



A water-secure world



SHAPING THE FUTURE OF

WATER MANAGEMENT

Water management has profoundly shaped Asia's past. From ancient times, civilizations across the continent mastered irrigation and water supply techniques, permitting a more productive agriculture that sustained large populations and helped expand trade. Several decades ago, massive public investment in large-scale irrigation contributed importantly to a green revolution in crop production and to subsequent economic growth.

Today, the issue is how Asia can shape the future of water management. Mounting pressures on this resource from rapidly growing and urbanizing populations, a changing climate and severe environmental damage threaten to undermine the continent's remarkable achievements. The overarching challenges are increased incidence of water-related disasters together with unsustainable and competing uses for water, which threaten food production and rural livelihoods, while also fueling conflict.

The International Water Management Institute (IWMI) works throughout Asia to help find effective ways to meet these challenges. Our aim is to enable communities and whole countries to tap the enormous potential for improving water management within the framework of the United Nations Sustainable Development Goals (SDGs). We pursue this aim through three strategic programs:

- Building Resilience
- Sustainable Growth
- Rural-Urban Linkages



Water harvesting to irrigate vegetable crops in Cambodia.

WORSENING WATER SCARCITY

With water demand
rising rapidly,

40%

OF ASIA'S POPULATION



could be exposed to
severe water scarcity
by

2050

Collaborating with partners from high levels of government to remote rural areas, IWMI researchers gather evidence, create new knowledge, strengthen capacities, shape policies and help channel investments. Our results guide the development of technologies and practices that lead to enhanced resilience in the face of water-related risks, increased water-use efficiency, improved water quality, greater gender equality, and more inclusive governance.

The continent presents a mosaic of water management conditions, requiring approaches that are tailored to differing needs and opportunities in South, Southeast and Central Asia. IWMI, with its varied expertise and decades of experience, is exceedingly well prepared to respond.

BUILDING RESILIENCE AGAINST

WATER-RELATED HAZARDS



Pilot testing of aquifer recharge to reduce flood risk and make more water available for irrigation during dry spells in Uttar Pradesh, India.

Asia faces a high concentration of water-related risks, which threaten the lives and livelihoods of a large share of its population and affect much of the agricultural area. IWMI researchers work on multiple fronts to help reduce the vulnerability of people and places to drought, floods and other hazards.

One urgent task is to provide government agencies and civil society with powerful information tools that better enable them to monitor and assess water-related risks, so they can target relief efforts and remedial measures more effectively. IWMI researchers and partners have developed the online South Asia Drought Monitoring System, for example, which generates weekly maps of drought conditions in the region, using state-of-the-art indices and freely available satellite imagery to provide local assessments of drought impacts.

With a sharp focus on disaster hotspots in Asia, IWMI is also developing a range of options that smallholder farmers can use to enhance the resilience of their production in the face of water-related risks and disasters. In Northeast India, for example, we have piloted a novel approach to index-based flood insurance in collaboration with private and government insurance providers. Through the use of modeling and remote sensing data to gauge the depth, duration and extent of flooding, the product facilitates damage assessment and can speed payment of compensation to farmers.

Other solutions improve storage and management of water for agriculture. One that has generated much interest in recent years, especially in India, involves solar-powered pumping for irrigation.

IWMI researchers have devised business models aimed at putting the use of this technology on a sound financial footing, while also ensuring equitable access to its benefits as well as sustainable management of groundwater. This work forms part of a wider effort to revitalize Asia's irrigation systems, which are critical for adapting agriculture to climate change. Another technology that IWMI is developing in South and Southeast Asia speeds the infiltration of floodwater into aquifers to replenish groundwater supplies for dry-season irrigation, thus turning climate hazards into new opportunities to improve rural livelihoods.

