# SOUTH ASIA GROUNDWATER FORUM

## Regional Challenges and Opportunities for Building Drought and Climate Resilience for Farmers, Cities, and Villages

**EDITORS:** Rafik Hirji, Sushmita Mandal and Ganesh Pangare

THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

IWA
the international water association

CHAPTER 12

# A ROAD MAP FOR BUILDING DROUGHT AND CLIMATE RESILIENCE


Chair:

Dr. Amita Prasad, *Additional Secretary, Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India*


## Is South Asia Positioned to Respond to the Effects of Climate Change?


Dr. Rafik Hirji, *Team Leader, World Bank, and*

Mr. Geert-Jan Nijsten, *Senior Researcher, International Groundwater Resources Assessment Centre (IGRAC)*


Recent studies by the Organisation for Economic Co-operation and Development (OECD), United Nations Educational, Scientific and Cultural Organization Groundwater Resources Assessment under the Pressures of Humanity and Climate Change (UNESCO GRAPHIC), and World Bank[22] all conclude that groundwater, if well managed, can act as an effective climate adaptation option: it is a natural insurance mechanism and not just a component of freshwater supplies. In operational terms, is the region positioned to respond to the effects of climate change?

South Asia's groundwater is highly vulnerable to climate change. This high vulnerability is a function of four factors: (a) utilization is moderate; (b) impact of climate change on recharge is likely to be negligible; (c) impact of sea level rising and storms is likely to be high, especially given South Asia's very large coastline. Finally, the region's adaptive capacity—physical, administrative, and institutional—is low. Over the recent decades, as surface supplies have become less reliable, dependence on groundwater has increased substantially in South Asia. Under climate change, surface runoff will likely be impacted and make surface supplies less reliable. This will likely put extra pressure on groundwater. On the demand side, warmer temperatures will affect crop water use. Thus, under warmer conditions, crop evapotranspiration would be higher. Population growth will increase demand for water, food, and energy. Rising sea levels will impact the coastal groundwater quality. In such a scenario, managed groundwater will be central to adaptation to impact of climate change.

Recharge and discharge of groundwater is affected by changes in climate (precipitation), land use change, and human intervention (e.g., pumping). Recharge and discharge rates are also impacted by different types of aquifers, for example, shallow, fast, connected aquifers versus deep, slow aquifers. Groundwater quality also affects the supply of water for human consumption directly or indirectly.

Thus, climate change has implications for groundwater-dependent systems as well. Rural populations often depend on groundwater as a safe alternative to surface water. However,

climate change is likely to have an impact on groundwater, human health, livelihoods, and food security. Even in urban areas climate change is likely to impact the use of water in the form of, for instance, unreliable reticulated water supplies, economic losses, adverse effects on human health, and social disruption. In addition, irrigation is increasingly reliant on groundwater. Reduced recharge diminishes irrigation use, whereas increased recharge leads to irrigation expansion. Irrigation may also increase salinization. Reduced recharge can affect base flow and dry up springs and wetland ecosystems. Thus, if groundwater is to become central to the adaptation mechanism for climate change impact, it is important to create a framework to build adaptation capacity based on (a) social capital (e.g., education, training, and governance); (b) information (e.g., understand climate, quantify groundwater, and monitor); (c) research and development (e.g., climate-impact assessments and adaptation methods); (d) governance (e.g., policy, regulations and institutions, conjunctive use, planning, and management of surface and groundwater, and demand management); and (e) groundwater entitlements and markets.

Central to a groundwater-adaptation framework must be management of the following aspects: recharge, storage, discharge, quality and demand. For this purpose, it is important to understand how the system works. Assessment of the complete groundwater system, including impacts of climate change and impacts of human behavior, needs to be done. Also adequate data need to be collected (e.g., classical hydrogeological data, including long-term monitoring data of groundwater levels, groundwater quality, and groundwater use [abstraction]). Analyses need to be done through modeling and conducting detailed studies to better understand crucial processes and responses and to make projections under different scenarios.

In addition, there is a need to move from assessment to management solutions. To find realistic solutions there is a need for further socioeconomic and political analyses and environmental studies. Sociocultural and political analyses need to be done to develop understanding to gauge acceptance of solutions. Finally, it is important to keep in mind that there is no “one-size-fits-all” solution in the Indian setting. Successful solutions depend on a combination of factors.

# A Road Map for Building Drought and Climate Resilience

**Dr. Amita Prasad,** *Additional Secretary, MoEFCC, Government of India*

According to *The Guardian* (Vidal 2009[23]), climate change is expected to have the most severe impact on water supplies. The current water cycle and the drivers of climate change (greenhouse gas emissions and land cover change), lead to vulnerability of water resources.

