WATER ACCESS, WATER SCARCITY AND CLIMATE CHANGE

Abstract

This paper investigates the approaches of the various discourses operating in the water sector and how they address the issues of scarcity and equitable access under projected climate change impacts. Little synergy exists between the different approaches dealing with these issues. Whilst being a sustainable development and water resources management issue, a holistic view of access, scarcity and the projected impacts of climate change is not prevalent in these discourses. The climate change discourse too does not adequately bridge the gap between these issues. The projected impacts of climate change are likely to exacerbate the problems of scarcity and equitable access unless appropriate adaptation strategies are adopted and resilience is built. The successful delivery of accessible water services under projected climate change impacts therefore lies with an extension of the adaptive water management approach to include equitable access as a key driver.

Key words:

Adaptation, water resource management, climate change, access, scarcity, environment, sustainable development

Introduction

Access to safe water for all people is key to a successful development strategy. So much so that one of the main United Nations Millennium Development Goals (MDGs) is aimed at reducing the proportion of people without adequate access to affordable water by half by 2015 (UN 2000). Sufficient clean water is the most significant resource for reducing poverty and disease and improving the lives of the poor (Reid and Vogel 2006; UN 2006). However, poor access to water is often confused with physical water *scarcity*, which is widely perceived as the key feature undermining water security. *Access* to water and water services is also a key aspect of water security, but is not always determined by scarcity, although this is often cited as the reason. However, what mostly passes as water scarcity, are policy induced consequences of mismanagement (Watkins 2006). Poor access to water could also be due to political or economic policies. People who do not have access to water are mostly geographically, economically, institutionally and socially marginalised.

Whilst access to safe water, as defined by the WHO as the receipt of 25-30 litres of safe water per person per day (WHO 1995), is generally accepted and measurable, the concept of water scarcity has been debated for some time and is relatively complex to determine since it could be viewed as a supply problem (physical) or a demand problem (social) or combination of both (Rijsberman 2004). There is a growing consensus by some commentators however, that the world is rapidly heading towards a physical shortage of freshwater which is likely to be a source of strategic rivalry, regionally, nationally and even locally (Postel 1996; Turton and Ohlsson 1999; Gleick 2003; Niasse 2005).

Beyond scarcity, water security is also about risk and vulnerability. One key such risk is that of projected climate change impacts. The most detailed and sophisticated planning methods in use in the water sector treat weather as an uncertain but stationary process. In other words, climate is assumed to be fixed. However, increased climate variability is expected to alter the present hydrological resources and add pressure on the availability of future water resources in some parts of the world. Scientific evidence confirms that climate change is already taking place and that most of the warming observed during the past 50 years is due to human activity. According to the Intergovernmental Panel on Climate Change (IPCC 2007b), global surface temperature is estimated to have increased by 0.74°C over the past 100

years. Superimposed on these changes are seasonal, annual and inter-annual variabilities, producing a complex climate variability and change signal.

Many uncertainties remain about the timing, direction and extent of the climatic changes, as well as the implications. The most important effect of climate change for water supply systems is the increase in uncertainty, which greatly complicate rational water resource planning, this in addition to fast changing socio-economic boundary conditions (Gleick 1998; Pahl-Wostl 2007). Climate change studies inherently have to consider the significance of uncertainty. This does not mean that there is no confidence in the understanding, or that the understanding is not certain enough to allow for the development of appropriate adaptation strategies and policies for resource management. Rather, current research would suggest that the political and planning response is lagging the understanding of climate change (Huq and others 2006). The recent UK Government's report on climate change, known as the Stern Review, is the first political step in this direction (Stern 2006). It states that "*the scientific evidence is now overwhelming: climate change presents very serious global risks, and it demands an urgent global response*".

Although mitigation efforts are essential to prevent continued global warming in the future and to minimise long term climate change from occurring, they will have limited effect on greenhouse gas (GHG) concentrations in the atmosphere over the next 30 years and prevent the climate changes that are both already happening and predicted to happen. Therefore adaptation measures are an essential component of any climate change response strategy to minimise unavoidable adverse effects of climate change. The extent to which a society is able to adapt to these climatic changes will depend on its relative adaptive capacity or resilience. Society is in many places already adjusting to climate change, since a gradual change in the climate will induce society to make small inexpensive changes without having to differentiate the source of the climate variability (Callaway 2004).

The issues of climate change impacts, water scarcity and affordable access have been tackled by different communities who view them from differing scientific and political angles, and in some cases not at all. A discussion of the discourses of key communities who deal with water issues viz. the development and water resources management sectors is presented. This is followed by a critique of the climate change community, which is a relatively new player in this field, specifically its approach to climate change

impacts on water resources and equitable access. The paper concludes with the suggestion that the linkage between climate change and equitable access to water still need to be integrated into the current discourses. The cross cutting discourse of adaptive water management with the inclusion of equitable access is put forward as the future paradigm.

