

water

research findings for development policymakers and practitioners

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The reality of river basin closure

As societies develop, they increasingly control, divert and consume water for agriculture, industry and domestic use. But these demands for water are causing shortages in many areas of the world and leading to river basin closures. How can people change their approach to water use?

A river basin is said to be closing when there is no longer enough water to meet both social and environmental needs and demand exceeds the amount of water available. River basin closures affect 1.4 billion people worldwide. Research from the Stockholm International Water Institute, in Sweden, and the International Water Management Institute argues that people need to realise and respond to the problems caused by river basin closure.

As rivers flow to the sea, they not only meet the needs of people, but sustain ecosystems and dilute pollution. The Jordan River basin is an example of a closure. Population growth, urban development and irrigated agriculture have all caused water shortage. The lower basin has also been affected by upstream transfers in Israel and Syria.

Closed river basins can be managed by reducing water use or increasing water supply. Transferring water from other basins, using groundwater and desalination (removing salt from sea water) are all options for increasing supply.

However, some management approaches can create more problems than they solve. For example, there is often a lack of information about the variability of water supply and a lack of clarity about who has a right to water. Politically, it is often easier to find short-term answers to water shortages, ignoring the future problems these create.

The research shows:

- In six case studies of closed river basin management, there was not one example of water being allocated for environmental flows.
- Sustainable management of closed river basins is possible, but requires some users to give up part of their water supply.



Over the past two decades, Israel has over-pumped the Sea of Galilee and the water levels have dropped dramatically. Scientists worry that the lake may soon reach the level where salinity seepage into the fresh water could cause irreversible damage. The upper Jordan River and its tributaries – the Sea of Galilee, the Yarmuk and the lower Jordan River – currently supply approximately one-third of Israel's water.

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- River basins often cross national boundaries. Different national approaches to water management increase the difficulty of finding solutions.
- Upstream and downstream activities are often in conflict, leading to serious consequences for lakes, deltas and coastal fisheries.
- The growing demand for biofuels is likely to increase the pressure on river basins. Increasing irrigation in many countries will also make river basin closure more likely. There are few examples of societies successfully coping with river basin closure, and no single solution to the problem. Several possibilities exist, however, that could be adapted to different environments. To be successful, there must be:
 - effective processes in place for negotiating water allocations between countries
 - better accounting of water flows; this is essential to support negotiations
 - mechanisms to ensure who has what rights to water
 - in closed basins, reallocation of water from richer to poorer people
 - systems analysis to understand how changes in one part of a basin affect others.

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'Wake Up to Realities of River Basin Closure', *International Journal of Water Resources Development*, 24 (2), pages 201 to 215, by Malin Falenmark and David Molden, 2008

The challenge of inter-state water management

India's Krishna River Basin covers three states and the river is used by 70 million people. This presents considerable challenges for managing water use. The overuse of water has led to water shortages in some areas, especially during droughts, and conflicts between states. How can such a vast water resource be managed effectively?

Research from the International Water Management Institute, in India, examines water use in the Krishna River Basin, which covers parts of Maharashtra, Karnataka and Andhra Pradesh states. Each has its own water policy and prioritises different aspects of water use.

The Inter-State Water Allocation Body decides how much water each state in the basin receives. Each state has built massive developments on the river, partly to secure the highest possible share of water. However, each has concerns about losing water rights if they do not use their allocation.

The Krishna River also supplies water to major cities, including Chennai and Hyderabad. In some areas, the most significant competition is between irrigation and urban water demands. But the on-going expansion of irrigated agriculture, combined with rising competition from growing industrial, domestic and power sectors, places increasing demands on resources. This makes the Basin much more susceptible to climatic variability, particularly droughts.

Between 2001 and 2004, the Krishna Basin experienced a severe drought. This severely affected water users in the lower areas of the Basin. Many people in the agricultural sector who depend on surface water did not receive their full allocation. Some reservoirs were almost emptied to ensure that people in cities had drinking water. The waters of the Krishna almost stopped flowing to the sea.

This had many impacts:

- Some farmers changed their crops during the later years of the drought, growing non-irrigated crops instead of paddy rice.
- Sugarcane farmers were badly hit, however, as sugarcane production cannot easily be changed to respond to water shortages.
- Many crops are irrigated by groundwater, but groundwater is increasingly over-used and the dynamics of its use are poorly understood.