Climate change will lead to deviation from normal conditions (climate and hydrology). Climate change and drought are linked. Increased evapotranspiration and reduced precipitation increase frequency and intensity of droughts. Droughts in turn can lead to desertification, land degradation, and deforestation. Srivastava and Rai 2012[24] estimate that sugarcane yields will fall dramatically. *Business Standard* (2015) reported that rice yield will drop in Odisha. The major climate change-related challenges include (a) that 16 per cent of India's geographic area is drought-prone and (b) implementation of the National Action Plan on Climate Change 2008 (NAPCC 2008), which outlines existing and future policies and programs addressing climate mitigation and adaptation. The plan identifies eight core "national missions," namely National Water Mission, Green India Mission, National Solar Mission, National Mission on Sustainable Habitat, National Mission on Enhanced Energy Efficiency, National Mission for Sustaining Himalayan Ecosystem, National Mission for Sustainable Agriculture, and a National Mission on Strategic Knowledge for Climate Change.

Institutional and policy framework supports coordinated action, preparation of the District Agriculture Contingency Plan (DACP) that was launched in 2010[25], mitigation of adverse impact through efficient water management practices, and promotion of knowledge sharing and capacity building. The key recommendations include (a) supporting better water management, (b) promoting climate-resilient agriculture, (c) imparting skills and education, (d) strengthening systems and effectiveness in data collection, (e) focus on agro-forestry, and (f) watershed management.

The *proposed national level actions* include (a) strengthening of the observational network for drought monitoring, (b) capacity enhancement for medium- and long-range drought forecasting, (c) developing mechanisms for context-specific and need-based forecasting, (d) improvement in information and communication technologies (ICTs), (e) dissemination in local languages for better understanding of the people. The *proposed regional level actions* include (a) enhancement of real-time monitoring capabilities through training and joint monitoring programs, (b) improvement in methodologies and analytical tools for drought analysis and vulnerability assessment, (c) capacity building through joint training programs in improved resilience toward drought, and (d) effective and collaborative implementation of drought relief programs.