Water access, scarcity and adaptive capacity

Currently about 1.2 billion people world wide, mostly in developing countries, still do not have access to safe drinking water. By 2025 it is estimated that due to the growing stress on water resources by population growth, unsustainable consumption patterns and uncontrolled usage, between 2.7 and 3.5 billion people globally (one third of the world population) will not have access to water (WHO 2000; WEHAB 2002; IISD 2006). As can be seen from Table 1, Africa still lags substantially behind the other developing continents of Asia and Latin America in terms of basic access (UN 2006).

Table 1: Access to drinking water in 1990 and 2000 (UN 2006)

It was not until recently that the United Nations Committee on Economic and Social and Cultural Rights declared that "the human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic use". Whilst not legally binding, these five key attributes represent the foundation for water security (CESCR 2002). It is implicit that institutional structures and capacity are in place as well as financial mechanisms to ensure that this security is guaranteed and affordable, and where necessary basic levels of service are subsidised. Parnell (2007) suggests, therefore, that since the demand for affordable basic services will dominate international and local service policy debates, it is important that increased prominence be given to identifying mechanisms that deliver on the demand for the *right to water*.

This leads to the question of whether *access to water* is a human right or a human need. It involves a discussion on the meaning of "rights" at an urban scale and the context of limited resources and capacity

at the local government level. It also requires a shift in focus from institutions of delivery to the recipients of services and to issues of access and equity.

The issue of the "right to water" bears directly on the water privatisation debate, since the view that human rights are violated by privatisation is often based on the assumption that privatisation of water services is accompanied with profit making, and that this may interfere with the task of providing access to water to the poor as well as the wealthy. In some cases privatization programmes have delivered water on an equitable basis, while the vast majority have not. In most cases the promise of reduced water tariffs does not materialise and in fact the opposite occurs (Loftus and McDonald 2001). It is not surprising therefore that according to Budds and McGranahan (2003) the rate of privatisation has been slowing due to a combination of the underestimation of risks and an overestimation of profits.

The debate on privatisation often diverts attention from public utility reform. Public utility providers account for more than 90% of water delivered in developing countries, often failing to meet the needs of the poor through a combination of inefficiency and unaccountability. There is general consensus that public utilities have been too slow in extending access to water services and that they can be inefficient and corrupt (Watkins 2006). In addition, pricing and water markets can also result in reducing access to water by marginalised communities (Smith 2004). This too creates an induced social water scarcity and associated social stresses, normally for the poor.

In understanding the concept of water *scarcity* in a global and regional context, it is useful to be able to measure it, just as access can be measured by the number of people with direct access to the levels of water supply as defined by the WHO. Hydrologists typically assess scarcity by looking at the population-water equation. According to the *Falkenmark Water Stress Index,* when a country falls below 1000 m^3 of freshwater per person per year it experiences water scarcity and below 500 m^3, absolute scarcity (Falkenmark and others 1989). International experience has shown that countries with renewable freshwater resources below 1000 m^3 per capita per year are prone to experience severe water scarcity that will impede development and be harmful to human health (WRI 1996). Approximately about 700 million people in 43 countries live below this level. Globally some 1.4 billion people live in areas where water abstraction exceeds supply. This is likely to increase as water stress intensifies in China, India and Sub-

Saharan Africa (Watkins 2006). Based on this indicator, it is obvious that as populations increase so the index will decrease given that the available water is relatively finite.

However, too conveniently the notion of *scarcity* is introduced to explain why global and local access to water is not universally equitable. This index unfortunately does not indicate the localised water scarcity nor account for seasonality or social and political choices in allocation (Rijsberman 2004). A key omission is that it also does not consider the ability of a nation to satisfy the basic water resource needs by adapting to reduced per capita water availability. Water resources per capita and the level of national development appear to be unrelated (Turton and Ohlsson 1999; Chenoweth 2008). While the availability of water is indeed a concern in some countries, the scarcity referred to globally is mostly rooted in power, poverty and inequality and not in the physical availability. Scarcity is driven by a combination of three principal forces, viz. depletion and degradation of the resource, population growth and unequal distribution or access, however the underlying cause of scarcity is largely institutional and political. In some countries the scarcity experienced is due to public policies that have resulted in overuse of water through subsidies and underpricing of water (Postel 1996; UN-HABITAT 2006; Watkins 2006).

