REACH

Improving water
security for the poor

Country diagnostic report

Bangladesh

Contents

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Executive summary

Bangladesh celebrates its 50th year of independence in 2021 with the goal of achieving middle-income status and ending extreme poverty. Water security has a defining role to play in this challenge, given the risks of multibillion losses associated with the country's adverse ecology, characterised by extreme flood and cyclone events intersecting with chronic water quality hazards. 80% of the land area and people's water-related livelihoods are vulnerable to water risks requiring improved understanding of, and responses to, the impact of water security interventions to promote economic growth and reduce poverty.

Water-related economic growth will be advanced by the goal of doubling Bangladesh's revenues to USD50 billion in the Ready Made Garment sector by 2021. The garment sector employs nearly four million people, mainly women, of whom many have been lifted out of poverty through employment in the industry. Balancing the opportunities for industrial growth with environmental sustainability and poverty reduction will be a signature water security challenge for global and local enterprises in partnerships with government, communities and researchers.

Water insecurity in Bangladesh's coastal area is increasing due to growing populations, rapid environmental change and chronic water-related hazards. Nearly 40 million people live in coastal areas vulnerable to cyclonic storm surges and river flooding. To identify long-term water security pathways, REACH will develop methods to appraise alternative water security investments to bring people out of a water-climate-poverty trap and to enable sustainable growth trajectories.

Universal safe and reliable drinking water security can be advanced with risk-based science that guides more effective investments in institutions and infrastructure. Tens of millions of Bangladeshis are vulnerable to seasonal river flooding and arsenic groundwater which increase risks to health and welfare threatening poverty reduction efforts. Women and children are groups at high risk. New models will be developed to promote scalable approaches informed by risk-based metrics to improve monitoring systems and deliver sustainable outcomes for the poor.

The University of Oxford is building a science-practitioner partnership with national and local government, UNICEF, the Bangladesh University of Engineering and Technology, the International Centre for Diarrhoeal Disease Research, Bangladesh, and the University of Dhaka, **to establish Water Security Observatories for 'universal drinking water security' and to reduce 'water security risks for the coastal poor'**. Impacts and implications of the work will support wider regional initiatives to improve water security for millions of poor people in South Asia.

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1. Winning against the odds?

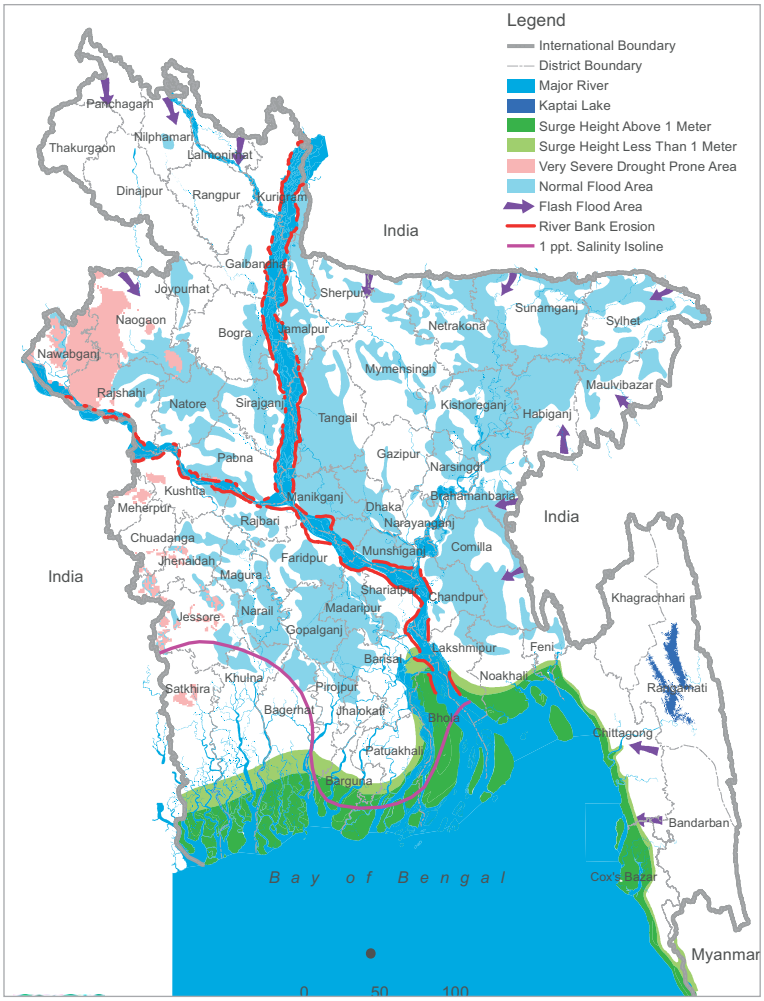
A turbulent future?

Bangladesh is one of Asia's most dynamic economies with water shaping its rich history and future growth. Water security is a defining feature of the opportunities and limits for growth and development towards the country's 50th anniversary of independence in 2021. Complex hydrology, chronic water-related risks, high exposure to water-related hazards and rapid environmental change mean that Bangladesh is already addressing challenges that will affect other South Asian countries in the decades ahead.

Located in 7% of the land that drains 91% of the annual flow of the Ganges, the Brahmaputra, and the Meghna, Bangladesh is highly vulnerable to floods, droughts, cyclonic storm surges, salinity intrusion, and river erosion[1,2]. Less frequent but extreme flood events inundate more than 60% of the country, causing losses to lives and damages to agriculture, properties, assets, infrastructures, crops and water supply and sanitation systems. Moderate to severe droughts affect the northwest and southwest zones, having negative effects not only on agriculture, but also on health, education, livelihoods and water usage[3].

Arsenic contaminated groundwater is the most widespread environmental risk for between 5 million and 19 million people[4]. About half of the affected population live in areas where more than 80% of the water points are contaminated. Increased climate variability, the anticipated sea level rise, and increased intensity and frequency of cyclones, will substantially aggravate the impacts on poverty and social deprivation. Water and soil salinity are creeping hazards in the coastal area, affecting about 70% of the cultivable area[5], leading to unproductive

Figure 1: This map of different natural hazards in Bangladesh highlights the extent to which the country is vulnerable.[7] An additional hazard, not included in the figure, is arsenic contamination of groundwater.



land use, low irrigation coverage and low cropping intensity6. High salinity in groundwater and non-availability of aquifers is also a major cause for drinking water problems in the coastal area.