- The use of irrigation water is not properly recorded in all three states.
- Although all water resources are already fully allocated, more development projects that use water are being planned and built, including for irrigation.

There are opportunities to improve water management across the whole basin. These involve taking a more integrated approach to the operation and management of water storage, and refining the water allocations given to each state. The researchers suggest:

- Information such as hydrological data and water accounting data must be shared and collected at the Basin level, rather than by individual states. This can form the basis for informed and rational management of water resources.
- Mechanisms for negotiating inter-state water disputes need to be more efficient. Possibilities include an independent national water commission or a management structure that incorporates all river basin authorities.

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Mechanisms to manage the variability of flow in water treaties

Most policymakers acknowledge the importance of addressing flow variability in water treaties, but there has been little analysis of the mechanisms actually used to do it. How can water treaties be flexible enough to consider changing flow variability whilst also being enforceable?

The increasing frequency of extreme weather events (such as droughts or floods) means that the amount of water flowing in rivers is often highly variable. In many regions, downstream countries depend on water sources that originate outside their borders. Many experts believe that tensions over water increase where existing treaties become outdated, due to changes in water resource conditions. They argue that there is a need for flexible mechanisms to be included in treaties to account for this flow variability.

Research from the International Water Management Institute, in Sri Lanka, and the Hebrew University of Jerusalem, in Israel, looks at the different mechanisms used to manage the variability of water flow in transboundary water treaties. The authors examined 50 transboundary water treaties signed between 1980 and 2002.

They found that:

- 60 percent of treaties address the issue of water allocation: of these, 16 percent are flexible about flows, but 10 percent define fixed water flows and 34 percent are vague on the issue of allocation.
- 64 percent provide flexible mechanisms for water management, but not all of these were specific related to flow variability.
- 90 percent include formal communication channels.

Using strategies that are both flexible and binding is ideal; however, the vast majority of treaties are either flexible or enforceable, but not both

Water treaties between countries are not just concerned with allocating variable amounts of water. Some also include plans to jointly develop infrastructure or technology to regulate water availability – important for coping with droughts and floods. Formal channels of communication or joint management institutions can help to overcome rigid water treaties and resolve conflicts. Cooperation can also go beyond water issues and create a more productive base for negotiation when flow variability becomes a problem.

Using strategies that are both flexible (to account for unforeseen conditions) and binding (to ensure credibility and action) is the ideal situation. However, the research

shows that the vast majority of treaties are either flexible or enforceable, but not both. The trade-off between flexibility and enforceability explains the informal, broad commitments and institutions that are part of many environmental agreements.

The authors conclude that:

- There are technical barriers to greater flexibility in water allocation: for example, it is difficult to change management mechanisms that involve massive water infrastructure, because of the high investments these require.
- There are political barriers, for example, competition and power struggles between institutions that block individual countries from creating innovative solutions.
- Too much flexibility can reduce the certainty about how much water a country will receive; in more conflictive environments, this can increase the likelihood of a country breaching a treaty.
- Efforts to create treaties with strong enforcement mechanisms can make negotiations more difficult, because the countries could see it as impeding their actions and sovereignty.

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'Governance Mechanisms to Address Flow Variability in Water Treaties', *Global Environmental Change*, 18 (2), pages 285 to 295, by Alena Drieschova, Mark Giordano and Itay Fischhendler, 2008

Evaluating the impacts of watershed development in India

Watershed development is a policy approach aimed at improving livelihoods in semi-arid regions. The social impacts of watershed development are often mixed, however, and projects can be difficult to evaluate.

Watershed development aims to balance the conservation, regeneration and use by humans of land and water resources within a watershed. Common benefits from successful watershed development projects include improved agricultural yields and increased access to drinking water.

Understanding how these projects affect local poverty is difficult, however. It is hard to separate the impacts of watershed development projects from other factors, such as employment trends, crop prices or climatic variability. It is also difficult to determine who benefits and who loses out from a watershed project. For example, increasing agricultural productivity may decrease the availability of groundwater for other uses, so farmers benefit but domestic water users may lose out.

Research from Oxford University, in the UK, evaluates the social impacts of watershed development in India, where watershed development has been used since the 1970s. The research, undertaken in Madhya Pradesh, used a method called 'propensity score matching' to compare the

impacts from a control micro-watershed, where no interventions had taken place, and a treated micro-watershed.

