Bangladesh integrated water resources assessment

A Bangladesh–Australia joint research project has assessed the integrated water resources and socio-economic impacts of water in Bangladesh. This document summarises the objectives and key findings of the project.

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Background

Climate change, increasing population and economic growth are expected to increase the demand for water resources in Bangladesh. However, the quantity and quality of its surface water and groundwater resources may also be negatively affected by climate change and economic development. There is a real risk of reduced access to safe drinking and irrigation water, and of induced contamination of groundwater by saline intrusion and ingress of polluted surface waters.

To examine the issues, researchers from Australia and Bangladesh have conducted a collaborative project on integrated water resources assessment.

About the project

The Bangladesh Integrated Water Resources Assessment project aimed to provide policy and management options to enable Bangladesh to equitably and efficiently allocate and use water in the future.

Researchers undertook an integrated biophysical and socio-economic study to provide a national overview of water resources and to describe the impacts of development and climate change on both surface water and groundwater. The study assessed how these impacts affect the poor and vulnerable, and how they affect the amount of water available for and used by different economic sectors such as agriculture, industry and households.

Project outcomes

Researchers identified key issues and challenges for Bangladesh in future water use and management, as well as potential hotspots for future detailed local assessments. Hotspots included areas at high risk of contamination by saline intrusion or polluted surface waters, and areas at high risk of lack of access to safe drinking water and irrigation water in rural areas.

The project helped build capacity in Bangladesh organisations for integrated water resources assessment, including assessment of socio-economic impacts of climate change and future water demand due to population growth.

Access to safe drinking water is a key concern for Bangladesh

Australian Government
Department of Foreign Affairs and Trade
Australian Aid
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INSTITUTE OF WATER MODELLING
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Bangladesh Institute of Development Studies (BIDS)
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Key challenges

The assessment examined water resources from both biophysical and socio economic perspectives and exposed several key issues and knowledge gaps. These are outlined below.

Food security is achievable, although there will be challenges

Food security is a high priority national goal, and the use of water for irrigation has been crucial to Bangladesh recently achieving national rice-grain food security.

Several developments could continue to increase rice production at or above the rate of increase required for national food security: closing yield gaps everywhere between average farm productivity and the best productivity; continuing to close yield gaps between high and low performing areas; and developing higher yield crop varieties.

These developments do not necessarily require more water or land than is used today; the challenge is to continue to improve crop varieties and farm performance (Figure 1).

Water is crucial to food security but land may be more limiting in the future

Whilst water, especially groundwater, is key to food security, food production can be boosted without necessarily using more water. As noted above, yields could be increased by several strategies, and other strategies such as replacing rice with wheat would require less water.

Perhaps of greater concern is the reduction in the land available for agriculture: about 1 per cent of agricultural land is being converted to other uses each year. If this continues unchecked to 2050, the land available for rice production would be considerably less than is currently used. Yield increases have, to date, coped with decreasing agricultural land and will continue to do so for a while; however, this trend cannot continue indefinitely.

Groundwater use is unsustainable in some areas, and a concern in many areas

The study showed that groundwater use is unsustainable in some areas such as parts of the Barind Tract. It is also unsustainable in the Dhaka area where urban water supply is the main use. In the north-west and north-central regions, wells for drinking and irrigation water run dry at the end of the dry season.

In addition to the concerns for drinking and irrigation water, declines in groundwater levels suggest that there will be less dry-season discharge from groundwater to the rivers and/or more wet-season recharge of groundwater from the rivers. This means that during the dry season, low river flows could potentially fall further with the reduction of baseflow.

The Bangladesh Integrated Water Resources Assessment has identified key challenges for Bangladesh in future water use and management

Sustainable levels of groundwater use are generally not known: this is a key knowledge gap

While there are good studies for the Barind area, the impacts on groundwater of rainfall, pumping for irrigation, and exchange with the rivers have not been analysed for Bangladesh more generally.

The Bangladesh Integrated Water Resources Assessment included a pilot study which showed that the volumes of water exchanged annually between groundwater and rivers could be significant. However, we know of no comprehensive study of this exchange, leading researchers to conclude that the levels of sustainable use of groundwater cannot currently be adequately assessed for most of the country. This is a major gap that needs further detailed study.

Increased flooding and salinity intrusion is a key climate change risk

Climate change is projected to increase peak monsoon river flows and flooding and coastal flooding due to storm surges. This in turn would increase river salinity due to sea water intrusion up the rivers of the delta, soil salinity resulting from coastal floods, and the salinity of groundwater due to its interactions with the surface water. As well as the risk to lives and property, the combined effects would limit the area of land available for crop production. This adds to the prospect that land may be the most limiting factor for future crop production (Figure 2).