Postel (1996) puts forward a view by addressing water scarcity through the establishment of priorities and policies for allocating water among competing uses. While supply side options cannot be ignored, more efficient and productive use of water should be encouraged and institutions should be better shaped to manage the projected era of water constraints. Investments in conservation, recycling and increased efficiency are more economical than establishing new sources of water such as new dams or desalination (WCD 2000).

Dealing with water scarcity and access requires a shift in thinking that recognises that the subject has moved from simple supply reliability and demand reduction to more complex issues of variable water quantity and quality. This shift requires social, cultural and economic adaptation. The level to which a society can adjust to uncertain or undefined change has been termed its "*adaptive capacity*" (Jeffrey and Gearey 2006; Smit and Wandel 2006). Societies with a high adaptive capacity will be able to respond with fewer social, financial and environmental costs and vice versa. Generally the poorer communities and nations will be harder hit by climate change impacts, not necessarily because of the direct impacts per se, but rather because they are less likely to be able to respond and adapt to those impacts. The prevailing

conditions of water scarcity due to climate variability and/or change, result in the cost of water supply rising, and this in turn increases the unit selling price . The ability of the society to absorb these additional costs, whilst still ensuring access to basic services for the poor by means of subsidies and grants, will depend on the level of its adaptive capacity (Mukheibir 2010).

Adger and Vincent (2005) warn that *adaptive capacity* only highlights the available resources available for adaptation and not the processes for decision making. Therefore the idea of *adaptive capacity* is limited to helping to understand that resource demand management only becomes an option once societies have developed their political economies to a point where these alternatives can be considered. The rising level of resource scarcity is met through the higher level of adaptive capacity in the form of high levels of financial, human and institutional capital. The opposite would then also be true, that some societies are not able to cope with the stress since they have exhausted their internal adaptive capacity to implement the demand management policies. The trend can be altered by means of external interventions such as foreign aid, however this is rarely sustainable in the long run (Turton 1999b).

The interrelationship of *water scarcity* and the *adaptive capacity* of a society was first developed by Ohlsson (in Turton 1999b). Whilst an inadequate level of development could be attributed to scarce resources ("first order scarcity"), this would be compounded by the low level of adaptive capacity within a society i.e. "*second order scarcity*". By shifting the focus onto *second order scarcity* instead of the resource scarcity, an improved understanding can be achieved of why and how certain societies cope with resource scarcity better than others do (Turton 1999b). For example, Israel has experienced water scarcity, but owing to its high social adaptive capacity, it is able to avert the debilitating conditions of water poverty. Whilst in Namibia, the country has high levels of water scarcity as well as a low level of adaptive capacity, which in turn causes the country to experience social stresses due to constant water shortages (Turton 1999a; Reid and Vogel 2006).

Approaches to access and scarcity in the water sector

In addressing this issue of water as a key development goal, three distinct discourses have emerged, viz.:

a) Sustainable development

b) Integrated water resources management

c) Climate change adaptation

Whilst they all actively champion water as vital for national and local development, their policy agendas differ and often operate in parallel with little or no intersection or interaction. The development sector has preoccupied itself with the concept of universal access to water and embarked on local level projects and programmes to achieve this aim. Little or no attention has been paid to the issue of water scarcity. This field has been left to the water resource management sector who have for the most part addressed this problem by concentrating on large infrastructure supply schemes and more recently with the introduction of demand side management strategies. More recently the issue of water scarcity has been publicised by the projections of climate change impacts such as drought and flooding, which cause water shortages and unsafe water respectively. The climate change discourse concerns itself with the consequences of long term climate induced impacts on water scarcity, and together with water resource management, has not focused on equitable access to clean water.

a) Sustainable Development

The concept of "*sustainable development*" has been accepted world wide, following the 1992 Earth Summit in Rio de Janeiro and the adoption of the UN's Agenda 21. However, how to achieve this has been the focus of much debate ever since. The three key factors of sustainable development are defined as social, environment and economic. The economic sector is driven by the consumption of goods and services in order to improve human welfare and is driven by factor such as growth, efficiency and stability. The development and transfer of technology is further influenced by the economic level of a society. The environmental sector focuses on the protection of the integrity and resilience of the ecosystem and is affected by pollution and natural resource depletion, and finally the social sector is geared mainly towards the enrichment of human relationships through empowerment and good governance (WCED 1987; Munasinghe 2001).

If this concept is used to understand the water sector more fully, we can see that for a water system to be sustainable and to meet the objectives of sustainable development, it should address all three components, which have both drivers as well as impacts/barriers. In the social context the key driver would be the equitable distribution of water, whilst the barrier would be local institutional management, technical

capacity and the level of social capital available to withstand impacts such as water shortages. Preservation of the ecological reserve would be an environmental driver and impacts due to climate variability, flooding or droughts and pollution would be threats. Economically viable water provision with appropriate pricing structures would drive the system towards a sustainable path, but the poverty levels and low levels of capital would undermine these efforts.