Transboundary water management is a further cause of concern, as upstream interventions, without consensus among the riparian states, have the potential to increase the negative consequences on water security in Bangladesh. Important secondary consequences of climatic hazards include riverbank, char (river and deltaic islands), and coastal erosion, causing displacement of millions of people. Cyclonic storm surges cause extensive flooding in the southwest coastal zone, leading to significant loss of life and damage to crops, properties and infrastructure, and salinisation of open drinking water sources, fresh groundwater sources and productive farm lands. Managing these climatic risks represents the greatest future challenge to water management in the country and is compounded by increased exposure due to growing population size and development interventions in vulnerable areas.

Economic transformation in fragile environments

Export-led manufacturing in the ready-made garment sector has created four million jobs in a USD25 billion dollar industry[8]. Around three quarters of these jobs are taken by first-generation female workers mainly from poor families. The social and economic consequences of this transformative sector are indirectly for the 'sender families' whose food poverty has fallen from 80% to 43%.

By 2021, the garment sector aims to double revenue to USD50 billion per year. Beyond the factory gate, water security will influence progress to this ambitious target in terms of (1) the reliability of water resources for the industry, (2) the impact of effluent discharge on the aquatic environment, and (3) the implications for neighbouring communities sharing the same water resources, particularly for drinking water. The uncertainty of the capacity of the Turag, Tongi and Balu Rivers around Dhaka city to safely absorb increasing point sources of pollution has raised questions on the need for improved monitoring and smarter policy to balance growth with poverty reduction and environmental goals[9].

Global retailers increasingly recognise the reputational risks in balancing economic growth, human development and environmental sustainability. Effective enforcement of water regulations is needed to respond to the increasing and currently unknown pollution impacts from dyes and other contaminants used in garment production. The water consumption and effluent discharge of the garment industry can provide a unit of analysis: this analysis is applicable to existing hydrological models estimating wider interactions and outcomes for water security in Dhaka. Achieving inclusive, pro poor growth and a fair and sustainable balance will require new partnerships and innovations to ensure a water secure future for all.

Is zero extreme poverty possible by 2021?

Bangladesh has made enormous strides in reducing poverty between 1990 and 2010. The 'headcount' poverty rate has fallen for the extreme poverty from 24% to 8% in urban areas and in rural areas from 43% to 21% in the same period10. However, poverty measurements are only available as standard income and consumption indicators despite recognition that marginalised communities are often located in ecologically and climatically vulnerable and remote areas of the country. Current measures do not adequately capture water security risks, or monitor shocks associated with the most significant events within or between years. Cross-sectional data offers aggregate trends, but without panel data on the same population cohort it is difficult to know who is moving in or out of poverty or why. Zero poverty is considered possible with sustained growth and the right blend of social safety net programmes. However, the current weak understanding of the dynamics and relationships between chronic exposure (arsenic, salinity) and periodic shocks (flooding) makes policy and planning loosely anchored in the realities of the lives of the poor.

Poverty reduction efforts will not enable sustainable growth and will not achieve desired development outcomes unless they include productive investments in water security and protective interventions against water-related risks. The prevailing water-related hazards together with socio-economic vulnerability and exposure have a profound bearing on poverty in the country. For the extreme poor, efforts to periodically climb up

the income ladder are hindered by the periodical push backs through loss of productive assets due to water-related disasters. Households in exposed areas are more prone to food shortages, have lower total household income, and have more difficulties in expanding their narrow livelihood base geared around lower agricultural activities and in recovering from financial crisis. Hazards and disasters pose major obstacles to translating the short-term gains or benefits the extreme poor receive, most importantly social safety net programmes, into longer term sustainable growth trajectories. The costs for addressing the health issues caused by natural disasters and poor water quality are also higher for the extreme poor as they have to spend a higher proportion of their income, often diverting critical household resources from other basic needs, including food, and from investment in income-generating activities.

Why water security matters

Water security recognises the interactions and trade-offs in balancing sufficient and safe water for people, agriculture, industry and nature under increasingly uncertain hydroclimatic futures. Water security risks are shaped by the exposure of vulnerable Bangladeshis to multiple hazards from storms, flooding or water contamination. Understanding how the likelihood and consequences of these risks vary over space and time and for different sectors of society, especially for the poor, is key for designing more effective and fair policies and programmes.

The aim of this report is to highlight key water security risks to Bangladesh's growth and poverty reduction efforts. Chapter 2 examines the progress made by Bangladesh in reducing poverty and improving growth and considers how current poverty measures may not pick up the risk factors to increasing poverty incidence, or the depth and severity of poverty. Chapter 3 illustrates evidence of significant but uncertain water security risks in places where long-term science-practitioner collaboration could promote new approaches and models that would benefit tens of millions of poor Bangladeshis. Finally, the report introduces the concept of water security observatories and outlines the rationale for two observatories, which will start REACH activities in Bangladesh.

2. Understanding the dynamics of poverty

2.1 Poverty and welfare

Poverty is a condition of multiple deprivations for vulnerable individuals, households and communities over space and time. Understanding the dynamic nature of poverty has generated an extensive portfolio of metrics and methodologies. Who defines poverty and how poverty is measured influences actions and outcomes. Making effective decisions can be challenging if measuring what we value is disputed or disregarded in favour of valuing what we can measure. If measurements are infrequent or inaccurate, policy will be less effective in reducing poverty. Poverty is commonly measured by four categories:

- Income poverty, for example the global estimate of USD1.90 per person per day at 2011 purchasing power parity (PPP);
- Consumption poverty in terms of the cost of basic needs such as food, energy, clothing or shelter;
- Multidimensional welfare, which recognises health, education, assets and other social deprivations; i.e. Human Development Index (HDI); Multidimensional Poverty Index (MPI)
- Subjective welfare which prioritises how people self-assess their individual or household welfare.

Poverty and welfare metrics are used for multiple purposes in Bangladesh, including global reporting for the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), policy making and for targeting measures of social safety net programmes. But these measures are not directly comparable across planning, policy and implementation, as they vary across scales, temporality, and spatial resolution. As shown below, this is significant for how we quantify and monitor vulnerable groups.

