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India: Issues and opportunities for investment

India's water availability varies significantly across regions and river basins.

In the north, the main source of water is glacial snowmelt from the Himalayas and rainfall; and in peninsular India, the annual monsoon. India's population has increased from about 343 million in 1947 to 1,181 million in 2008. More than half of the population is active in agriculture. Total water demand will equal water availability by 2025, but industrial and domestic water demand are expected to rise drastically at the expense of the agriculture sector, which, in turn, will have to produce more food with less water.

Key messages

- India's population of over 1 billion means high demands for both agricultural and non-agricultural uses of water.
- Demand for irrigation water, both surface water and groundwater, is rising but productive use of that water is not. Water management is a state issue and each state handles issues of allocation and productive use differently.
- Key river basins including the Ganga, Indus, Tapi, Mahanadi and Godavari are reporting water deficiencies in excess of 40%. In some areas there is acute seasonal physical water scarcity.

Key water issues

Policy and institutions

Currently, over 80% of irrigated agriculture in India is supported by groundwater. India has 23 million pumps with almost a million added every year. With little control on groundwater extraction, the country faces serious groundwater depletion. Food grain production has increased as more land is brought under cultivation. High-yielding crop varieties are grown that also have high water requirements, which are being met through a boom in groundwater use. The physical expansion of large-scale irrigation schemes has reached its limits. Innovative water-saving techniques and improved water-use efficiency are essential. Large-scale river linking and water transfer schemes, while technically possible, need more careful consideration of costs and benefits.

Water quality

Water quality is a major issue in India. Although the water quality is good in the upper reaches of most rivers, misuse and abuse of those rivers and the lack of wastewater treatment plants in the middle and lower reaches of almost all rivers, is causing serious degradation of surface water quality. Groundwater is also being affected by domestic, industrial and agricultural pollution. The overexploitation of groundwater resources is also leading to seawater intrusion in many coastal zones. In the eastern region, arsenic contamination of groundwater is a serious problem.

Irrigation performance

India has the second largest irrigated area in the world, but due to the rapid expansion of irrigation, with its emphasis on new construction, irrigation performance and the sector's increasing management needs have not received adequate attention. The development impact of irrigation is well below its potential, and deficiencies in implementation have accumulated over time.

At the grassroots level, farmers are turning to groundwater. Unless policymakers can come to grips with the current anarchic situation, India could well be facing a groundwater crisis in the near future.

Public sector irrigation is failing to live up to its potential, which is largely due to underinvestment in the maintenance of infrastructure. Rehabilitation requirements represent an increasing part of construction investment and environmental problems are mounting. Major investments are also needed to improve management capacity.

IWMI research in India

IWMI's work in India focuses on research-backed insights for improved policies and practices to help India address its water challenges now and in the future.

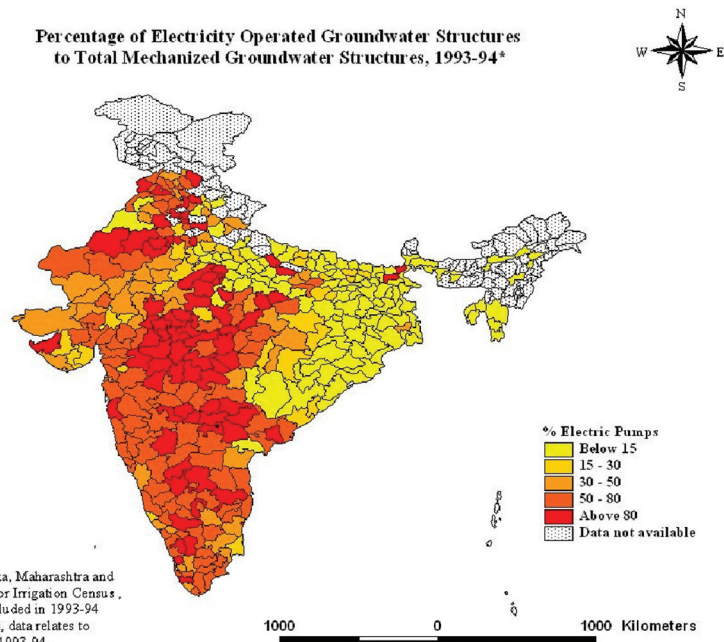
Influencing policy, reducing costs and conserving groundwater

With nearly 25 million diesel and electric pumps at work, the supply and regulation of energy is an important factor in managing water resources. The *Jyotigram Yojana* scheme in Gujarat State is a landmark example of how effective policy can be in regulating groundwater extraction and creating equitable water markets. Based in part on the research IWMI conducted with local partners, the government invested US\$250 million in the scheme, which has helped farmers increase their incomes and reduce groundwater extraction and electricity use by as much as 50%.

Benchmark solutions

In the water-scarce Krishna Basin, IWMI researchers and local partners are implementing activities aimed at improving water productivity. This includes mapping the water-land-poverty nexus in the Lower Krishna Basin to improve basin-scale productivity through integrated hydrologic, water resources and economic research, looking at the implications of different water-allocation scenarios for food production and long-term resource sustainability in the basin.

