



Meeting the **Water and**
Climate Change Challenge

Asian Development Bank

“Observational records and climate projections provide abundant evidence that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change, with wide-ranging consequences for human societies and ecosystems.” (IPCC, *Climate Change and Water*, 2008)

Many of the Asia and Pacific region’s 3.5 billion people live in highly developed river basins. The Ganges, Brahmaputra, and Indus in the South, the Mekong in Southeast Asia, and the Yangtze in the People’s Republic of China (PRC), for instance, support the lives and livelihoods of over one billion people. These rivers begin in the greater Himalayan Mountains and the Tibetan Plateau, whose glaciers and winter snowpack provide water during the critical dry seasons to the extensive irrigated agriculture that is the primary source of food throughout the region. Other Asians—almost two out of five—live within 100 kilometers of coastlines, relying on fragile coastal aquifers for water supply.



Flood victims being rescued in typhoon Ketsana’s wake in Manila, Philippines

Climate change impacts on water resources

The Intergovernmental Panel on Climate Change’s *Fourth Assessment Report* (2007) has identified the water sector, along with the agricultural sector, as the “most sensitive to climate change-induced impacts in Asia.” River basins are particularly vulnerable, as the melting of glaciers leads to reduced water security for hundreds of millions, while increased rainfall variability leads to greater risks of floods, droughts, and other extreme events that will adversely affect both surface- and groundwater quality and reliability. In coastal areas, rising sea levels will further degrade aquifers through salinity intrusion. Climate risks exacerbate the existing stresses on the region’s water resources due to rapid economic development, demographic changes, and associated increases in water demand.

The projected impacts of climate change and associated risks to the water sector will exhibit strong regional variability, given the diversity of hydro-climatic conditions across the Asia and Pacific region. Many important geo-climatic zones are at particular risk:

- **Arid, semi-arid, and dry sub-humid regions** will be more vulnerable to increased frequency and severity of floods and droughts. Rain-fed agricultural yields are likely to decrease due to temperature and moisture stress.
- **River basins, deltas, and other low-lying areas** will be susceptible to increased flood risks.
- **Coastal areas** will be more vulnerable to intensified typhoons and storm surges. Aquifers will be at risk of salinization from rising sea levels.
- **Mountain ecosystems** face increasing hazards from glacial outburst floods in the near term and from reduced dry season flows and increasing water stress in the longer term, as glaciers and snowfields recede.
- **Small islands** are increasingly vulnerable to decreased water security, as groundwater lenses are diminished by erratic precipitation and sea-level rise; and to the impacts of typhoons, storm surges, and other extreme weather events.

Meeting the challenge: Climate change adaptation

The Asian Development Bank (ADB), through its Long-Term Strategic Framework 2008–2020, acknowledges the urgency in meeting the diverse water sector challenges posed by global and regional climate change, whose impacts threaten to reverse decades of progress toward an Asia and Pacific region free of poverty, and undermine efforts to promote sustainable, equitable, and environmentally-sound growth within the region.

Accordingly, ADB’s regional departments have developed climate change implementation plans to mainstream climate change adaptation in water sector activities and projects. ADB is already implementing a range of climate change strategies, including portfolio risk assessment (see table), the development of knowledge products and risk management tools, regional knowledge networking, specialized funding mechanisms, and regional, national and project-level technical assistance.

Project sector	Projected climate change impacts
Water Supply and Sanitation	<ul style="list-style-type: none"> • Decrease in freshwater supplies due to drought, salinity intrusion • Increase in water demand due to warmer temperatures • Adverse impacts on surface- and groundwater quality • Increased temperatures, precipitation variability and water use alter groundwater recharge patterns • Loss of winter snowpack and glacial retreat increase flood risk; reduce dry season flows
Agriculture and Natural Resources	<ul style="list-style-type: none"> • Increasing frequency, severity of drought and altered rainfall reliability and timing threaten irrigated and dryland agriculture • Elevated temperatures increase irrigation water demand; reduce yields • Salinization of groundwater in coastal aquifers • Direct flood damage to crops
Energy	<ul style="list-style-type: none"> • Loss of winter snowpack and glacier storage alters hydroelectric generation potential
Health, Nutrition and Social Protection	<ul style="list-style-type: none"> • Increasing water temperatures, washoff from intense precipitation events degrade water quality; increase incidence of waterborne disease • Unstable agriculture leads to increases in malnutrition • Direct threats from riverine flooding and coastal storms

Knowledge products and risk management tools

Knowledge gaps exist in credible regional climate change projections, climate impact assessment, and strategic adaptation planning in river basins, cities and rural areas. ADB is facilitating the extension of pathbreaking work at advanced knowledge centers in countries such as PRC, Japan, Malaysia, and the United States to provide improved climate projections for other critical regions, supporting impact assessment, and adaptation planning in Asian river basins.