Figure 1: The concept of sustainability and the water sector (after Allan 2001)

The hydropolitical discourse at various levels of government is one where priorities associated with these three dimensions play a role in determining the uses and policy outcomes in particular society. Figure 1 provides a graphical illustration of the developmental priorities of the three sectors. The water needs of society are focused around domestic use and subsistence agriculture in the developing world. Economic demands require water for industrial and commercial agriculture, whilst water for the ecological reserve is often recognised or sacrificed to meet the other two needs. For water resources to be managed in a sustainable manner, water management policies have to prioritise interventions and resource allocation so that society, the economy, as well as the environment are sustainable. Political processes at national and local levels determine whether this balance is achieved or not (Allan 2001). If the balance is not achieved, water shortages and stresses will be experienced.

The sustainable development approach usually focuses on local resources and impacts in relation to the provision of basic services and livelihoods. Coping strategies are developed to deal with short term water shortages. Scarcity is viewed as one of many barriers to service delivery and no special attention is given to it. It has for the most part been argued by this sector, that scarcity is human induced and that distribution is the problem that retards the access.

The impending crises of poor *access* to safe water and the related spread of waterborne diseases, led in part to the United Nations General Assembly at the turn of the century to adopt the Millennium Development Goals (MDGs). These include amongst others, a specific water related goal aimed at

reducing the proportion of people without adequate access to affordable water by half by 2015 (UN 2000). The MDGs were proposed and driven by the development community and developing countries, primarily seeking financial assistance to address the lack of water provision in their countries through programmes aimed at building technical and institutional capacity as well as physical infrastructure. However, the focus of the MDGs is on the actual numbers of people with access to water and fails to address the mechanisms used to achieve these goals or how to sustain them in future.

Key MDG's related to poverty reduction, water, food, energy and health are critically influenced by climate change and climate adaptation measures should therefore be tackled in the context of development policies (Halsnaes and Traerup 2009). Climate impacts on sustainable development policies have been limited to those induced by climate variability such as flooding and periodic droughts that result in localised water shortages and are dealt with through disaster management interventions. Coping strategies are seen as short-term interventions that are undertaken to manage these short term stresses. It is often hard to determine a specific factor since people react to range of stresses and factors at any given time and hence it is difficult to identify the part of the strategy that react directly to the climate impact (Ziervogel and others 2005). It would seem logical therefore that climate impacts are intrinsically bound in the sustainable development approach, however until recently little reference had been made of climate change impacts in development plans other than disaster management plans for droughts and floods (Huq and others 2006). Longer term impacts due to climate change such as the gradual change in rainfall patterns still do not fit into most planning horizons which are usually politically and financially constrained.

b) Water Resources Management

The predominant focus of water planners and managers has been to meet growing demands for water by augmenting the supply through technical solutions based on medium term (<30 years) demand projections. As these large infrastructure solutions have become less attractive, the development of new and the revival of traditional ideas such as integrated water management and rainwater harvesting have come to the fore (Gleick 2003). Molle, Turton and Ohlsson have observed a three stage progression of water management, starting with augmenting supply with infrastructure, then moving to water conservation and demand side management and finally shifting to re-allocation of water from one user to

another by shifting to a higher value use. These responses to water scarcity have been implemented at both national and local level. The authors acknowledge that in practice, however, these stages do not always occur in a linear fashion and often occur concurrently or in a different sequence, depending on the level of strategy development. Interlinked with this, is an understanding of the socio-economic context and the political economy of water resources development and the specific response of communities that face water scarcity. There are trade offs between sectors that need to be taken into consideration (Turton and Ohlsson 1999; Molle 2003).

Integrated Water Resource Management (IWRM) is an approach which focuses much of its attention on the issue of water as a resource and the scarcity thereof. It is usually undertaken at a regional or catchment level where medium term resource decisions are made to meet growing water demands. Despite the fact that (IWRM) has been put forward as the most sustainable way to incorporate multiple competing and conflicting demands for water resources since the first UNESCO International Conference on Water in 1977, the most common criticism is that there is still a large gap between theory and practice. The concept of IWRM remains a normative theory and the set of principles underpinning it have not found their way into the socio-economic development policies and legislation of many countries (Maganga and others 2002; WEHAB 2002; Jeffrey and Gearey 2006). IWRM needs to take on two missing elements, namely the impacts of climate change and the issue of equitable access. The approach incorporates environmental issues and equity in the user allocation sense, but it does not however concern itself with issues of affordability and hence access at the household level.