2.2 National progress in reducing poverty 2000–2015

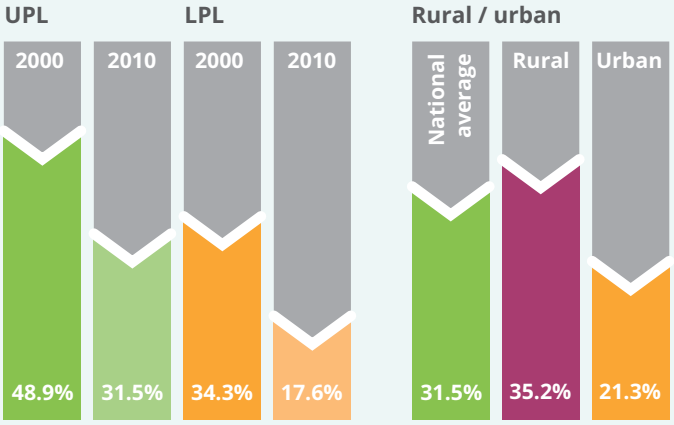
Bangladesh has made considerable progress in reducing poverty since its independence in 1971, a significant achievement for one of the most densely-populated countries in the world with a population of 160 million inhabitants[11]. National data shows that Bangladesh has experienced a gradual decrease in poverty, including extreme poverty, across multiple poverty measurement frameworks. Income-based poverty measures, the primary metrics for national policy-makers, show the greatest reduction in poverty, decreasing from 48.9% in 2000 to 31.5% in 201010. In comparison, a multidimensional poverty assessment for Bangladesh in 2011 suggests 49% of the population, is living in poverty.[12] This poverty indicator takes into account additional measures of social deprivation by incorporating household access to education, infant and child mortality, as well as the rate of access to antenatal care, electricity and water and sanitation. But many of the key indicators are still at low levels for Bangladesh, such as significant gender and income disparities, and one of the world's highest incidences of child malnutrition.

Secondary analysis of poverty dynamics also reveals the existence of poverty pockets and prevalence of unemployment and underemployment among the youth. Stunting and wasting among children under five as well as universal access to reproductive

Box 1: Income and consumption poverty, multidimensional poverty and subjective welfare

Income & consumption

Headcount poverty ratio: estimates the percentage of people living below the poverty line, that is defined by the Cost of Basic Needs (CBN) approach, as a share of the total population.



Income and consumption poverty in Bangladesh is calculated with the CBN Method: This method has been one of the main poverty metrics used by the government of Bangladesh since the mid-1990s. It calculates the cost of the basic food basket that enables a household to meet nutritional requirements, and adds this to an allowance for basic non-food consumption. Bangladesh government sets a Lower Poverty Line (LPL) by computing the food poverty line. They also calculate the Upper Poverty Line (UPL) by estimating food and non-food poverty lines.

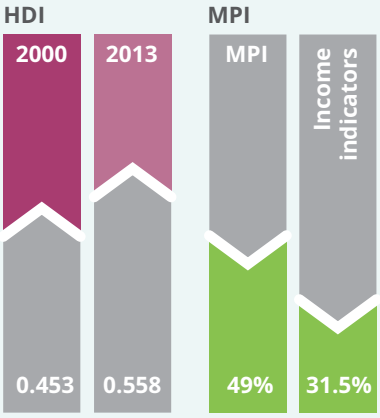
For more information see Bangladesh Bureau of Statistics (BBS) (2011)[10]

Multidimensional poverty

Human Development Index (HDI): This global framework evaluates three dimensions including life expectancy, access to education and gross national income (GNI).

Multidimensional Poverty Index (MPI): These indicators recognise health, education, assets and other social deprivations. The Global Multidimensional Poverty Index (MPI) is an index of acute multidimensional poverty that quantifies 10 indicators of the intensity of poverty.

For more information see HDI (2015)[13] and OPHI (2015)[12]



Subjective welfare

Subjective measures of welfare often capture aspects of poverty which are not present in poverty measures. The indicators prioritise how people self-assess their own well-being. Welfare measures provide a broader reflection of household capabilities and vulnerabilities which are complementary but not directly comparable to income or consumption metrics. Subjective welfare allows individuals to self-evaluate giving choice and voice beyond income and consumption based metrics.

For more information see Asadullah and Chaudhury (2012)[14]

health and resource constraints are still identified as stumbling blocks in fulfilling the targets of the Millennium Development Goal's, soon to be linked to the new Sustainable Development Goals, in Bangladesh[15].

Poverty metrics reflect different elements of poverty and draw on national scale data, collected in five year intervals. But the commonly used development indicators do not provide a measure of vulnerability to evaluate the risk of becoming poor or poorer, or provide an understanding of the risks and drivers of changes in poverty incidence. Water security risks and environmental impacts on the livelihood of different groups are not incorporated into these frameworks directly.

Institutional responses and investment strategies

The Government of Bangladesh continues to prioritise ending extreme poverty and applies the described national poverty and development indicators for evaluating progress. The National Sustainable Development Strategy (NSDS)[16], the Perspective Plan for Bangladesh[17] and the 7th Five-Year Plan (FYP)[11] all aim to increase the country's GDP growth rate by 7 % annually over 2011–2021, while simultaneously decreasing consumption inequality and ending all forms of extreme poverty. The objectives of these policies promote an increase in investments in public sector infrastructure, such as roads, electricity connections and water supply, as well as the targeted growth of the manufacturing industry to support the overall growth and poverty reduction targets. Moreover, a variety of national water sector policies highlights the water and sanitation needs of the poor given that ensuring the delivery of public services is a key element of the poverty reduction strategy and pro-poor growth. New revenue from this sustained growth would generate additional tax returns intended to finance social service programmes targeted at ending extreme poverty.

These national poverty reduction programmes target livelihood interventions as part of a 'social safety net' programme, emphasising the need of access to public services to break the poverty cycle. These programmes range from cash transfers for identified vulnerable groups and micro credit programmes to disaster response support measures. The programmes draw from both national poverty surveys but also from local data collection specifically directed at programme design and decision-making. The continuation and expansion of local poverty reduction programmes and social service safety nets are increasingly reliant on funding derived from sustained national economic growth. This creates an array of inter-dependencies and contingent variables required to achieve the national goal of ending extreme poverty by 2021. Factoring in water risk and mitigating potential shocks to the economic development plan, the social services and social safety net programmes is important in this closely linked cycle.

2.3 Achieving zero extreme poverty

Extreme poverty, measured at the lower poverty line has steadily decreased by dropping from 44% in 1991 to 21% in 2010 at the national level. Moreover, the share of the extreme poor as a proportion of the total poor is diminishing (Figure 2)[18]. However, poverty reduction efforts would need to accelerate the trend in reducing income and consumption-based poverty rates to achieve the national development objectives of zero extreme poverty by 2021.

