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Putting Research Knowledge into Action

1 Banking on groundwater

Over the past 50 years, groundwater development has been a feature of agricultural production across the developing world.

Groundwater now accounts for approximately 50% of all irrigation supply in South Asia and two-thirds of supply in the grain belts of North China. Whilst the benefits of groundwater use are apparent, so too are the problems, which mainly concern issues of sustainability and water quality. While it is the problem of overuse that most often captures the attention of the media, there are parts of the developing world that have yet to take full advantage of the poverty-reducing and livelihood enhancing potential of groundwater.

Key messages

- Effective groundwater management requires a comprehensive and coordinated program of research and advocacy that entails understanding the physics of groundwater replenishment and movement, the sociology of groundwater users, the political economy of the water and agricultural sectors, and the laws and institutions that have a bearing.
- The need for information to support decision making is a critical element for groundwater management.
- In regions of overdevelopment, relevant government authorities need to effect a paradigm shift from resource development to management.

The context

There is no 'one-size-fits-all' position on groundwater management. To be effective, groundwater policies must address the unique socio-ecological characteristics of a region and its people. In South Asia, that means recognizing the decline of gravity-fed surface irrigation systems and the rise of a thriving groundwater economy based on millions of smallholder farmers pumping groundwater with the use of cheap diesel or electric pumps. China has some of the most abundant groundwater resources in the world and a highly heterogeneous groundwater economy, with falling water tables in some regions and little apparent decline in others. In the Middle East and North Africa (MENA), conflict over water has global implications. Significant quantities of renewable groundwater reside in coastal aquifers that are vulnerable to saltwater intrusion and sea level rise driven by global warming.

Groundwater recharge in Mekelle, Ethiopia (*Photo credit*: Akiça Bahri).

Wherever they are, renewable aquifers are susceptible to overexploitation. In the deserts of Northern Africa and the Arabian Peninsula, there is abundant fossil groundwater, but much of it is far from where it can be used. A lack of data (or access to data) makes it difficult to accurately estimate the extent and use of groundwater, but, as in other regions, it seems clear that groundwater plays an increasingly central role in agricultural livelihoods. In Central America, groundwater is used mainly for human consumption and industrial activities, with little use in agriculture to date. In most regions, there is a lack of reliable data to support decision making. Globally, the use of groundwater is rising. Among its many benefits, its widespread presence and enormous capacity provides a form of insurance against increasingly unpredictable rainfall patterns. With few notable exceptions, governments have yet to formulate or implement effective management policies that address the livelihood needs of small farmers.

IWMI's position on using groundwater

Common themes running through IWMI's research on groundwater are sustainability and management. Where groundwater is overexploited, IWMI and partners are actively assessing the merits of managed aquifer recharge (MAR) as a supply augmentation strategy. Successful applications of MAR have been demonstrated in peninsular India, trials are underway in northern Thailand, and the concept has been presented as a solution to transboundary disputes over water along the Syr Darya River in Central Asia. Planning for groundwater use and addressing problems of overuse and water quality require a sound understanding of the local social, economic and political ecologies. Technical solutions alone are not sufficient. Within the technical realm, there is growing consensus that surface water and groundwater are intricately connected and must be managed 'conjunctively', that is, as parts of a holistic system at a scale that is meaningful. There is more than sufficient evidence to show that good groundwater governance can make a significant contribution to rural livelihoods and poverty reduction.

Actions needed

Coming to terms with the challenges of groundwater use and management requires a comprehensive and coordinated program of research and advocacy that entails understanding the physics of groundwater replenishment and movement, the sociology of groundwater users, the political economy of the water and agricultural sectors, and the laws and institutions that have been or might be to bear. A number of key action points emerged from the Comprehensive Assessment of Water Management in Agriculture, among them: greater emphasis on conjunctive management with surface water; augmenting groundwater irrigation with urban wastewater; managing demand through indirect means, for example, by tackling the energy-irrigation nexus in many regions; moving towards 'precision' irrigation and water-saving technologies (e.g., micro-irrigation); and crop and livelihoods diversification.

How IWMI can help

The need for information runs across all these topics and is a critical element for groundwater management. There are substantial gaps in basic information on groundwater availability and agricultural use, but enough available information to suspect that agricultural groundwater use appears to be substantially underestimated. IWMI is an active participant in, and supporter of, the global movement for sharing area-specific or geo-referenced data, information, knowledge and experience.

Where groundwater withdrawals are increasing and an excess of surface water is present, programs for managed aquifer recharge are urgently needed to ensure that falling water tables are stabilized or increased. IWMI researchers in India have helped to put groundwater on the national agenda and are providing the scientific basis for policies promoting *in-situ* recharge technologies, many of which incorporate rainwater harvesting. Where groundwater is abundant but underused, such as in sub-Saharan Africa for example, IWMI researchers are gathering evidence and demonstrating how groundwater can be used to enhance livelihoods based on pastoral livestock production and the role it plays in drought mitigation, small-scale irrigation, rural domestic supply, urban use and poverty reduction.

Perhaps the most important arena for action is governance. With few exceptions in the developing world, government authorities need to upskill and transition from resource development to management.

Source

This Water Issue Brief is based on the following publications:

Giordano, M.; Villholth, K. (Eds.). 2007. *The agricultural groundwater revolution: opportunities and threats to development*. Wallingford, UK: CABI. 419p. (Comprehensive Assessment of Water Management in Agriculture Series 3).

IWMI (International Water Management Institute). 2005. *Planning groundwater use for sustainable rural development*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 6p. (IWMI Water Policy Briefing 014)

Related IWMI publications

Open access (electronic version freely accessible via the internet)

Amarasinghe, U. A.; Smakhtin, V.; Sharma, B. R.; Eriyagama, N. 2010. *Bailout with white revolution or sink deeper? groundwater depletion and impacts in the Moga District of Punjab, India*. Colombo, Sri Lanka: International Water Management Institute. 32p. (IWMI Research Report 138)

Barry, B.; Kortatsi, B.; Forkuor, G.; Gumma, M. K.; Namara, R.; Rebelo, L-M.; van den Berg, J.; Laube, W. 2010. *Shallow groundwater in the Atankwidi Catchment of the White Volta Basin: Current status and future sustainability*. Colombo, Sri Lanka: International Water Management Institute. 30p. (IWMI Research Report 139)

IWMI (International Water Management Institute); GWP (Global Water Partnership) Advisory Center. 2005. *Reducing poverty through integrated management of groundwater and surface water*. Colombo, Sri Lanka: International Water Management Institute (IWMI); Global Water Partnership (GWP) Advisory Center at IWMI. 6p. (IWMI Water Policy Briefing 013)

Sharma, B. R.; Villholth, K. G.; Sharma, K. D. (eds.). 2006. Groundwater research and management: integrating science into management decisions. *Proceedings of IWMI-ITP-NIH International Workshop on "Creating Synergy Between Groundwater Research and Management in South and Southeast Asia," Roorkee, India, 8-9 February 2005*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 270p. (Groundwater governance in Asia series 1)

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