Watershed development aims to balance the conservation, regeneration and use by humans of land and water resources within a watershed, with common benefits including improved agricultural yields and increased access to drinking water

The analysis focuses on changes in agricultural income and access to domestic water following several development interventions in the treated watershed. These include pond construction, tree planting and water harvesting terraces.

Findings and analysis show that:

- Paid labour opportunities were seen as the most important benefit of the watershed development project, but over one in five respondents stated that there had been no benefits.

- There was a reduction in domestic water collection times for those households that had previously spent the longest time collecting water. However, despite these benefits, the majority of people were still without basic access to water.
- There were no significant improvements in agricultural incomes across farmer groups as a result of the watershed development project. This directly contradicts the impressive gains reported in the project's own evaluation.

These findings are consistent with the wider literature and support the growing calls for improved evaluation of watershed development projects in India. To achieve more effective development impacts, there is a need for more rigorous and objective evaluation methods. There are several recommendations for how to achieve this:

- Evaluation should be an early and integral part of watershed development projects.
- This evaluation should focus on what works, for whom, and by how much.
- Evaluations need monitoring indicators that can be directly linked to watershed activities and which respond to the priorities of those people benefiting from them.
- Evaluation results must be effectively shared to improve other watershed development initiatives.

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'Evaluating Social Impacts of Watershed Development in India', *World Development*, 35 (8), pages 1436 to 1449, by R A Hope, 2007

The project report is available on the DFID R4D website (PDF)

www.research4development.info/PDF/Outputs/Forestry/R8171_-_Evaluating_social_impacts.pdf

A woman carries water gathered from a hand pump in a village in Shivpuri district, Madhya Pradesh state, India. Wise water management is an issue in this part of the country, where in the last two years some districts had floods while others experienced water shortages.

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Lessons from a long-term river dispute in India

India has approximately 13.5 percent of the world's population but only about 3 percent of the world's total renewable water resources. This leads to conflicts over supplies. How can policymakers tackle the problems of water sharing?

Research from the University of Bradford, in the UK, examines the Cauvery River dispute in southern India. The Cauvery flows mainly through the states of Karnataka and Tamil Nadu. The origins of the Cauvery River dispute are in a 1924 water-sharing agreement. Analysis of the 1924 agreement shows that it:

- neither considered extreme rainfall variations during events such as monsoons and droughts, nor explained precisely how states should share the flow of water during such events
- did not provide for a flexible and adaptable management structure
- emphasised fair distribution of the quantity of water, rather than the final benefits of that water
- only made limited provisions for resolving conflicts.

The terms of the agreement were due for review after 50 years, but discussions between the two states during the 1960s and 1970s failed to produce a new agreement. A central government tribunal produced an interim award in 1991, but Karnataka rejected the terms and protests broke out in the state, during which 25 people were killed. The dispute continued until 1998, when the Cauvery River Authority was set up to implement the interim award. The final award was only decided in 2007.

The dispute over the Cauvery mainly concerned the quantity of water allowed by the agreement. The river is economically important for both states, which depend on irrigation systems and

The dispute over the Cauvery mainly concerned the quantity of water allowed by the agreement; both states were primarily concerned about their farmers having enough water

canals for growing crops such as rice. Both states were primarily concerned about their farmers having enough water. However, the dispute was about more than just economic issues; it was also political. In the Cauvery districts in Karnataka, for example, almost all the successful candidates in the Legislative Assembly elections took a strong position on releasing the river waters.

Based on the evidence from the Cauvery river dispute, the researcher concludes that states sharing rivers should not focus on absolute quantities of water. Political and historical factors also play a major role in whether river water remains in dispute. For example, disputes are likely to be worse when governments exploit differences in language or ethnic groups for political purposes.

Policy options for peaceful water-sharing include:

- a system of proportionate sharing to allocate water in the event of extreme rainfall variations, so that water is fairly allocated in times of plenty as well as droughts
- a river-basin authority with representatives from all those sharing the resource
- an assessment of all water resources and water use patterns before undertaking water sharing agreements
- person-to-person dialogues between all parties in any dispute
- alternative water management practices that are based on small-scale local technologies, such as rainwater harvesting and conservation, rather than large-scale dams, canals and turbines.

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'An Analysis of a River Dispute: Interaction of Politics and Economics', by P B Anand, in *Scarcity, Entitlements and the Economics of Water*, pages 112 to 141, New Horizons in Economics Series: Elgar Publishing, by P B Anand, 2007

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