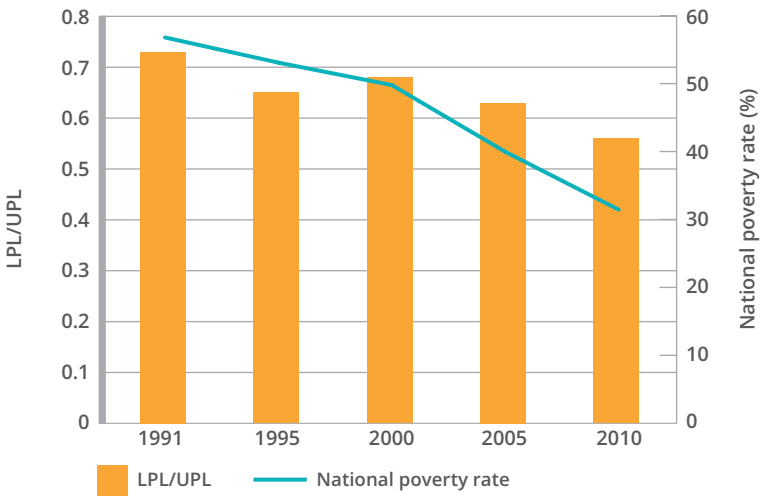


Figure 2: This figure shows the change in the structure of poverty as the share of the extreme poor (LPL) of the total poor (UPL) decreased between 1991 and 2010.[10]

Extreme poverty is difficult to tackle because the extreme poor differ significantly from the moderate poor or the non-poor by multiple levels of vulnerability, increased exposure and deprivation. Studies have identified the challenge of multiple deprivations facing the extreme poor characterised by no income or employment, little or no education, ill health, malnutrition, and social marginalisation19. There are two key challenges to address extreme poverty including, the lack of assets and/ or social capital required to overcome chronic poverty as well as repeated shocks to the well-being. Water security risks influence extreme poverty by causing sudden loss of incomes, food insecurity and health problems, yet it is rarely included in poverty metrics currently used by policy-makers.

Multidimensional poverty and development indicators attempt to capture the position of the extreme poor and to provide a wider analysis of extreme poverty incidence. Improvements or worsening in these non-income indicators is closely interlinked to water-related risks as these deprivations have multiple linkages with the water dimension of development, which is not adequately reflected by the poverty indicators used. The prevailing hazards and disasters in the country together with socioeconomic vulnerability and exposure have a profound bearing on poverty incidences. Changes in hazard, disaster intensity and frequency, as well as exposure and vulnerability will impact future poverty risks.

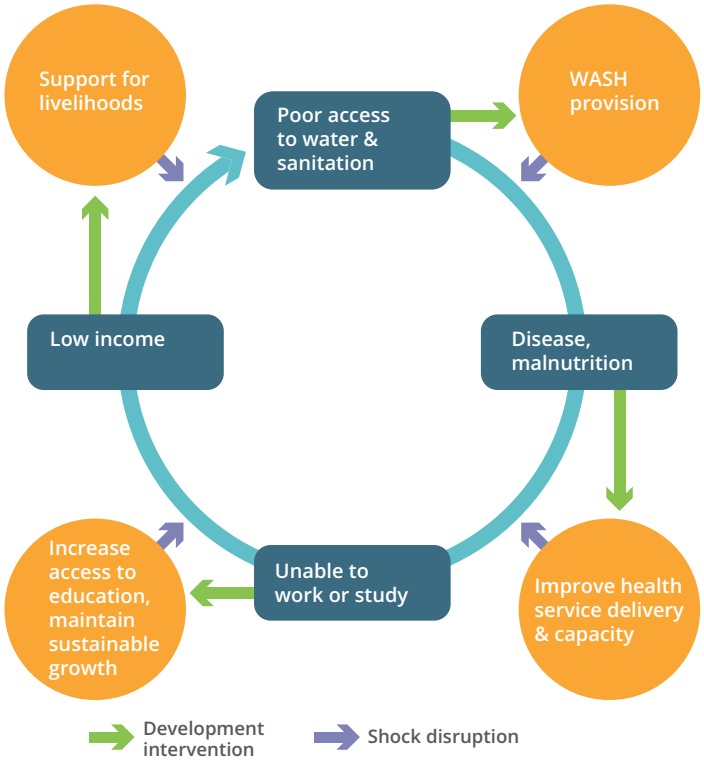
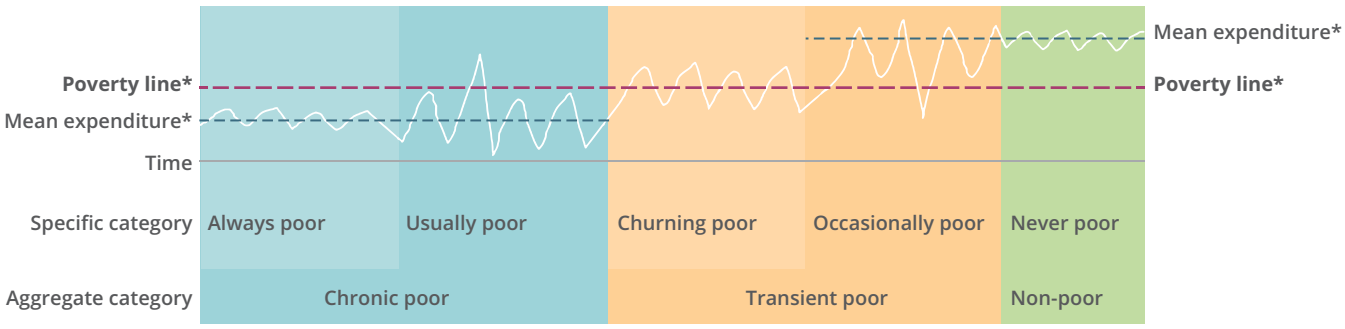


Figure 3: This figure shows an example of how water-related risks (red arrows) threaten interventions designed to support poverty reduction progress (blue arrows). This risk is either to perpetuating the poverty or undermining current policy efforts to reduce vulnerability.

Figure 4 This figure shows the different poverty transitions, highlighting how household expenditure varies, resulting in the poor transitioning between different depths of poverty, potentially as a result of water-related shocks.[21]



* Depending on data availability, poverty could be assessed in terms of household expenditure, income, consumption, a nutritional measure, a poverty index, a poverty score or an assessment of assets / capital

Understanding the dynamics of poverty requires an assessment of the patterns and determinants of transitions into and out of poverty, as not every shock affects 'the poor' with the same likelihood or consequences. This will help to explain the persistence of extreme income-poverty, as the two major sources of income shocks are natural disasters and ill-health.[20] Other potential variables include the role of adverse demographics, under-nutrition, and limited financial and human capital as well as the living conditions of poor households and are essential to design efficient poverty reductions strategies and enhance targeted decision-making for investments.

Measuring transitory poverty focuses on factors that impact the 'changes in welfare that cause individuals or households to cross a fixed poverty line between one period and the next'[22] and identifying the characteristics of vulnerable groups. Poverty transition measures have to explore how the likelihood and consequences of poverty risks impact vulnerable groups due to varying exposure levels over time and space (Figure 4). Current gains in terms of gradual eradication of poverty may be short-lived due to increased shocks. Addressing these poverty risks requires more reliable poverty data to increase the response capacity of policies and government institutions to shocks.