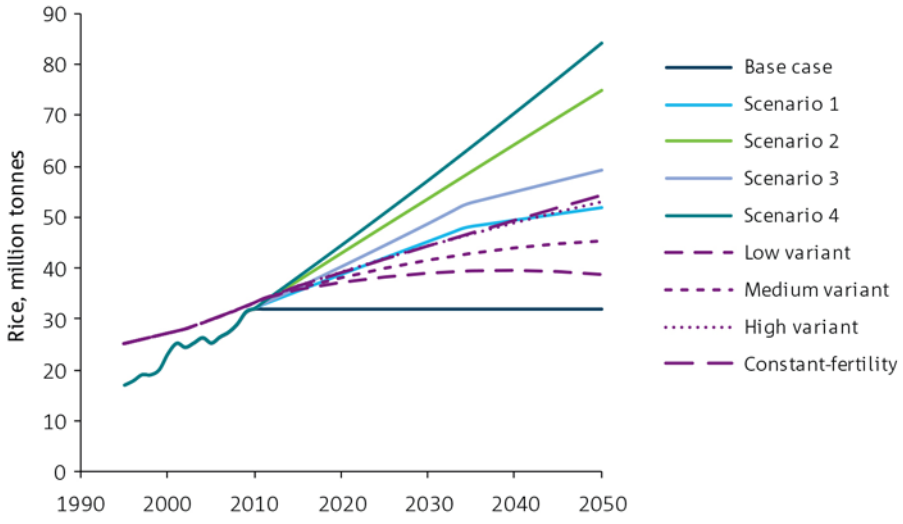

Figure 1. This figure compares projected production of rice under a range of different scenarios (solid lines) with the rice consumption requirements for different population projection scenarios (dotted lines). It shows that increases in yields will likely be sufficient to maintain rice security.

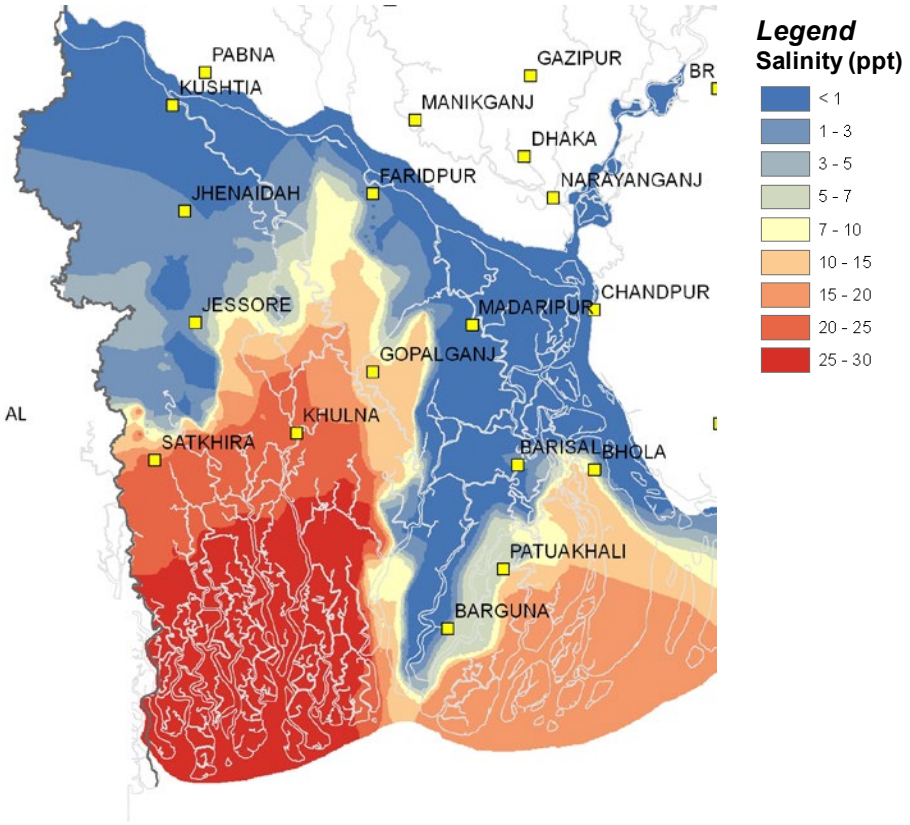

Figure 2. Salinity intrusion in southwest Bangladesh projected under rising sea level in 2050 (Institute of Water Modelling, 2014)

Climate change is a key concern, and for many water related issues coping with climate variability is likely to enable coping with climate change

Bangladesh is projected to be more affected by climate change than any other country. Climate change is projected to affect many aspects of water availability and use in Bangladesh. Although peak monsoon river flows and flooding and coastal flooding due to storm surges are likely to increase, the magnitude of changes to rainfall is uncertain.

The impact on groundwater is also uncertain: larger flows and floods could enhance recharge, whereas greater plant and crop water demand could increase natural groundwater use and irrigation withdrawals. Changes to water use, such as upstream withdrawals and substituting surface water for groundwater use may also affect groundwater levels and river flow in addition to climate change; sea level rise may be exacerbated by channel constriction and dredging in the coastal zone.