Further, although listed as a key principle, recent formulations and applications of IWRM have not sufficiently focused on poverty reduction or livelihoods. Given the vast analytical literature on poverty, IWRM has yet to developed a coherent analysis of the relationship between poverty and the access to water, specifically with regard to the productive use of water. The role of water access and use in livelihoods of the poor needs special attention (Maganga and others 2002; GWP 2003). The message from the 2006 World Water Forum (IISD 2006) was that the water crises was largely a governance crises typified by poorly organised institutions, weak legal frameworks, limited human and financial resources, corruption and lack of transparency, and a limited involvement of stakeholders in decision-making. Current methods of drought management was viewed to be largely crisis-driven and there was an

expressed need for a more risk-based management approach to planning at national and regional levels. There was a general call for a new approach to water management, including decentralisation and increased public involvement and the development of IWRM as part of broader national and local planning. This lead to specific recommendations being made by the Global Water Partnership (2003) to ensure that IWRM addresses poverty reduction which included, amongst others, the need to abandon sectoral approaches to water management, the need to shift the paradigm from thinking about water for drinking only to include the productive use of water and the recognition that competition over scarce resources should not discriminate against the poor. However, despite these explicit suggestions, the debate still remains silent on how to ensure basic access to water services for the poor under a climate induced water scarcity scenario. Further, current water management systems are still characterised by sectoral fragmentation. The lack of communication and planning between spheres of government, horizontally as well as vertically, results in disjointed policies and planning. This is compounded by the fact that people have not been involved in planning and decision making at a local level (Ballweber 2006).

Whilst the key focus of IWRM is the sustainable management of resources, the inclusion of climate change impacts would seem like a natural fit. However, the issues around climate change impacts on water resources are only more recently being considered by regional water managers, hence the inclusion of these issues is still in its infancy and need to be fully integrated into water planning methods. It has been argued by some, such as Kabat et al (2002), that Integrated Water Resource Management should be the approach for coping with natural climate variability and the precondition for adapting to the highly uncertain consequences of global warming and associated climate change.

However, based on the concept of adaptive capacity, the notion of *adaptive management* has also been advocated by others as the paradigm within which natural resource planners and managers should operate, since resource management systems, like ecosystems, need to be able to adapt to sudden changes in the system (Jeffrey and Gearey 2006). This requires a paradigm shift in water management from a "prediction and control" to a "management as learning approach", where water management is flexible enough to adapt to changing socio-economic and environmental conditions (Pahl-Wostl 2007). The main objective of *adaptive water management* as defined by Pahl-Wostle et al (2005), is to enhance the

adaptive capacity of a water system based on a good understanding of what determines *resilience* and *vulnerability* in that system. The focus of the adaptive capacity should be on the management of socio-ecological systems, while vulnerability primarily refers to the exposure to adverse impacts.

Adaptive water management has therefore been put forward as the timely extension of IWRM to cope with these challenges, since it is aimed at increasing the adaptive capacity of water management areas based on the good understanding of key factors that determine its vulnerability. This would also take into consideration the environmental, technological, economic, institutional and cultural characteristics of catchment and supply systems. Despite being silent on the issue of ensuring affordable access to water, it has the potential to be the encompassing paradigm for adaptation to contemporary climate variability and the prerequisite for coping with the still uncertain impacts of climate change on the water cycle (Turton 1999b; Pahl-Wostl and others 2005; Schulze 2005; Jeffrey and Gearey 2006).

Regrettably, this adaptive management approach does seem far off at this stage. Observations by Rayner et al. (Rayner and others 2005), indicate that currently there is a limited use of climate forecasts in the operation and maintenance of water supply industry, which rely heavily on the large infrastructure to deal with irregular weather events and to ensure reliability of supply. There is non existent infrastructure planning based on the greater predictability of short-term climate fluctuations. This limitation is due mainly to contractual constraints, regulations and economic considerations. They further found that the principal factors affecting the use of new weather and climate information was conservatism and complexity. Water resource managers rely on traditional planning methods so as to avoid exposure if improved outcomes are not met. Probabilistic forecast information is complex and not well understood by water resource managers and viewed as unreliable. This is exacerbated by institutional resistance to externally generated information (Rayner and others 2005). It is not surprising therefore that water resource managers have been reluctant to engage with climate agenda and have paid little attention to and are often unaware of the projected impacts of climate change on future water resources.