Poverty reduction efforts will face increased difficulties due to the disproportionate risks of climate change on the extreme poor and differentiated impacts on women and men[23]. A concern is that standard approaches have not been proven to effectively reach the extremely poor, at critical times in the poverty transition cycle[24]. Understanding how poverty dynamics link to these risks is one of the key objectives of the REACH Bangladesh portfolio.

2.4 Risks and vulnerability

Static poverty measures have limited explanatory power when linking them to the temporal dynamics of estimating risks and vulnerabilities of different groups. The risk of becoming poor or 'poorer' is reflected by the interaction of hazards, vulnerability and exposure. Understanding the relationship of environmental vulnerability to poverty is crucial to identify 'at-risk' groups who may be tipped into poverty, or trapped into cycles of poverty.

There is a direct link from natural disasters to destitution, through loss of productive assets, as well as an indirect link, through the costs of addressing the health shocks caused by the natural disasters, which draws a picture of poverty as a cause of vulnerability and a result of hazard impacts. Even though the evidence is uneven,some studies illustrate water-related health risks by showing that the incidence of cholera, diarrhoea, dysentery and measles increased in years of flooding in Bangladesh[26].

Analysing the impact of water-related risks to poverty requires identifying the level of exposure and vulnerability of different groups. In order to effectively provide social safety net programs and respond effectively to the water-risk, the Government of Bangladesh identifies several vulnerable groups, including women and girls, children, elderly and disabled that are often the most vulnerable.

Girls & Women: Women face increased difficulties due to differentiated roles and responsibility. They are more vulnerable to climate-induced hazards, including cyclonic storm surge, water logging, salinity intrusion, floods, river bank erosion, and agricultural droughts.[23] For instance, flood-related deaths are higher for children and adult women.[27] Moreover, women often suffer more from sexual and reproductive health related problems during and after a disaster as opposed to normal times.[28] Girls drop out of school at faster rates than boys, with early marriage being a reason why girls do not complete secondary school.[29] Additional physical and psychological security risks for women during disasters lead to many women and girls not taking refuge in shelters during disasters due to a lack of personal security.[28]

Children: Severe deprivations of basic human needs have serious adverse consequences for the health, well-being and development of children, as they experience poverty differently from adults. Even short-term deprivations have a long-term impact on child development. Child deprivation constitutes an important dimension of poverty in Bangladesh as children represent about 40% of the population and the incidence of poverty increases with increasing

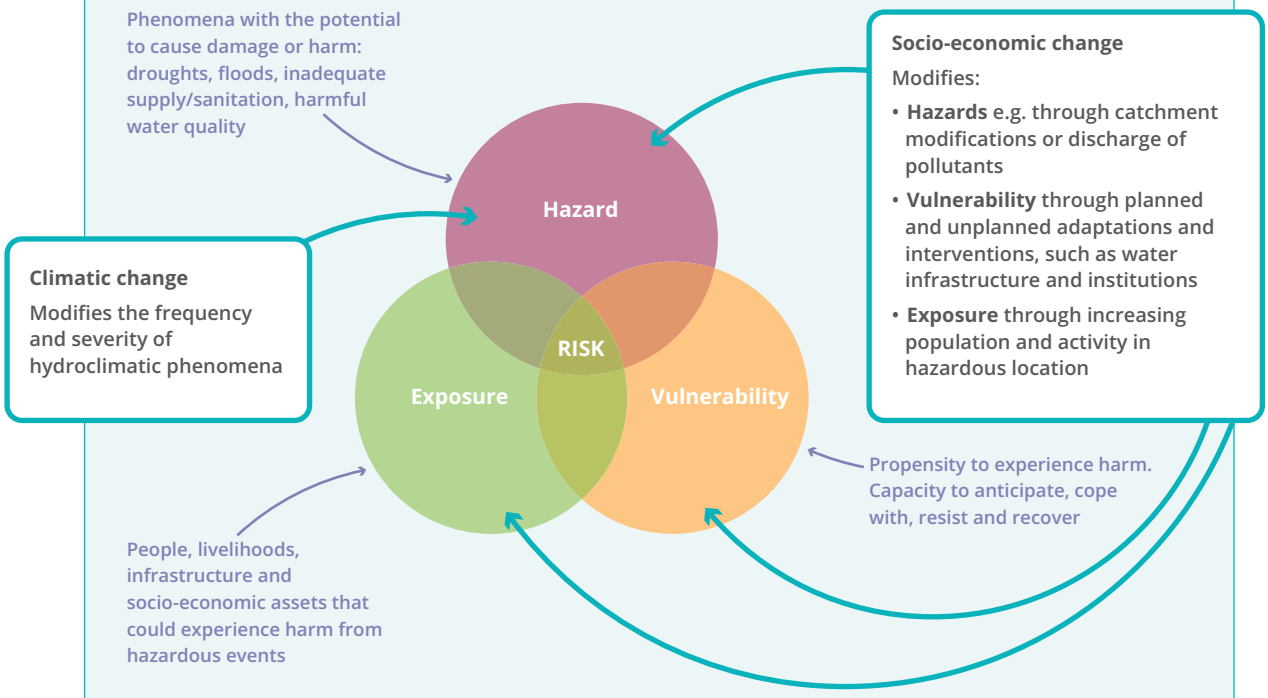
Box 2: Defining water security

Water security is defined as "the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies"[25]

Central to this definition is the notion of water-related risks, which can be characterized as a function of hazard, vulnerability and exposure:

- hazard is a phenomenon with the potential to cause damage or harm;
- exposure refers to the people, assets and livelihoods that could experience harm and loss due to the hazard;
- vulnerability captures the propensity to experience harm as a dynamic function of the capacity to anticipate, cope with and recover from harmful events. Poor people have typically higher vulnerability due to lower capacity to anticipate and recover from water-related hazards.

These components can be mapped onto the well-known definition of risk combining probability and consequences, where the probability is that of the hazard materializing and the consequences are determined by exposure and vulnerability.



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number of children in households30. About 41% of children in Bangladesh are deprived of shelter, 57% of nutrition and about 64% of sanitation facilities[31]. More than 50% of children suffer from fever, diarrhoea and pneumonia which are related to poor WASH facilities. The extent of poverty reduces with the educational attainment level of the parents; 53% of households with no education of household head live below the upper poverty line compared to only 19% of the same category with secondary plus educational level. Under-5 mortality has reduced significantly to 44 deaths per 1,000 live births[32], but long-term analysis showed spatial dynamics as certain micro-regions maintained higher-risk over the years[33]. The proportion of the population below 18 years is highest in the regions with severe social deprivation such as in districts of the Sylhet and Chittagong divisions, creating pockets of child

deprivation in the least accessible and most densely populated areas, such as urban slums[34]. This analysis identifies pockets of social deprivation and shows that the spatial and temporal analysis can help identify appropriate responses for public health actions.