A heavy burden of WATER-RELATED RISKS

SINCE 2000
more than

45%

of South Asia's
population

and

58%

of its agricultural
area

have been hit by
CLIMATE HAZARDS

THE BUSINESS CASE FOR SOLAR-POWERED IRRIGATION

Solar power is poised to revolutionize water use in agriculture, providing an attractive means for farmers to irrigate their crops, while gaining other livelihood benefits for rural households. In support of efforts to scale out solar-powered pumping, IWMI researchers have devised different business models for contrasting situations in India. These approaches have gained major support from the government, which has decided to incorporate them into new programs for refurbishing irrigation systems nationwide.

One of the business models (developed in Gujarat, India) is designed for regions where groundwater is scarce and farmers currently receive free or highly subsidized electricity for pumping. Since the subsidies prompt many farmers to pump more irrigation water than they

need, our concern was that unrestrained solar pumping would worsen the depletion of groundwater resources. In response, we proposed to farmers the option of selling surplus electricity generated by solar panels to the electricity utility, giving them a strong incentive to use water more productively.

In collaboration with local partners, we established a pilot project with farmers growing wheat, rice and vegetables on small plots. The solar pumps were connected to a micro-grid, which in turn was linked to the national energy grid at a single metered point. Each farmer contributed 10% of the capital cost of the equipment, which the government subsidized as part of a carbon mitigation program. The farmers formed a cooperative of solar pump irrigators, which is selling back surplus solar power under an agreement with the local power company. The farmers no longer need to use their diesel pumps and also benefit from energy sales to the utility.

In Bihar, India, we have developed a business model tailored to the needs of farmers in areas where groundwater is plentiful but limited access to electricity and the high cost of diesel have slowed the spread of irrigation, thus depressing agricultural productivity. Solar-irrigation service providers were supplied with a large solar pump and a network of buried pipelines, which they are paying for in installments. The service providers are enthusiastic about the model, because they have gained significant revenues and saved cash that otherwise would have been spent on diesel fuel for irrigation. Since they compete with one another for users of their service, water prices remain low, encouraging farmers to expand irrigated agricultural production.



Farmers in Gujarat, India, are piloting innovative models for solar-powered irrigation.

WATER-SMART OPTIONS FOR SUSTAINABLE GROWTH

Asian economies have grown more quickly than those in any other part of the developing world. The resulting transformations have come at a high environmental cost, however, and the uneven pace of growth has resulted in many people being left out. A central development challenge for the continent, therefore, is to achieve sustainable and inclusive growth. Improved water management figures as a key factor in the growth equation and is especially important for agriculture, which remains Asia's single largest employer and a major source of pressure on its vital ecosystems.

Conventional thinking about water management revolves around technology and built infrastructure, with particular emphasis on hydropower and large-scale irrigation. IWMI's research seeks to challenge and shape this thinking, and the actions that result from it. Our work on governance and gender, for example, identifies means by which women and marginalized groups in society are empowered to participate in decisions about water technology, infrastructure and their management, and to gain a fair share of the benefits. To ensure that nature receives due attention as well, our research demonstrates the value and multiple contributions of "natural" infrastructure (such as wetlands, floodplains and aquifers) to improved livelihoods and sustainable growth.

Providing water security for everyone, while also ensuring that enough water is available to sustain vital ecosystem services and biodiversity, requires balanced decisions based on reliable scientific evidence. IWMI researchers employ a variety of geo-spatial tools, analytical methods, and web-based resources to inform contentious debates over competing uses of water for food, energy and the environment.



Mahi canal, Rajasthan, India.

A global hotspot for

WATER INSECURITY



With

60%

OF THE WORLD POPULATION
HALF OF IT POOREST PEOPLE &

80%

of water resources
going to Agriculture,

ASIA FACES
an uncertain

WATER FUTURE

To facilitate decision-making, we actively promote "water accounting," an approach that capitalizes on remote sensing and global databases to quantify the status of water resources in specific areas over a given period. A key aim is to integrate water accounting into national efforts to bolster food and water security. Since about half of Asia's river basins cross national boundaries, we also work to consolidate knowledge and foster exchanges that help national governments and transboundary bodies manage water cooperatively.