Climate change will force a change to traditional water resource management and planning, which is currently based on the premise of static long-term climate. The projected global warming will have a substantial destabilising effect on the hydrological cycle, resulting in greater variability in precipitation

and therefore stream flows, and the intensity of extreme events such as drought and flooding. These projections currently come with great uncertainty however and given that the climate change science is still evolving and precise long term predictions are not possible, water management needs to be adaptable to changing circumstances (Pahl-Wostl and Kabat 2008). Therefore current risk management approaches and tools will need to also incorporate climate scenario analysis and vulnerability assessments thereby leading to a systems approach to water resource management and planning (New 2002; Bergkamp and others 2003).

c) The climate change adaptation discourse

Climate impacts are transforming the nature of global water security. Firstly through climate variability and secondly in the future through projected climate change impacts. Callaway (2004) argues that there are more conceptual similarities than differences between the adjustments that are made to cope with climate variability (variations in the mean state of the climate on all temporal and spatial scales beyond the individual events of the weather) and those made to adapt to climate change (any natural change in climate over time, whether due to natural variability or because of human activity). The obvious similarity is that the aim of both types of action is to avoid meteorologically induced damages when predicting them is subject to some error. Both actions have the potential to improve society, whilst making decisions under some risk, both involve reallocating scarce resources to make the adaptive adjustments. The major difference, according to Callaway, between variability and change is that historical records are more reliable for planning for variability than the reliability attached to climate prediction models, in other words, the variability in the existing climate is much easier to plan for than the variability associated with alternative climates. Not withstanding that many poorer countries and communities are unable to manage even their current variability, not because the necessary strategies are unclear, but because they lack the financial and technical capacity to implement them (Mukheibir 2007).

While the threat due to rising temperature is firmly established on the international agenda, the role that this will play in future climates is less certain. Global warming will transform the hydrological patterns that determine the availability of water. Global modelling exercises point to complex outcomes that will be shaped by micro-climates. Managing uncertainty will therefore become key in ensuring water supplies. Water infrastructure is critical in reducing unpredictability and mitigating risk. However, globally there

are large inequalities in access to infrastructure. For example The USA stores about 6000 cubic meters of water per capita, whereas Ethiopia only 43 cubic meters. Even wealthy countries are exposed to climate impacts and risks, but they have the resources and capacity to ensure a lower vulnerability. It is usually the poor who bear the brunt of water related shocks (Watkins 2006).

The climate change discourse recognises the impact of climate induced water shortages and stress on the vulnerable and poor communities due to their lack of resilience (Ziervogel and others 2005; IPCC 2007a). The IPCC (2007a) defines adaptive capacity as "the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences". However, it is interesting to note that this definition of adaptive capacity explicitly confuses the less predictable aspects of climate change with the more predictable gradual changes, and is evidence of how the failure to separate them out when addressing vulnerability has spread to the level of developing practical responses. Midgley (in Midgley and others 2007) proposes that this confusion be resolved by separating out the adaptive capacity needed for impacts of and vulnerability to unpredictable extreme events from the more predictable and gradual changes in climate. Two types of adaptation are therefore suggested viz.:

- *Resilience-type adaptation* aimed at reducing system sensitivity and increasing system resilience, especially in anticipation of extreme climate events
- *Acclimation-type adaptation* aimed at reducing system sensitivity to gradual changes in average climate conditions, in anticipation of predictable trends in stimuli, or key thresholds in climate drivers.

Due to climate variability and the incidence of extreme events a need currently exists for resilience-type responses, such as disaster management and insurance approaches, to cope with this risk. This would involve enhancing the capacity of responses (infrastructure and human capacity) that are already in place. However, under gradual climate change conditions a need would exist for acclimation-type adaptation. This splitting of two major adaptation types facilitates a focus on two distinct sets of practices, and could even allow water resource management strategies and finance for them to be prioritised in a more logical way.

The climate change focus to date has mainly been on mitigation of GHG emissions in terms of policy development and financial support and has been structured under the United Nations Framework Convention on Climate Change (UNFCCC). Stern (2006) therefore argues that an equitable international response to climate change should not just include action on mitigation, but also on finding ways of working with vulnerable countries to ensure that their growth and poverty reduction goals are not compromised, since the adverse effects will be felt most acutely by poor people in developing countries. This is mainly due to their geographic and climate locations, their high dependence on agriculture and natural resources, limited human capacity and financial resources to cope with climate impacts. However, support for adaptation in developing countries is fragmented and piecemeal. Very few countries have prioritized adaptation in key planning documents such as poverty reduction strategy plans (PRSP), integrated resource management plans or urban development plans (Watkins 2006).

The response of the international community to this problem of climate change is organised under the UNFCCC, which was adopted at the 1992 Rio Earth summit. The present approach by the UNFCCC and other UN agencies is to separate climate adaptation from the normal development and management activities. The result is that much of the adaptation funding has been allocated to capacity building around climate change and has not included the provision of adequate funding for the implementation of adaptation strategies (Bouwer and others 2006). As adaptation activities can be capital intensive and the benefits highly localised and immediate, the real challenge will be the development of secure, adequate and predictable funding to meet priorities. Local actions and initiatives will need to be harnessed to improve their resilience.