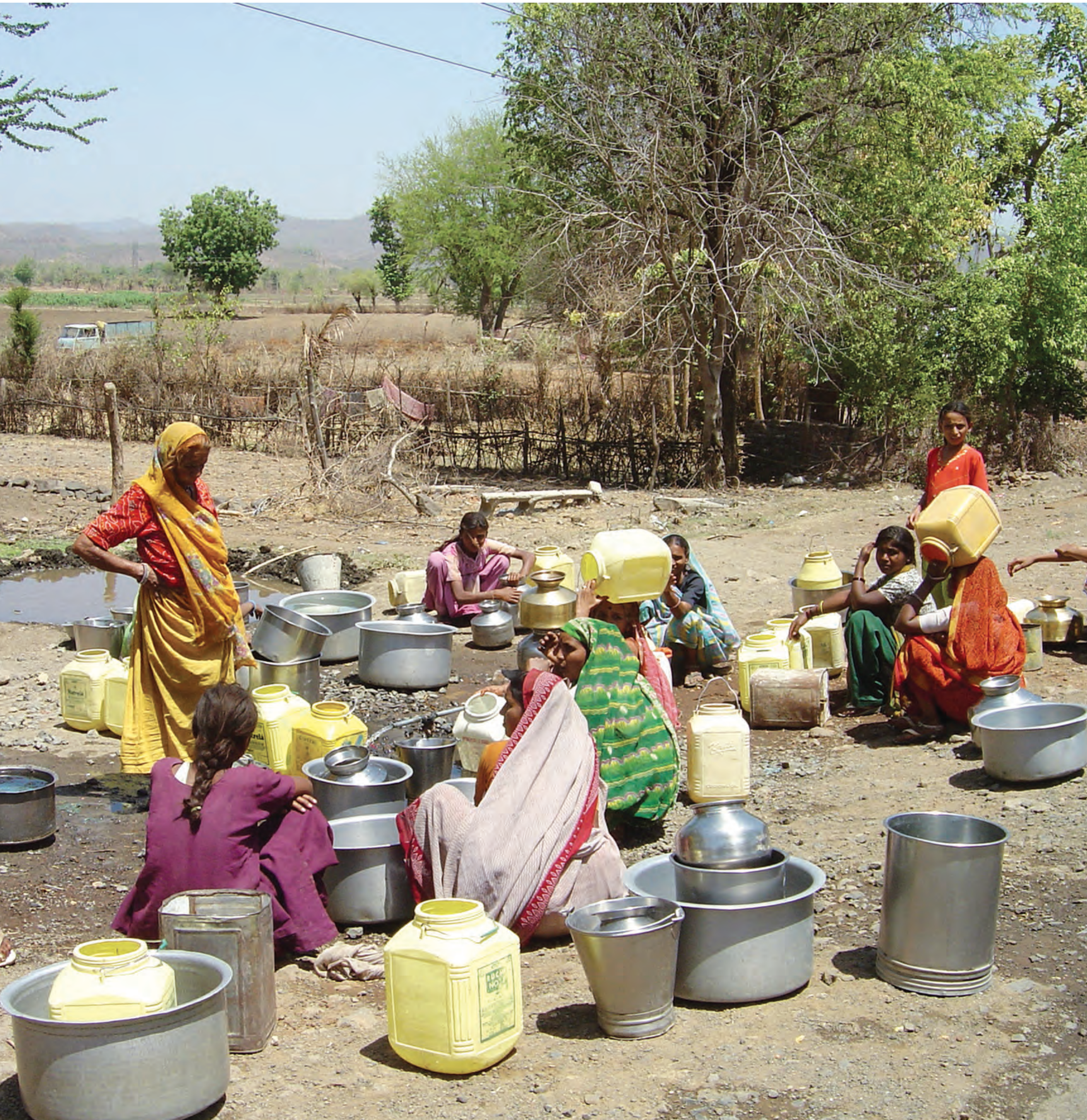
---

[22] Studies mentioned: (a) Clifton, C., R. Evans, S. Hayes, R. Hirji, G. Puz, and C. Pizzaro. 2010. "Water and Climate Change: Impacts on Groundwater Resources and Adaptation Options." Water Working Note 25, World Bank, Washington, DC; (b) UNESCO GRAPHIC. 2015. *Groundwater and Climate Change: Mitigating the Global Groundwater Crisis and Adapting to Climate Change, Position Paper and Call to Action*. UNESCO: Paris; (c) OECD. 2015. *Drying Wells, Rising Stakes: Towards Sustainable Agricultural Groundwater Use*. OECD Studies on Water. Paris: OECD.

[23] Vidal, John. 2009. "Global Warming Causes 300,000 Deaths a Year, Says Kofi Annan Thinktank." *Guardian* (blog), May 29 (accessed May 31, 2017), https://www.theguardian.com/environment/2009/may/29/1.

[24] Srivastava, A. K., and M. K. Rai. 2012. "Sugarcane Production: Impact of Climate Change and Its Mitigation. *Biodiversitas* 13 (4): 214–27.

[25] DACP are technical documents aimed to be ready reckoners for line departments and farming communities on prevailing farming systems and technological interventions to manage various weather aberrations such as droughts, floods, etc. The contingency plans are useful for drought preparedness.



## SOUTH ASIA GROUNDWATER FORUM

South Asia—the world's fastest growing region—is the largest abstractor of groundwater; it pumps nearly a third of the groundwater used globally and half of global groundwater for irrigation. Groundwater drove the Green Revolution, which lifted hundreds of millions of people out of poverty across the region; in addition to irrigation, it is critical to rural, urban, and industrial water supplies. However, intensive pumping and unregulated use have caused rapid declines in water tables, putting these benefits at risk. In addition, groundwater contamination (from arsenic, fluoride, salinity, sewage, industrial effluent, and agricultural chemicals) is undermining the value of the resource, increasing water treatment costs, and causing significant health impacts. While groundwater depletion can be quickly reversed, contamination, saltwater intrusion, and land subsidence are either too costly or impossible to reverse.

The South Asia Groundwater Forum organized in June 2016 together 126 participants including 46 decision makers and 80 technical experts and community representatives from across 18 countries including Afghanistan, Bangladesh, Bhutan, China, India, Nepal, Pakistan, and Sri Lanka. The forum drew from existing and emerging experiences and knowledge generated from within and outside South Asia. These experiences included policy issues related to the groundwater-energy-food nexus; the challenges of instituting and enforcing groundwater regulation; experiences on community-based groundwater management, urban water supply management, and irrigation development; and lessons about building drought and climate resilience.

Contact Details:

Rafik Hirji
World Bank
Email: rhirji@worldbank.org

Sushmita Mandal
International Water Association
Email: Sushmita.mandal@iwahq.org

THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

the international water association