The main practical conclusion is that Bangladesh should prepare for climate change, as it is already doing. Dealing with existing climate variability (coping with the extreme floods, storm surges and droughts already experienced) is likely to prepare the country for climate change at least to 2050. Bangladesh has more become resilient to climate-related hazards; nevertheless, they still cause large economic losses and slow progress in reducing poverty.

Water use in Dhaka is unsustainable; returning to sustainable use will include solving water quality problems

Water use in Dhaka draws mainly on groundwater. Although already unsustainable, demand is likely to grow several-fold by 2050. The dramatic lowering of the groundwater table beneath Dhaka, combined with suggestions that the resulting groundwater pressure gradient may draw sea water into the aquifer at the coast, is cause for quick action. Surface water quality around Dhaka is too poor to allow a rapid switching to surface water supplies, and water quality must be improved (by reducing pollution, treating already polluted water, or both) as part of the overall solution. Demand management will also be part of the overall solution. There is no single, obvious solution that can be quickly and cheaply implemented.

Water related climate change may not affect overall economic development, but may affect the structure of the economy

The Bangladesh economy is growing rapidly, and the overall rate of growth is not likely to be greatly affected by climate change impacts on water related factors. However, the projected impact of climate change on crop yields (while not threatening food security) is projected to change the structure of the economy, relative to the structure likely in the absence of climate change. Fewer crops will be available for export and the need to import some food commodities will increase. Relative to a “no climate change” economy, these changes are projected to divert activity away from agriculture and into other areas of the economy.

Development is the main factor in future poverty reduction

Bangladesh is vulnerable to water related stress (floods and droughts, as well as water quality stresses such as arsenic and salinity contamination), and the poor are particularly vulnerable. Lifting people out of poverty is a worthy end in itself, and doubly so because it will reduce the vulnerability of poor people to water related stresses.

General economic development is the main factor in future rural household income security. Loss of agricultural land due to climate change and growing land use competition would adversely affect incomes and food availability for poor people, but the effect is likely to be small relative to non-agricultural employment and education growth impacts.

This suggest that poverty reduction policy should be directed towards accelerating growth in non-agricultural activities and education, as these are likely to yield the greatest improvements on household income.

Research for Development Alliance partners

This study was funded by the Department of Foreign Affairs and Trade (DFAT) and CSIRO, through the DFAT–CSIRO Research for Development Alliance. Partners in Bangladesh include the the Water Resources Planning Organization, the Bangladesh Water Development Board, Institute of Water Modelling, the Bangladesh Institute of Development Studies and the Centre for Environmental and Geographic Information Services.

BANGLADESH PARTNERS

Water Resources Planning Organization

The Water Resources Planning Organization (WARPO) is an apex organization under the Ministry of Water Resources, dealing with nationwide water resources planning and with a mandate to prepare National Water Plans.

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Bangladesh Water Development Board

The mission of the Bangladesh Water Development Board is to develop a state of knowledge and capability that will enable the country to design future water resources management plans by itself with economic efficiency, gender equity, social justice and environmental awareness to facilitate achievement of water management objectives through broad public participation.

CONTACT: Md. Amirul Hossain, Executive Engineer Flood Forecasting and Warning Centre, amirulbd63@yahoo.com

Institute of Water Modelling

The Institute of Water Modelling provides world–class services in the field of Water Modelling, Computational Hydraulics & Allied Sciences for improved integrated Water Resources Management.

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Bangladesh Institute of Development Studies

The Bangladesh Institute of Development Studies (BIDS) is an autonomous public multi-disciplinary organization which conducts policy oriented research on development issues facing Bangladesh and other developing countries. The mission is to facilitate learning in development solutions by conducting credible research, fostering policy dialogue, disseminating policy options, and developing coalitions to promote informed policy making.

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Centre for Environmental and Geographic Information Services

The mission of the Centre for Environmental and Geographic Information Services , as a Center of Excellence, is to support the management of natural resources for sustainable socio-economic development of Bangladesh (and also of other countries when asked for) using integrated environmental analysis, geographic information system, remote sensing technique, database, and information technology.

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Climate change may affect many aspects of water availability and use including river flows and flooding

AUSTRALIAN PARTNERS

Department of Foreign Affairs and Trade

The Australian Department of Foreign Affairs and Trade's role is to advance the interests of Australia and Australians internationally. This involves working to strengthen Australia's security; enhancing Australia's prosperity; delivering an effective and high quality aid programme; and helping Australian travellers and Australians overseas.

Commonwealth Scientific and Industrial Research Organisation

CSIRO, the Commonwealth Scientific and Industrial Research Organisation, is Australia's national science agency and one of the largest and most diverse research agencies in the world. Our water research, undertaken in collaboration with government, industry and other research agencies, provides the scientific basis for water managers and governments to develop policy and make informed decisions to ensure that water resources are sustainably managed and deliver greater economic, social and environmental benefits.

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