. Specific complexity includes differences in information and knowledge for a shared watercourse held by member states, and differing approaches to learning and institutionalisation of experience. Diversity also introduces complexity, as water use diversity in a shared river basin often implies uneven development and in the absence of shared benefits and shared resilience, can lead to conflict. Also, different perspectives on environmental resilience based on specific developmental needs may imply differing approaches to resource protection and maintenance of environmental goods and services. The institutional arrangements that support transboundary water resource management are integral to appropriate and adaptive management, and imply a harmonisation of legal and policy frameworks, a common strategy and management plan, and organisational alignment of structure, systems and processes to enable coherent and cohesive management of the resource. Finally, appropriate infrastructure at a transboundary level introduce complexity of authority and ownership, sharing of benefits, responsibility for financing and management, and a common vision of strategic and technical requirements.



Source: Zambezi River Authority (http://www.zaraho.org.zm/basin.html)

When applied to the Zambezi Basin, this adaptive systems approach to climate change results in some practical conclusions on the management of the shared basin. From a climate science perspective is it clear that flooding of the Zambezi is going to remain a significant concern for Mozambique, and will perhaps become even worse. Given that these floods are estimated to reduce Mozambique GDP by up to 10%, the management of floods that originate primarily in Zambia will become a key adaptive response. Coordination between the Zambezi River Commission (ZAMCOM) and the Mozambique national water authority regarding sharing of information on impending flooding, the management of upstream impoundments (Kariba and Cahora Bassa) and land- and water use activities in the upstream catchment will enable the Mozambqiue authority to respond to disasters timely and to pre-empt subsequent disasters through a learned response and appropriate investment (infrastructure or otherwise).

A further climate change impact likely within the basin is the drying of the Southern Province of Zambia, which hosts some of the highest density of small-scale dry-land agriculture in the country. These small farmers are highly vulnerable to climate change and poverty will deepen significantly within the region unless some appropriate adaptation responses are deployed. An important part of such adaption is the development of storage capacity, to store the plentiful rainy-season run-off for productive (and domestic) use during the dry season. Irrigation infrastructure linked into the storage capacity is a further response to enable diversity in livelihood strategies and to reduce uncertainty and risk associated with dry-land production. From a water management perspective, appropriate institutional arrangements for the development of this infrastructure should be established. While development of such infrastructure rests with the national authority (unless the infrastructure itself will be shared by member states), the strategic perspective should be captured within basin development strategies and plans under the auspices of the basin commission (ZAMCOM). Financing for such initiatives is widely available through various climate adaptation funds, but requires a coherent case developed as part of a larger strategy. A combined basin and national authority approach to the technical, institutional and financial planning of such infrastructure will strongly support this larger strategic approach, reducing financing risk and increasing bankability.

In conclusion, it is clear that climate change is going to have significant impacts on the water resources and associated economies and societies of Southern Africa. Given that the state of our understanding of the complex and dynamic climate and water resources interactions is not sufficiently advanced to enable detailed, accurate and reliable forecasting of specific water resources impacts, an adaptive systems approach to water resources management is required. Such a system builds flexibility, adaptability and resilience into the water resource management. However, achieving an adaptive system at a transboundary water management level is complex and complicated, and a number of challenges are introduced that must be addresses if successful adaptive capacity to climate change is created.

Key references:

Grey D and Sadoff C (2005). Water for Growth and Development: A Framework for Analysis. A Baseline Document for the 4th World Water Forum Theme 1: Water for Growth and Development. The World Bank. Pp 22.

OneWorld Sustainable Investments (2007). SADC Regional Climate Change Programme: Feasibility Study. Report to the Department of International Development, Johannesburg, South Africa. Pp 56.

Thornton PK, Jones PG, Owiyo T, Kruska RL, Herrero M, Kristjanson P, Notenbaert A, Bekele N and Omolo A, with contributions from Orindi V, Otiende B, Ochieng A, Bhadwal S, Anantram K, Nair S, Kumar V and Kulkar U (2006). Mapping climate vulnerability and poverty in Africa. Report to the Department for International Development, ILRI, PO Box 30709, Nairobi 00100, Kenya. Pp 171..