Spatial and temporal heterogeneity of poverty and its dynamics: Over the past decade, regional disparities in income-based poverty indicators have been viewed by an 'East-West' divide. For the period from 2000 to 2005, poverty measures showed a highly unbalanced decline in income-based headcount poverty, favouring the Eastern part of the country over the West, but the regional differences significantly reduced between 2005 and 2010.[35] The Bangladesh Bureau of Statistics' data shows that the extent of extreme poverty is highest in the Rangpur division with 30.1%, followed by the Barisal division (south west) with 26.7% of the population living below the poverty line and the lowest in Chittagong (south east) with 13.1% in 2010, respectively. Extreme poverty is particularly a rural phenomenon, with 21.3% of the rural population living below the poverty line compared to 7.7% in urban areas.[10]

Poverty analysis at the upazila level, which is the second lowest administrative level in Bangladesh with 488 upazilas, provides a more detailed picture of the distribution of poverty. The high degree of spatial heterogeneity of poverty incidences is further manifested by the fact that poverty incidence in the 10 poorest upazilas within the Dhaka division was 55% or higher, while that in the 10 richest upazilas in the same division was less than 4%, revealing pockets of poverty in relatively developed divisions36. Poverty rates vary considerably with pronounced inequalities at the District (zila) and sub-district (upazila) levels. Half of the 64 districts had poverty rates greater than the national average of 31.5%, which is an indication of a high degree of disparity among districts in terms of poverty measures. This reveals pockets of poverty in relatively developed districts, which are attributed to the lack of connectivity of these areas with the regional growth centres, political tensions, and climate and ecological adverse effects.

When poverty incidences are compared with social and other parameters, it is found that districts of over-and under-achievers for various poverty and social indicators do not necessarily coincide with each other, implying that there is diversity in terms of achievement for various poverty and social indicators for each of the districts. While the 'eastern' division show a comparatively lower incidence of income poverty, more than 31.5% of the population show high levels of social deprivations in these areas.

High poverty incidences were found in chronic disaster-prone areas such as districts along rivers where the communities are repeatedly affected by river erosion and flooding and in the south-west which is prone to cyclones, tidal surges, salt water intrusion and water-logging. Agricultural water security is a major issue, especially in coastal areas where the lack of irrigation water limits crop intensification due to increasing salinity. Despite the on-going economic transformation to a manufacturing-based economy, the dependency of the rural population on agriculture continues to be a significant driver of poverty.

Flood-prone zones are considered most at risk across disaster prone areas in terms of food shortages, the incidence of extreme poor, insufficient income and illiteracy. Some of the poorest districts in Bangladesh are located in river erosion prone areas18. The most vulnerable to the impacts of extreme climatic events are the poor communities in the coastal areas of Bangladesh. The recognition of the geographical and regional variations and inequality in growth and poverty at the district (zila) and sub district (upazila) level linked in with climate vulnerability measures is important to allow for more effective targeting of policy interventions based on local conditions.

3. Improving water security for the poor

This section identifies two of the most significant and uncertain challenges in improving water security and reducing poverty in Bangladesh. First, drivers of water insecurity for the coastal poor are presented and the need for appraisals of water security interventions is discussed. Second, a risk-based model for universal drinking water security is outlined. We introduce the concept of 'Water Security Observatories' which are long-term, interdisciplinary and instrumented areas for science – practitioner partnerships. Observatories will generate evidence to address the gaps highlighted in this report and priorities identified through stakeholder forums in Bangladesh with government, private sector, academia, civil society and donor communities.

3.1 Water Security Observatory

A Water Security Observatory is a long-term, instrumented and interdisciplinary research location where significant but uncertain trajectories of change are predicted to emerge over a decadal or longer time span. Observatories will be designed in collaboration with practitioner partners, such as government and UNICEF, to introduce and test new concepts, models or approaches to understand the distributional impacts, particularly for the poor, and the opportunities to replicate successful interventions, or to learn from failure.

3.2 Water security pathways for the coastal poor

Coastal areas in developing countries face increasing water-related hazards including sea level rise, intensification of tropical cyclones and salinity intrusion. Exposure to water-related hazards in coastal areas is also on the rise, due to growing populations and assets, with the majority of this increase in exposure projected in East and South Asia37. Expected annual damage due to flooding in the region ranges from 2 % to 10 % of Gross Domestic Product (GDP) and is projected to worsen due to the combined impacts of coastal urbanisation and sea level rise[38].

Developing and implementing interventions to address these coastal water security challenges requires an understanding of the complex dynamics between water security, human wellbeing and economic growth. In Bangladesh, these complex dynamics materialise in the coastal areas of the South-West where communities face multiple water-related hazards, ranging from chronic salinity affecting drinking water quality and reducing agricultural yields to frequent floods and cyclones that destroy livelihoods and wipe out agricultural production (see figure and box).

Khulna Observatory

Around eight million Bangladeshis live inside polders (land enclosed by embankments), which cover approximately 8% of the country. About 53% of the coastal area is affected by chronic salinity problems, which reduce agricultural yields to 50% of national averages[39] and deteriorate drinking water supplies, increasing the risk of health problems in communities and preeclampsia in women. Communities in the coastal area are also exposed to tropical cyclones, which leave people homeless and at risk of post-disaster diseases.