Whilst the integration of climate change adaptation is already happening in developed countries, it is not evident in developing countries. Institutional change and the development of local government adaptive capacity is sadly lacking (Huq and others 2006). Efforts made to integrate adaptation to climate change have proven relatively successful in the agriculture sector, a sector which has a long history of working at mitigating drought impacts. At the national policy making and planning level in other sector such as the water sector, this has not been the case (Huq and others 2003). Adaptation actions should be integrated into development policy and planning at every level and across all relevant sectors. It should not be an add-on or an after thought. Development itself is key to adaptation, since adaptation should be an

extension of good development practice and should reduce vulnerability. All levels of government should ensure that policies, programmes, budget frameworks and projects take account of climate change and adaptation strategies.. However, there is little evidence of this (Burton and others 2002; Stern 2006; Mukheibir 2008). Many development practitioners view climate change as a long-term problem that does not compare with the urgent needs such as food security or HIV/AIDS programmes. The climate change discourse is based on long term projections, typically 50 - 100 years, whereas most development scenarios are for a much shorter period, for example the Millennium Development Goals are set for 2015 (Huq and others 2006).

The linkages between access to water and climate impacts on water supplies are less known or understood by decision-makers and planners, particularly in developing countries, due to the fact that they normally focus their attention on conventional development strategies like growth, employment and poverty alleviation. Therefore adaptation strategies to climate impacts, will only be taken seriously by decision makers if they are successfully integrated with national and local sustainable development strategies in pursuance of the local development goals and should not be viewed as an add on or different planning process.

Whilst responses to climate change impacts form a small subset of sustainable development agenda (Munasinghe 2001), they have to a large extent been pursued by different communities and have had different scientific and political discourses. The climate change scientific discourse has revolved around the Intergovernmental Panel on Climate Change (IPCC) through its four assessments. In the fourth assessment it is proposed that the interaction between sustainable development and climate change be given a priority (IPCC 2007a). The political discourse has been debated through the United Nations Framework Convention on Climate Change (UNFCCC), but the agenda has mainly focused on mitigation of greenhouse gas emissions (Huq and others 2006). There has been a shift in focus in recent years, where policy makers and academics have begun to debate the issues surrounding adaptation to future climate impacts and to consider the implications for the future (LEG 2004). However, this has mainly been focused at the national or regional level. For example, National Adaptation Plans of Action are developed at national level, but the resources and capacity at local level to deal with the implementation and operational issues are not always considered (IPCC 2001; Burton and May 2005).

The climate change agenda is largely driven by the scientific community, who by broad consensus believe that global climatic change is a real problem and that it will alter the hydrological cycle in a variety of ways. Previously water planning and management relied on the assumption that the future climate would be similar to the past. Burton and May (2005) warn that it is misleading to refer to climate change impacts only, since the consequences of climatic induced events are a result of an interactive process between human activities, or lack thereof, and climate. They argue that the failure to adapt water management systems well enough and quickly enough account for larger portions of water problems than the actual or projected climate change impacts. The IPCC too urges water managers to begin "a systematic re-examination of engineering design criteria, operating rules, contingency plans and water allocation policies" and states with high confidence that "water demand management and institutional adaptation are the primary components for increased system flexibility to meet uncertainties of climate change" (MIND 2006).

The recent IPCC Fourth Assessment Report now shows signs of recognising the importance of climate change on local water resource management. Chapter 3 of the Impacts, Adaptation and Vulnerability report (IPCC 2007a) specifically mentions that current water management practices are unlikely to be adequate in reducing the negative impacts of climate change on water supply reliability. It suggests that improved incorporation of current climate variability in water related management would improve the resilience to future climate change impacts (Kundzewicz and others 2007). However, the focus of the IPCC is still at a regional and national scale leaving local issues such as equitable access and sustainable institutional capacity to manage climate impacts unaddressed.

According to Burton and May (2005), other forums outside of the Convention and IPCC are focusing much of their attention on issues of declining water resources, lack of access to safe drinking water, efficiency of use, water rights and water management. Many of the actions required now to deal with current water scarcity are being advocated by the Convention as adaptive measures for future climate impacts. The development community however, argues that these measures should be funded and implemented now to avert the current crises and thereby minimising the future crises.

The failings of the current discourses

Primarily the issue of access to basic services such as water is located in the sustainable development discourse. The accepted definition for sustainable development requires that social, environmental and economic considerations be addressed. For a water supply system the delicate balance between the consumption of resources to meet basic needs, the preservation of the natural resources and the equitable access to resources through good social governance is key to achieving sustainable service.