SAFEGUARDING THE LIFE BLOOD OF A LAND AND ITS PEOPLE

Rapid growth of Myanmar's economy – expected to quadruple in size over the next 15 years – will both depend on and impact the country's rivers. Vital for key growth sectors – agriculture, mining and energy – water supports the livelihoods of millions of rural people, while sustaining a wide range of ecosystem services and a wealth of biodiversity. Central to Myanmar's economy and culture lies the Ayeyarwady River Basin, embracing about two-thirds of the entire population and land area. The uniquely valuable and largely unexploited Salween River supports the livelihoods of many ethnic minorities, but has seen decades of armed conflict and social turmoil.



Ayeyarwady River, Myanmar.

What will become of these rivers and the people who depend on them, as climate change, urban growth, hydropower development, and other pressures mount? Myanmar's government and rural communities urgently need new tools to help support sustainable and equitable development. Through the Myanmar Healthy Rivers Initiative, IWMI and several partners are helping create a:

- Shared vision of what is important for river users
- Knowledge base consisting of data, maps and reports
- Report card on river condition
- River health resource kit

Only by better understanding the changes unfolding in the rivers of Myanmar, can its people shape the direction of events toward a prosperous and sustainable future.

MANAGING CHANGE IN CENTRAL ASIA

Central Asia's arid climate leaves little margin for error in the management of water for crop production, which depends almost entirely on irrigation. A prolonged civil war in Tajikistan during the post-Soviet period and the break-up of large collectives into



Members of a water user association in Tajikistan.

thousands of private or *dekhan* farms led to major disruptions in irrigation. This caused a sharp drop in cotton production, which has been a mainstay of Tajikistan's agricultural economy since Soviet times.

In the aftermath, local water user associations have proved vital for improving the country's irrigation management. IWMI research has generated quantitative evidence on the positive effect of longer training for improving the associations' performance. But out-migration of male laborers is greatly complicating their operations. New research shows that, with more women operating *dekhan* farms, training programs need to target these farmers directly as a means of strengthening their role in the water user associations.

WATER SOLUTIONS TO

STRENGTHEN RURAL-URBAN LINKAGES



Fertilizer pellets made from processed fecal sludge in Bangladesh.

By 2030, about 55% of Asia's people are predicted to be living in cities, up from about 45% today. Growing numbers of migrants to urban areas of high population density are rapidly driving up demand for water and food, while also generating ever larger volumes of waste. Especially near cities, farmers are intensifying food production to meet increased demand, often using wastewater to irrigate crops. Most countries lack the means to install conventional facilities for waste treatment on the scale needed to mitigate the growing threat to human and environmental health.

In a novel effort to confront this predicament, IWMI pursues an approach that centers on safe recovery and reuse of resources from waste, including crop nutrients (for organic fertilizer) as well as water and energy. Promising options have emerged in recent years for applying this approach to the management of fecal sludge (human waste) in particular. By generating marketable resources from waste in ways that are safe for people and the environment, the approach could contribute significantly to food, water and energy security as well as improved health in expanding rural-urban corridors.

IWMI researchers have thoroughly documented dozens of innovative options in a book presenting business models for energy, nutrient and water reuse that are applicable in low- and middle-income countries. Having first pioneered this approach in West Africa, we are pursuing it in Asia as well, partly through major efforts to incorporate the approach into university curricula. Judging from the figures available, wide application of the business models could deliver significant volumes of valuable resources, while also helping recover the costs of sanitation.

This research goes hand-in-hand with the search for new water solutions to various health and nutrition problems, including those associated with water pollution, the use of untreated wastewater for irrigation and water-related, vector-borne diseases.

