

Sustainable catchment management: principles and practice



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What is meant by the “ world water crisis”? Critically assess the contribution of River Basin Management in addressing this crisis

The world's freshwater is commonly discussed in the literature as being a finite resource under increasing pressure from the greater demands being placed upon it globally (Postel 2000, Hamdey *et al* 2003, Oki and Kanae 2006, UNEP 2007). It has consequently become a highly contentious resource, and in recent years the focus of much debate on how best to manage it; with the latest favoured paradigm (particularly in developed countries) being that of holistic sustainability – achieved using the ‘ best practice’ of basin-wide management (Biswas 2004, Watson *et al* 2007). Such an approach is particularly emphasised in key policies such as Agenda 21 and the Water Framework Directive, with the latter enforcing the creation of River Basin Management Plans by law for all EU member states. This paper will discuss whether there really is a world water crisis, and if so to what extent river basin management (RBM) can help to address this using case examples such as the Murray-Darling basin to discuss this in context.

According to the research of Oki and Kanae (2006 pp1068) the global consumption of renewable freshwater resources is well below its Malthusian limits, with only 10% of the maximum available blue water and 30% of green water being presently used. However, because its distribution both in quantity and quality for purpose is spatially and temporally uneven – as shown in figure 1 – water stresses exist through a demand and supply imbalance. Gleick 1998, Hamdey *et al* 2003, and UNEP 2007 amongst others cite figures such as “ already 80 countries with 40% of the world population suffer serious water shortages” (Hamdey *et al* 2003 pp3) and “ more than a

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billion people in the developing world lack access to safe drinking water” (Gleick 1998 pp487), which suggests that water stress is a major issue (as reflected in the Millennium Development Goals); and with population growth/demographics (figure 2), economic, standard of living, and climatic factors set to change, such stresses are expected to worsen on the whole through increasing the imbalance. This is especially true for developing countries since an estimated 90% of the 3 billion people expected to add to the global population by 2050 are expected to reside in such countries – with many of which already experiencing high water stress (UN 2007 cited UNESCO 2009). At what point down the line an actual absolute crisis at a nation scale is reached is still yet to occur; although given the social and economic value attached to water, and its three-dimensional effect upon food supply, ecosystem health, and standard of living for example, it may already indicate a crisis is underway (Newson *et al*/ 1999 cited Newson 2000). This is especially true if freshwater access is considered as a basic human right (Gleick 1998).

Assuming this, RBM is often discussed in the literature as being a viable management option to address the crisis, since its approach is holistic and all-encompassing. Its current favour comes from the fact that unlike the traditional response to water shortages – assessed through developing more supplies often via unsustainable sources and ‘hard engineering’ practices such as damming rivers (Hamdey *et al*/ 2003) – it tries to achieve long term sustainability through encompassing land-use planning, environmental management, and agricultural policy into the management of all surface and subsurface water within a catchment. This theoretically allows for all of the

direct and indirect natural and anthropogenic demands placed upon the resource to be addressed and met under a best-practice regime to achieve an optimal relevant management outcome.

A classic example of where such a policy has been successful is in the Murray-Darling basin, southeast Australia. The RBM regime here is a highly evolved form of institutional arrangements first started in 1917, and consequently modified, to meet the desired outcomes and changing pressures on the 1 million Km² five jurisdictional state catchment. At its heart the scheme seeks to “ promote and coordinate effective management planning for equitable, efficient and sustainable use of water, land and other resources” (Pigram 1999 pp108), which it achieves through a ‘ hydraulic approach’ using top-down policy making and bottom-up implementation, coordinated through the central Murray-Darling Commission (Shar et al 2005). In doing this it allows for all of the key stakeholders within each state to meet and discuss how best to manage the water resources to maximise the resultant biophysical, economic and social interests not only within each state (and its respective water share), but for the whole catchment.

Theoretically this coordinates the upstream-downstream interests and encourages more productive/efficient use of water through improved technology such as crop per drop (Postel 2000), which in turn allows all of the water demands to be attained equitably. And, combined with the top-down governance system setting standards which need to be reached by every state regarding water quality and quantity, ecological requirements and permitted degradation levels through land use policies, it ensures that management is not static and behind the changing catchment pressures

upon the water resource. This is not to say however the system is perfect since its effectiveness depends on the cooperation of each state government, and as of yet no true full sustainability has been achieved (Pigram 1999). However, with regards to the world water crisis it is clear to see that in this instance, along with many others, RBM is having a positive impact. This is because it is encouraging through laws and other means the more efficient and equitable use of water (Postel 2000), whilst regarding the whole basin and its long term demands and pressures such as climate change. In doing so it may lessen the effect of future crises/pressures through being proactive.