The attainment of development goals such as those set out in the Millennium Development Goals, is seen as the key driver for basic human health and wellbeing. The focus has been predominantly short to medium term and the service is delivered at the grassroots level through local projects and programmes. Table 2 has been developed to summarise the key features of the three discourses. It is evident from the literature that sustainable development is a conceptual objective while climate change is a reactive response to a changing global environment. IWRM falls somewhere in the middle of the continuum. IWRM is a planning and management tool and approach, while climate change is a projected impact that needs to be incorporated into this planning and management. Whilst it would intuitively seem that there should be some overlap in the policy responses, they are pursued by predominantly separate scientific and political communities and the integration of the ideas and approaches does not happen easily. This is due mainly to the fact that all three operate at different temporal, spatial and institutional scales. They also have dissimilar foci and approaches and are informed by unrelated academic and policy environments.

Table 2. The difference between Sustainable Development, Integrated Water Resources Management and Climate Change Adaptation discourses

What has not been clearly articulated by any of these discourses, is a recognition that a change in resource constraints due to climate change will bring about a change in water pricing, affordability and access. It has been demonstrated that the cost of supplying water in a rainfall constrained future due to climate change will increase faster than under an unchanged climate, which in turn will result in the poor being adversely affected (Parry and others 2009; Mukheibir 2010). Alternative supply and funding

arrangements will need to be made, and society as a whole will need to demonstrate increased resilience under these conditions.

An integrated approach

Given their differing approaches of the discourses discussed above, there is a need to bring integration into plan and management around the goal of equitable water access. By focusing on this goal as a cross cutting issue, it can be conceptually demonstrated that the integration and co-ordination of these three sectoral discourses is key to sustainable water provision and hence sustainable development. Key to this is the development of adaptive capacity by addressing the political, institutional and economic aspects of water management. Political expediency and short-term planning horizons, together with poor institutional capacity, have in the past resulted in the entrenchment of the vulnerable poor. The additional impacts of climate change are likely to put undue pressure on the attainment of the MDGs and further exacerbate the low levels of resilience and lack of water access amongst the poor.

Figure 2: Water access nexus

As a tool, IWRM has been proposed to ensure sustainable water services (Kabat and others 2002), but to achieve this it needs to more proactively take on two missing elements, namely the impacts of climate change and the issue of equitable access. The current approach incorporates environmental issues and equity in the user allocation sense, but it does not, however, usually concern itself with issues of affordability and hence water access at the household level. The key focus of IWRM has been the sustainable management of resources and therefore the inclusion of climate change impacts would seem like a natural fit. However, the issues around climate change impacts on water resources are only more recently being considered by regional water managers, hence the inclusion of these issues is still in its infancy and need to be fully integrated into water planning methods.

In order to address future climate change impacts, a distinction between the responses to climate variability and climate change should be made. Climate variability affects water resources through

periodic droughts resulting in short term water shortages at local municipal level. In order to address these shortages, short term strategies are employed to meet basic domestic requirements. Much of the academic and policy focus to date has been on the impact of climate variability, such as droughts and floods, albeit often reactive (Holloway 2005). On the other hand, climate change is projected to increase the frequency of droughts which will in turn have the impact of more frequent water shortages. The implementation of long term adaptation strategies is required to reduce the vulnerability to future frequent droughts in order to meet development goals. This approach for coping with natural climate variability and the precondition for adapting to the highly uncertain consequences of global warming and associated climate change impacts is achievable through *adaptive water management*. This is schematically depicted in Figure 3.

Figure 3: Adaptive water management and the relationship between climate variability and climate change (Mukheibir 2007)

By coping with present-day climate variability in water resources management, which is already a formidable challenge, resilience to any further impacts of climate change will be improved (Kabat and others 2002). Adaptive water management strategies that are employed against climate variability, if properly screened, could be used to address future climate impacts due to climate change. The screening of these strategies should consider the second order scarcity in the society in terms of their adaptive capacity and resilience (Mukheibir 2007). With the reduction of second order scarcity comes improved resilience to climate variability. As the adaptive capacity is developed and strengthened and more of the climate variability is accommodated in water management and planning, so too are the negative impacts due to climate change minimised.

Hence the way forward is to build on the adaptive water management paradigm, by including access and affordability of water as a driver, thereby developing a holistic water management discourse. This approach to adaptive water management can address the prospect of water scarcity whilst ensuring equitable water access under future projected climate impacts. It should therefore be viewed as the encompassing paradigm for adapting to contemporary variability as well as being the prerequisite for coping with the relatively uncertain impacts of climate change in the water sector.

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