WATER GLOBAL PRACTICE

High and Dry

Climate Change, Water, and the Economy

WORLD BANK GROUP

EXECUTIVE SUMMARY

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Cover photo: View of lakes, hillsides, and mountaintops. © Curt Carnemark/World Bank. Permission required for reuse.
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Executive Summary

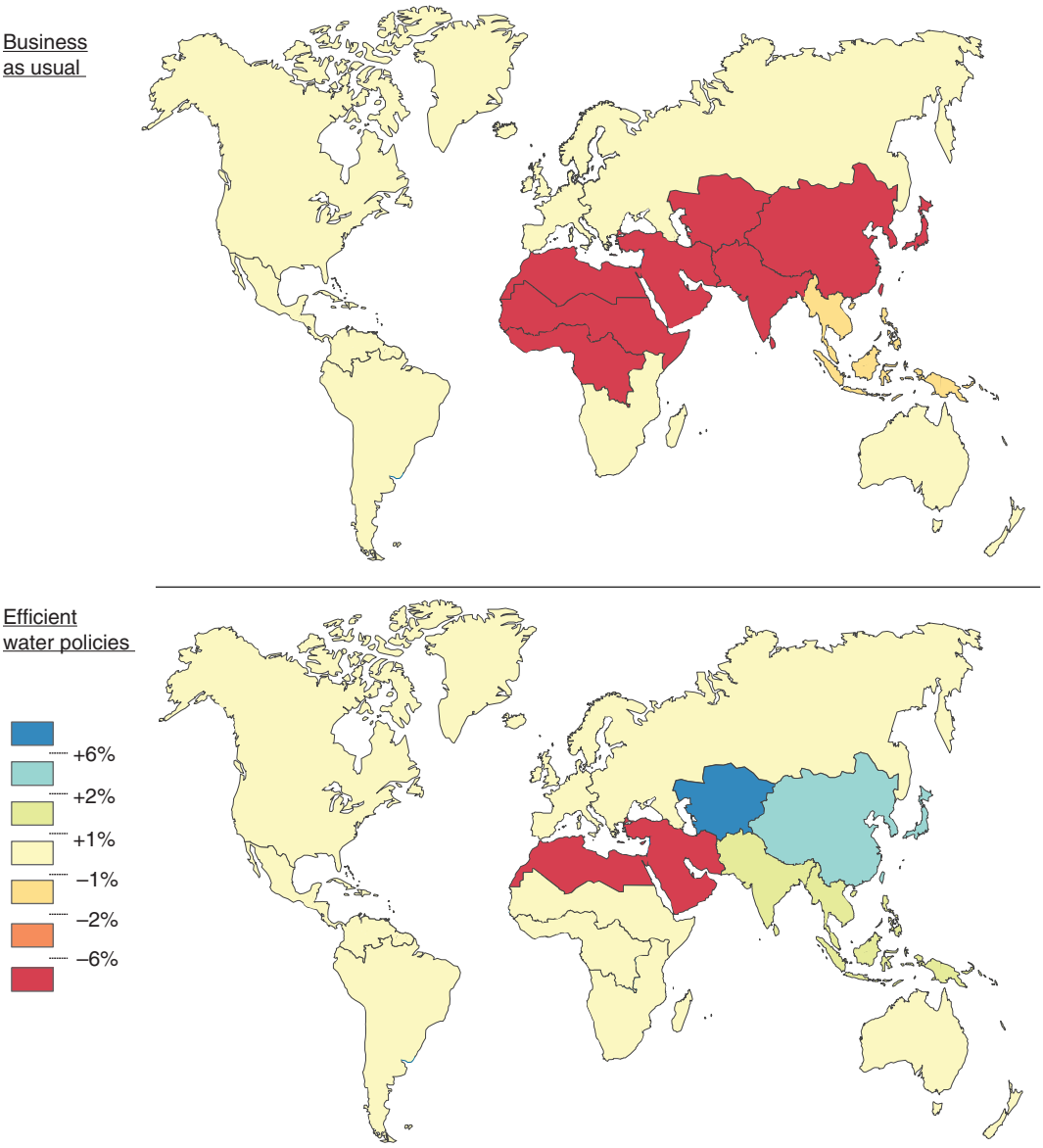
The impacts of climate change will be channeled primarily through the water cycle, with consequences that could be large and uneven across the globe. Water-related climate risks cascade through food, energy, urban, and environmental systems. Growing populations, rising incomes, and expanding cities will converge upon a world where the demand for water rises exponentially, while supply becomes more erratic and uncertain. If current water management policies persist, and climate models prove correct, water scarcity will proliferate to regions where it currently does not exist, and will greatly worsen in regions where water is already scarce. Simultaneously, rainfall is projected to become more variable and less predictable, while warmer seas will fuel more violent floods and storm surges. Climate change will increase water-related shocks on top of already demanding trends in water use. Reduced freshwater availability and competition from other uses—such as energy and agriculture—could reduce water availability in cities by as much as two thirds by 2050, compared to 2015 levels.