Similar RBM regimes also exist under other political systems such as throughout the whole of the European Union (due to Water Framework Directive legislation) and South Africa (since 1998). In the latter Gregersen et al (2007) states that although the regime is working it is not yet sustainable, since such management systems take several years to develop and offer no ready made solutions. Therefore at its national level it is not fully able to address the water crisis, although it seemingly is on the way to try to do so through using a management system which looks to achieving this from the outset.

It must be said however that most of the successful RBM regimes are in developed 'formalised society' countries where the fundamental water stresses are often far lower in the first instance (see figure 1). Such systems cannot be directly transferred between political institutions easily due to the context in which the regime was fundamentally formed to meet within the founding country regarding the hydraulic and climatic conditions,
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demographics, socio-economic conditions and the structure of the water sector (Barrow 1998, Hunt 1999, Shar et al 2005). For example Hu (1999), Malanu et al (1999) (cited Shar et al 2005) and Hunt (1999) each found that the Murray-Darling RBM system could not be successfully transferred to the Chinese, Vietnamese and Solomon Island contexts because of such issues; with Shar et al (2005 pp46) arguing that transferring RBM regimes between developed and developing countries is particularly problematic since the problems developing country find critical have either remained unresolved or irrelevant in developed country river basins such as ground water exploitation. Thus in regard to the world water crisis it provides little use in this sense, especially since the greatest stresses/crises are expected to occur here.

Hunt (1999) therefore argues that the contextual fit between policy development and application is key to managing the water resource successfully. In setting the correct framework to set play and play in provides an effective environment to address the water crisis in, whether through RBM or not. In some cases I would also argue that to address the current water crisis RBM can only be used as part of the solution, due to the interconnectivity of the water resource with standard of living (relating back to the Millennium Development Goals) and economic development. If full RBM sustainability is strived for under the current conditions, inclusive of the environmental requirement, it may only serve to worsen the current crisis such as in Jordan – which withdraws some of its supply unsustainably from non-renewable aquifers (Macoun and El Naser 1999). The same is true for other basins globally such as in the Colorado, Tennessee and Yangtze river

basins, since in order to meet their past and current demands, supply had to be increased through building dams for instance. This could be seen in some cases as being unsustainable due to the impact it has on the basin, and even though the two former river basins are now managed under RBM regimes (Newson 2009) they are operating under modified conditions. RBM still has value however in promoting more efficient water use (Postel 2000) and sustainable ethical management, so should not be completely ignored in management. The contextual fit of countries as a whole is important in determining the best approach to address the world water crisis.

RBM may also fail in addressing the world water crisis too if it fails to be effective itself in the first instance. For instance since RBM seeks to achieve equitable sustainability (Barrow 1998), unequal power sharing may result in such a failure. To exemplify this if a dam was allowed to hold back more water for power generation it would put increasing pressure on the quantity of flow for the ecological needs and irrigative agriculture uses amongst others. Similarly if a factory was allowed higher pollution levels then the changes in the water quality could draw a system closer experiencing a water crisis (assuming it was already highly stressed). This is especially true if a non-integrated RBM regime is used, since the different interests of each RBM stakeholder groups, such as land owners, farmers, developers and conservationists would prioritise their needs over others. This consequently may be ineffective due to the differing overall outcomes, needing some coordination and compromising to a certain degree to be effective in terms of long-term holistic management.

A similar failing may occur within international river basins also if a common-goal transboundary management agreement cannot be established in practice – even if it is agreed upon politically. This is the case today between Israel and Palestine despite the fact of the ‘ road to recovery’ (common goal) plan. Israel in 2003 abstracted 95% of the water from the diverted Lower Jordan to meet its own abstraction needs and left Palestine with only 5%. Consequently Palestine is in a water crisis since it cannot meet its own water needs (Frederiksen 2003). To be effective therefore in the first instance RBM plans need to be authoritative, equitable, coordinated and true to RBMs initial purpose. Only then can it help in addressing the world water crisis.

In conclusion therefore it can be successfully argued that RBM is a worthwhile management option to pursue in relation to addressing the world water crisis. Where such regimes are well established and operational, such as in the Murray-Darling catchment, its sustainability approach to management allows for all of the demands and threats/pressures to the freshwater resource (such as excessive nutrient runoff from poorly managed land) to be identified and dealt with equitably and accordingly within the basins long-term carrying capacity. But, given the contextual fit of each country with regards to its current resource base, water pressures, and demands/needs, it may mean that in the grand scheme of things RBM may not be the most suitable management option to address the crisis with on its own. Interestingly RBM is according to Shar et al 2005 harder to implement in developing countries due to its developed background, but it is such countries where the water stresses are already at high stress levels and expected to worsen from most through the predicted population growth and

climate change pressures (UNESCO 2009). Only time will tell how useful and politically favoured RBM is in addressing the crisis, and whether it is continued to be used alone or alongside other water management concepts such as international 'virtual water' sharing.