Encouragingly, many municipal governments in Asia have embraced the principles of a circular economy, realizing that the current linear pattern of single water use and waste disposal is not sustainable. Redoubled efforts to recover and reuse resources from waste are critical for the success of this movement in Asia and beyond in reducing poverty, stimulating markets and lessening the health and environmental threats posed by proliferation of municipal waste.

**A MAJOR SOURCE OF
WATER POLLUTION**

**MORE THAN
90% OF**

**PATHOGENIC POLLUTION
OF SURFACE
WATER IN
INDIA**

MAY BE ATTRIBUTED TO



**100_{MN}
SEPTIC TANKS**

60_{MN}

&



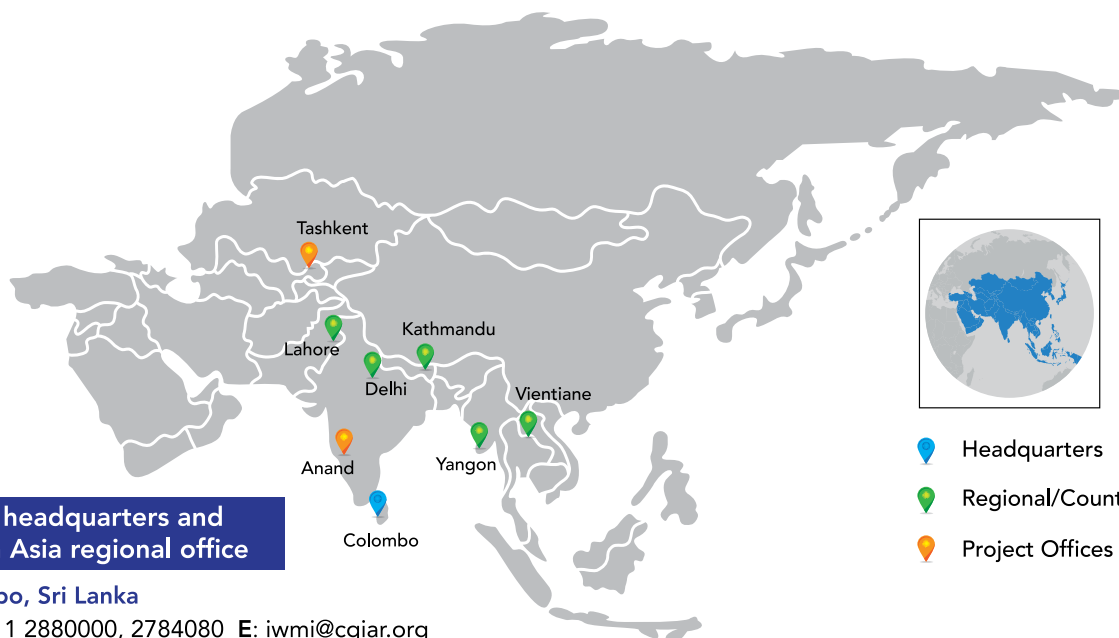
LATRINES IN URBAN AREAS

IWMI AND ASIA'S DEVELOPMENT AGENDA

IWMI's research contributes to key international initiatives that are important for Asia, such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), Asia-Pacific Water Forum (APWF), Sendai Framework for Disaster Risk Reduction, and Ramsar Convention on wetlands. At the national level, our researchers work with government ministries and agricultural research institutes as well as with a wide array of development partners, including civil society organizations and private enterprises.

IWMI is a CGIAR Research Center focused on research for development to deliver new evidence-based approaches that address key water-related challenges. CGIAR is a global research partnership for a food-secure future. Its work is carried out by 15 centers in close collaboration with hundreds of partners across the globe. IWMI contributes importantly to CGIAR Research Programs that prioritize Asia's needs and potential: leading Water, Land and Ecosystems (WLE) and playing an active role in Climate Change, Agriculture and Food Security (CAAFS); Policies, Institutions and Markets (PIM); Fish; and Livestock.

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