Information is also needed on how water resources systems will respond to projected changes, and how effective proposed approaches will be to managing risk. ADB is developing and adopting a range of tools and products to support climate-resilient water sector investments, such as

- Climate risk screening tools
- Adaptation studies
- Geographic information systems based risk and vulnerability mapping
- Asset risk management audit tools

Regional knowledge networking

ADB and partners are supporting the creation of regional knowledge-sharing networks in water, climate change, and related sciences. For example, the National Hydraulic Research Institute of Malaysia serves as a regional knowledge hub for climate change adaptation. The Network of Asian River Basin Organizations, formed in 2003 by ADB, the Japan Water Agency,

and the ADB Institute, promote integrated water resources management (IWRM) in Asian river basins. IWRM provides an effective framework for managing the diverse water sector risks associated with climate change. In 2009, the Asia-Pacific Water Forum has also initiated a regional Steering Group on Water and Climate Change, comprising experts, leaders, and funding agencies to promote good practices, knowledge sharing, and capacity development.

Specialized funding mechanisms

Globally, costs of climate change adaptation in developing countries may exceed \$100 billion per year. ADB is providing its developing member countries with adaptation-oriented finance through dedicated funding mechanisms, and is assisting them in securing finance from a wider range of sources, including the Global Environmental Facility. Important ADB-affiliated funds include:

- **Climate Change Fund.** Offers grant financing for projects, technical assistance, and research. To date, \$10 million has been allocated for adaptation initiatives.
- **Water Financing Partnership Facility.** Supports investment projects, technical assistance, knowledge management, and regional cooperation. The emphasis is on rural, urban, and river basin water management and climate change adaptation.
- **Promoting Climate Change Adaptation in Asia and the Pacific.** A regional technical assistance project providing grants to promote integration of climate change adaptation into project planning, national capacity development, and disaster risk reduction.
- ADB and other multilateral development banks are also offering the **Climate Investment Fund** to assist developing countries in integrating climate resilience into development plans and budgets.
- **Adaptation Fund.** Supports concrete adaptation projects and programs.



A drought strikes India.

Regional, national, and project-level technical assistance

ADB is responding through a wide range of finance and technical assistance to achieve “climate-ready” projects, cities and river basins. Representative projects include the following:

Bangladesh: Making Khulna’s water sector resilient to climate change impacts (2008)

Bangladesh is projected to be exceptionally vulnerable to the impacts of climate change, which is likely to intensify flooding, drought and other risks associated with sea level rise. In Khulna, the third-largest city in Bangladesh, the consequences of climate change are expected to be particularly severe. Drainage is already a serious problem, and sewers frequently back up during the monsoon. Sea level rise will further retard drainage from low-lying areas, and flooding by contaminated wastewater presents serious health risks. ADB is providing technical assistance to prepare Khulna for the impacts of climate change. The project supports both structural and non-structural water sector climate-proofing measures, targeting drainage, water availability, and salinity, including water intake works and the appropriate design of the drainage system.

Indonesia: Climate change-ready Citarum river basin (2008)

ADB is assisting Indonesia to adapt to climate change-related threats through a 15-year, \$3 billion program aimed at upgrading water resources management infrastructure and institutions in the Citarum River Basin (CRB) on the island of Java.

CRB provides 1,400 megawatts of hydroelectric power, irrigates almost 400,000 hectares of agricultural land, and supplies 80% of Jakarta’s water supply. Competition for the CRB’s resources has increased significantly over the past 20 years, causing acute water stress and depletion of aquifers. Climate change is compounding the stresses and poses increasing risks to the health, livelihood, and disaster vulnerability of poor communities. CRB will be the first basin in Indonesia with a comprehensive strategy for adapting to climate change.

Pakistan: Climate proofing water and energy projects in the Indus (2008)

Reduction in Indus river basin’s winter snowpack formation and retreat of alpine glaciers threaten the reliability of downstream water supplies and the production of hydro-electric power. ADB’s Glacial Melt and Downstream Impacts on Indus-Dependent Water Resources and Energy project will support the water and hydro-energy sectors in the Indus river basin.

Through the Promoting Climate Change Adaptation in Asia and the Pacific technical assistance, ADB is helping the Government of Pakistan to develop a Mountain Glacier and Downstream Water Risk Management Framework and Adaptation Guide. The framework encompasses operational risk management and climate impact resiliency strategies for the hydroelectric and water sectors (critically, irrigation), promoting the sustainability of an investment portfolio exceeding \$2 billion in existing and planned projects.

For further information, contact:

Wouter T. Lincklaen Arriens

Lead Professional (Water Resources Management)
Sustainable Infrastructure Division
Regional and Sustainable Development Department
wlincklaenarriens@adb.org

Charles A. Rodgers

Senior Water and Climate Change Specialist (consultant)
crodrgers.consultant@adb.org

WATER for ALL

www.adb.org/water