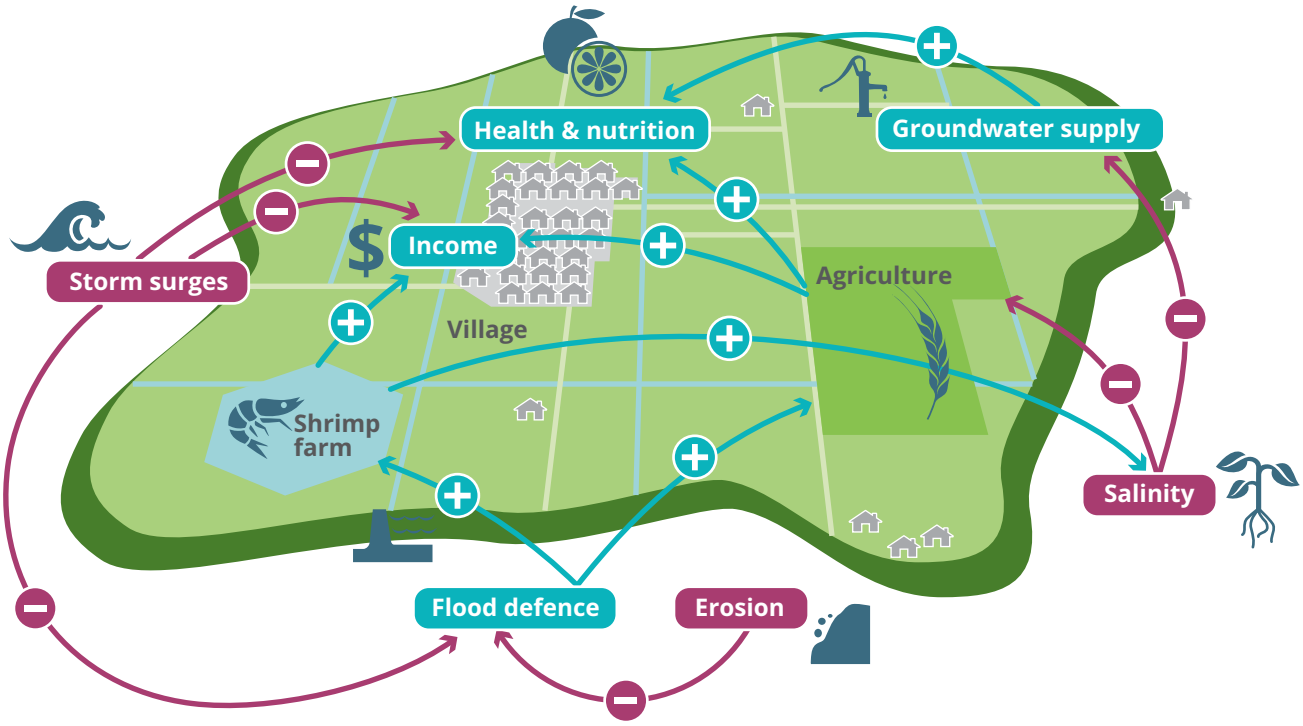
In the 1960s and 1970s a total of 139 polders were constructed in the coastal area to protect

communities from tidal flooding and salinity intrusion and to enable food security and economic growth. These interventions have yielded a number of positive impacts, including increased agricultural production and improved transport, but have also significantly altered the sediment balance in the delta, inducing subsidence and waterlogging in some of the polders. Despite these interventions, communities in the coastal area are still water insecure and many of the embankments are poorly managed and rapidly deteriorating. This insecurity demonstrates that institutional reforms and collective action are needed to promote effective management of the water infrastructure. The poverty of families in the polders remains extreme, with estimates suggesting that 80% of households are below the national poverty line, compared to a national average of 31.5% [39].

A number of ongoing initiatives – including the World Bank funded USD400 million Coastal Embankment Improvement Project, the Government of Netherland's EUR60 million Blue Gold project and UNICEF's managed aquifer recharge project, are planning and implementing water security interventions in the area. Despite this large number of initiatives, the government and donor communities have recognised that there is a gap in understanding the long-term impacts of different water security interventions and their potential to enable sustainable growth and lift communities out of the water-climate-poverty trap.

Current water security interventions in the coastal area are mostly focused on achieving flood protection, without sufficient attention being paid to how these investments can be sequenced and designed to address multiple water-related risks to achieve multiple objectives and benefit poor communities. By monitoring and analysing the impact of alternative sequences of interventions in Bangladesh's south-western coast, REACH intends to provide evidence to target future investment based on learning about the system response to interventions.

Figure 5: Schematic representation of a polder system showing interactions between hydrological, social and economic elements. For instance, the negative impact of salinity on agricultural production and groundwater supply (minus sign) reduces the positive impacts of agriculture on incomes and of safe groundwater supply on health (plus sign).



REACH is selecting number of polders in the Khulna division as a large-scale water security observatory where the impact of water-related hazards on poverty outcomes can be assessed and alternative sequences and types of water security interventions (including infrastructure, institutions and information) analysed. In this observatory, REACH seeks to identify investments capable of breaking the water-climate-poverty trap and of enabling long-term sustainable growth. In doing so, REACH research will develop a polder system model to capture the dynamical response of these complex socioecological systems to interventions. REACH will also analyse the potential for institutions and water management organisations to contribute to improved management of the water infrastructure in the polders.

The schematic representation of a polder system in Figure 5 depicts how water-related hazards interact with socio-economic elements to negatively influence human health, well-being and incomes. These dynamic interactions result in communities being stuck in water-climate-poverty trap where chronic salinity reduces agricultural yields and compromises health and where periodic floods cause widespread destruction and loss of income.

The analysis and insight gained from the Khulna observatory are intended to inform water security interventions in the coastal area of Bangladesh. The potential to improve water security for the poor is significant given the large planned investments in the area at present and in the future. By developing methods to appraise investments in terms of their ability to positively influence livelihoods and to contribute to the economic growth of poor communities, REACH's work has the potential to inform future resource allocation and investment planning and benefit millions of poor in the coastal areas.

3.3 Risk-based metrics for universal drinking water security

New models and approaches are required to achieve universal and safe drinking water security in Bangladesh. In rural areas – where the majority of the population lives – the challenges are characterised by operational, financial and institutional challenges. There are roughly 14 million handpumps in the country of which 90 per cent are privately installed and owned. Around 1.5 million have been installed by the Department of Public Health and Engineering (DPHE) with long-term partners including UNICEF. A UNICEF/DPHE survey of 125,000 public water points installed between 2007 and 2012 indicated high functionality (92%) and low levels of arsenic contamination (5%) but concerns with variable levels of iron and manganese. A study of the performance metrics of water points across Bangladesh illustrated major concerns once a more demanding filter of provision of sufficient, physically accessible, affordable, reliable and safe water was applied. Water service delivery declined from 95 per cent by availability alone to 13 per cent when other service factors where considered, particularly safe water quality. Advancing sustainable models for universal drinking water security in Bangladesh will be advanced with improved monitoring systems which test alternative models to quantify development impacts.

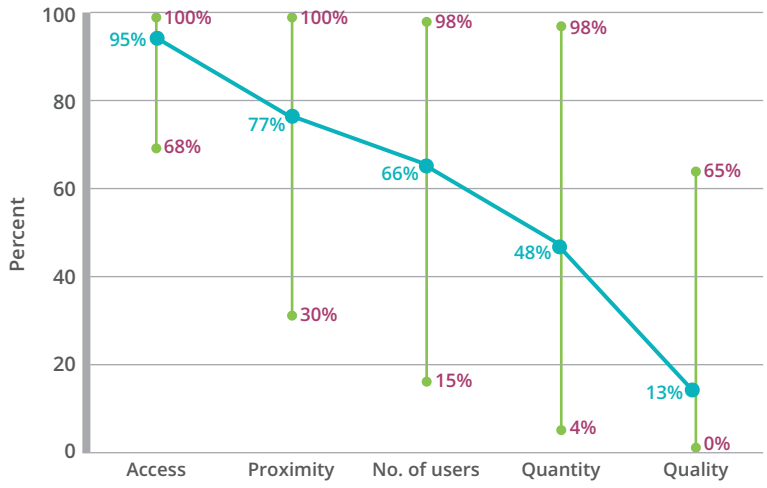


Figure 6: Range of coverage of universal and safe drinking water across 24 districts in Bangladesh.[40] The figure shows how the level of coverage decreases when the numbers are controlled for quantity and quality of water supply.