Percentage of Electricity Operated Groundwater Structures to Total Mechanized Groundwater Structures, 1993-94*



* Figures for Gujarat, Karnataka, Maharashtra and Tamil Nadu are based on Minor Irrigation Census, 1986 as they have not been included in 1993-94 MI Census. For the other states, data relates to 1993-94 based on MI Census, 1993-94.

With little control on groundwater extraction, the country faces serious groundwater depletion
(Credit: Aditi Mukherji, IWMI).

IWMI–Tata Water Policy Program

The IWMI-Tata Water Policy Program (ITP) was founded in 2000 and is jointly supported by the Sir Ratan Tata Trust and IWMI. The program is providing data and information of use to policymakers at central, state and local levels and helping them to address issues in sustainable groundwater management, water scarcity, rural poverty and livelihoods, by translating research findings into practical policy recommendations. Under the ITP, IWMI works in close cooperation with a range of partners across India to identify, analyze and document relevant water management approaches and current practices to improve future policy.

Technology adoption and spread

Impact of different water management technologies and their adoption levels are being analyzed in order to outline the technologies that are suitable for different regions and farms.

Climate change and adaptation strategies

Impact of climate change on agricultural production is being analyzed in the Godavari, Krishna and Cauvery river basins. Several adaptation strategies both at farm and community level are outlined.

Hill water management

The fragile ecosystems are facing water shortages. The fragmented farm holdings need appropriate and affordable technologies. Gravity-based micro-irrigation technologies are implemented in selected states such as Uttarakhand.

Future investment needs

Since its inception, IWMI has been working with the Indian Government and local partners on solutions to some of the most complex and pressing water management problems anywhere on Earth. IWMI is seeking partners and funds for the following research projects.

Nearly 90% of the Indian population live in basins with some form of water scarcity or food production deficit. One of the key factors directly affecting the



Nearly 90% of the Indian population live in basins with some form of water scarcity or food production deficit (Photo credit: Paul Pavelic, IWMI).

poor is inequity in irrigation water distribution, further aggravated by inequity in landholdings. This situation underpins the need for more focused pro-poor options to increase returns to poor farmers in low productivity areas.

Groundwater is a key research area in India. There is arsenic contamination of groundwater in most areas, and groundwater overdraft threatens India's long-term food security goals. Managed Aquifer Recharge programs on a basin-scale may provide a solution.

Closely connected with groundwater use is the issue of irrigation. The sector needs renewed investment in both physical infrastructure and human capacity along with new directions in policy. The feasibility of large-scale river linking and water transfers need careful consideration in light of potential alternatives. Irrigation of food and fodder crops with urban wastewater is a reality in India but gets scant attention as a potential resource.

India must set targets for increasing the productivity of water across the entire agriculture sector. This will entail new technologies such as drip and sprinkler irrigation on a larger scale as well as smarter policies.

The impact of a warming climate is already visible in more frequent extreme weather events. Indian agriculture can adapt to floods and droughts if policymakers can be convinced that water must be managed at the basin and landscape level.

Source

This Water Issue Brief is based on the following publications:

International Water Management Institute, IWMI-TATA Water Policy Program. 2003. *The energy-irrigation nexus*. Vallabh Vidyanagar, Gujarat, India: International Water Management Institute (IWMI). 6p. (IWMI Water Policy Briefing 010)

IWMI (International Water Management Institute). 2006. *Improving performance and financial viability of irrigation systems in India and China*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 6p. (IWMI Water Policy Briefing 020)

IWMI (International Water Management Institute). 2007. *IWRM challenges in developing countries: lessons from India and elsewhere*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 7p. (IWMI Water Policy Briefing 024)

IWMI (International Water Management Institute). 2007. *Rethinking tribal development: water management strategies for revitalizing tribal agriculture in central India*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 6p. (IWMI Water Policy Briefing 027)

Related IWMI publications

Open access (electronic version freely accessible via the internet)

Amarasinghe, U.; Shah, T.; Turrall, H.; Anand, B. K. 2007. *India's water future to 2025-2050: Business-as-usual scenario and deviations*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 41p. (IWMI Research Report 123)

Amarasinghe, U. A.; Shah, T.; Malik, R. P. S. (Eds.). 2009. *Strategic Analyses of the National River Linking Project (NRLP) of India, Series 1. India's water future: scenarios and issues*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 403p.

IWMI (International Water Management Institute). 2009. *Strategic Analyses of the National River Linking Project (NRLP) of India Series 5. Proceedings of the Second National Workshop on Strategic Issues in Indian Irrigation, New Delhi, India, 8-9 April 2009*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 359p.

Kumar, M. D.; Amarasinghe, U. A. (Eds.). 2009. *Strategic Analyses of the National River Linking Project (NRLP) of India, Series 4. Water productivity improvements in Indian agriculture: potentials, constraints and prospects*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 152p.

Saleth, R. M. (Ed.). 2009. *Strategic Analyses of the National River Linking Project (NRLP) of India, Series 3. Promoting irrigation demand management in India: potentials, problems and prospects*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 169p.

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