Matlab Observatory

In response to advancing the Government of Bangladesh's goal of universal and safe drinking water security, REACH will partner with icddr,b to design and test new models in Matlab. The MatLab Health & Demographic Surveillance System (HDSS) represents a population of 223,000 people that live within a defined area near the Meghna River. It was originally established in 1963 by the SEATO Cholera Research Laboratory for research in an area with chronically high rates of cholera. In 1978 the laboratory became the International Centre for Diarrheal Disease Research, Bangladesh (icddr,b) and now includes other health and water-borne disease research. icddr,b continues to lead a unique, geographically bound, demographic surveillance, research and practice programme that has the potential to advance understanding of multi-dimensional poverty. icddr,b provides a robust, multi-decadal information system on the region's demographics, health, socio-economic characteristics and can be linked with the area's bio-physical, hydrological and geospatial characteristics.

REACH will advance new risk metrics fusing both existing health and demographic streams of data with climate, hydrology, socio-economic and infrastructure data to provide unique insights into understanding and quantifying water security risks to guide new models for Bangladesh. The Matlab HDSS area is located in Chandpur district 50 km southeast of Dhaka in a low-lying delta plain facing multiple water-related risks. The study region is sub-divided into seven blocks for data collection. icddr,b provides health services to four of the blocks, with programmes ranging from family planning, immunisation and limited curative services for under-five children and women of reproductive age, while the Government of Bangladesh provides health services to the other three blocks.

The area is characterised by the hydrology of two major river systems. The Dhonogoda river offtakes from the Upper Meghna and later flows back into the Lower Meghna. Due to the flow conditions, this often affects the downstream rise of the flood level and reduced drainage. There is increasing evidence documenting the impacts of the seasonal flooding and high-rainfall events on agricultural productivity and community health conditions, but this evidence does not link directly to measures of poverty. The construction of an embankment system that bisects the HDSS area in 1986 has altered the natural and social system, bringing differential impacts within and outside the polder, both positive and negative.[41] The flood-protection infrastructure creates spatial and intra-community variation of benefit and risk distribution by degree of seasonal flood exposure, including impacts on well-being and wealth.

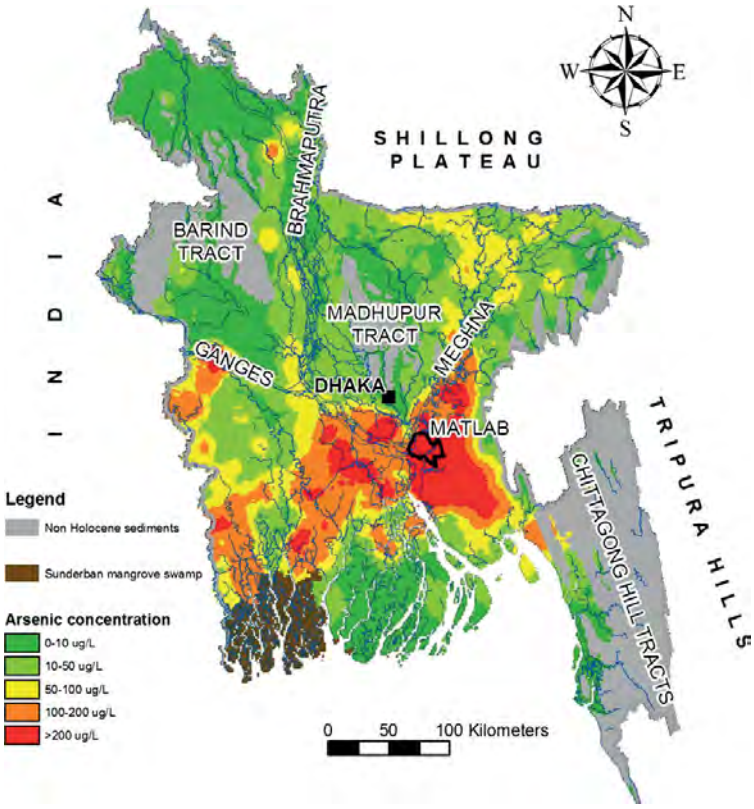


Figure 7: Arsenic contamination map. This figure shows the areas that are most affected by arsenic contamination in groundwater, including the study area in Matlab.[42]

Arsenic remains a major problem for community water supplies. Recent studies have shown a reduction in the percentage of arsenic in the HDSS area that exceeds the WHO and Bangladesh guideline values. A study identified 30.42% of tubewells in the HDSS area above the safe arsenic standard.[43] The use of deep tubewells has the largest association with reduced instances of diarrhoea in children under five years, greater than socioeconomic status, latrine density, population density or study year.[44]

The REACH programme will collaborate with icddr,b in conducting detailed data analysis of major health and migration events to determine the relationship between social, environmental, economic, seasonal, infrastructure and water quality variables. Machine learning methods will be applied to develop novel water security risk metrics capable of informing the design and testing of a replicable drinking water security model. The data analysis will also inform the installation of novel monitoring systems. Working closely with UNICEF, the Government of Bangladesh and other partners, REACH will develop an approach to support improved institutional design and regulatory frameworks for identifying and reducing drinking water security risks across Bangladesh.

3.4 Conclusion

Bangladesh's progress to middle income status by 2021 will be influenced by balancing water security risks for growth and development. The 7th Five Year Plan will be a key policy framework to inform REACH activities in improving water security for the poor with the Planning Commission, General Economics Division, Department for the Environment, Department for Public Health and Engineering and other key government departments. REACH has consulted widely with multiple government and non-government stakeholder groups identifying the observatory sites in Khulna and Matlab. Further work is planned to build on excellent engagement with stakeholders in the Ready Made Garment industry sector including the Bangladesh Garment Manufacturers and Exporters Association, International Finance Corporation and other stakeholders.

The REACH programme in Bangladesh will convene national and local governments with UNICEF, the Bangladesh University of Engineering and Technology (BUET), icddr,b, the University of Dhaka and the University of Oxford in advancing a long-term, science-practitioner partnership to support development of water security outcomes that specifically meet the needs of the poor. In partnership with UNICEF and regional partners from government, enterprise, research and practitioners in South Asia, REACH will contribute to advancing new approaches to water security to benefit tens of millions of poor people in South Asia.

Photo: Rob Hope

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Photo: Alex Fischer

REACH Improving water security for the poor

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