Economic growth is a surprisingly thirsty business. Water is a vital factor of production, so diminishing water supplies can translate into slower growth that cloud economic prospects. Some regions could see their growth rates decline by as much as 6 percent of GDP by 2050 as a result of water-related losses in agriculture, health, income, and property—sending them into sustained negative growth. Economic modeling described in this report suggests that bad water-management policies can exacerbate the adverse growth impacts of climate change, while good policies can go a long way towards neutralizing them (map ES.1). Some regions stand to see growth accelerate as much as 6 percent with better water resource management. The impacts of water mismanagement are felt disproportionately by the poor, who are more likely to rely on rain-fed agriculture to feed their families, live on the most marginal lands which are more prone to floods, and are most at risk from contaminated water and inadequate sanitation. Ensuring a sufficient and constant supply of water under increasing scarcity will be essential to achieving global poverty alleviation goals.

Changes in water availability and variability can induce migration and ignite civil conflict. Food price spikes caused by droughts can inflame latent conflicts and drive migration. Where economic growth is impacted by rainfall, episodes of droughts and floods have generated waves of migration and statistical spikes in violence within countries. In a globalized and connected world, such problems are impossible to quarantine. And where large inequities prevail, people move from zones of poverty to regions of prosperity which can lead to increased social tensions.

This is why water management will be crucial in determining whether the world achieves the Sustainable Development Goals (SDGs) and aspirations for reducing poverty and enhancing shared prosperity. Water is the common currency which links nearly every SDG, and it will be a critical

MAP ES.1 The Estimated Effects of Water Scarcity on GDP in Year 2050, under Two Policy Regimes



Source: World Bank calculations.
Note: The top map shows the estimated change in 2050 GDP due to water scarcity, under a business-as-usual policy regime. The bottom map shows the same estimate, under a policy regime that incentivizes more efficient allocation and use of water.

determinant of success. Abundant water supplies are vital for the production of food and will be essential to attaining SDG 2 on food security; clean and safe drinking water and sanitation systems are necessary for health as called for in SDGs 3 and 6; and water is needed for powering industries and creating the new jobs identified in SDGs 7 and 8. None of this is achievable without adequate and safe water to nourish the planet's life-sustaining ecosystem services identified in SDGs 13, 14 and 15.

Water is to adaptation what energy is to mitigation, and the challenges the world will face in adapting to water issues are enormous. It calls for

recognizing the interlinkages between water for food, energy, cities, and the environment through an "*expanded water nexus*," which acknowledges that the fortunes of these sectors are tied through a common dependence on water. The costs of policy inaction are high, and prudent stewardship of water resources will pay large dividends. Although significant challenges exist, the right actions need not be costly. Thoughtful policies and well-placed investments can yield large benefits in improved welfare and increased economic growth.

There are three overarching policy priorities that can help lead countries down the road to a water secure and climate resilient economy. None of these will be a panacea, however, just as there is no one-size-fits-all solution. In practice, hybrid solutions will be needed, determined by country and regional risks and circumstances.

- **Optimizing the use of water through better planning and incentives**. Building climate-resilient economies that can develop and grow in a warming world will require better ways of *allocating scarce water resources across sectors* to higher-value uses. This could be achieved through planning and regulation, or using market signals through instruments such as prices and permits. In both cases there would need to be adequate safeguards to assure access to poor households and farmers as well as the environment. None of this will be easy. It will call for establishing credible institutions, policies and legal systems that can facilitate transfers of water in ways that benefit all parties to the transaction. Economic instruments such as water permits and prices can be valuable for promoting improved environmental stewardship of water resources, but they are also the most misunderstood due to anxieties of elite capture, denial of services to the poor, and the complex social and cultural values of water. Much depends upon how such policies are implemented and enforced. In countries where water is deemed to be free, the poor are unserved or under-served and are compelled to pay a much higher price than the rich for each drop of water. As a consequence, free water is typically costly for the poor as well as harmful to the environment.

  Water *efficiency must also increase within sectors*. This calls for the creation and adoption of new water saving technologies, incentives, education, and awareness. Approaches are already available, such as Climate Smart Agriculture (CSA) or Sustainable Agricultural Intensification (SAI), that allow farms to maintain or even increase yields, while reducing their energy and water footprint. Similar approaches exist for significant water savings in the energy sector through improved efficiency. However, the adoption of these solutions is slow, hesitant, and below desired levels. The constraints most often lie in misaligned incentives. For instance, a large proportion of the benefits of approaches such as CSA are public, while technology adoption costs are private. This requires sharper incentives for technology uptake that might require a change in the subsidy regime, public investments in infrastructure or extension services, selective forms of crop insurance, and increasing access to credit. There

are opportunities to alter behavior and change thirsty consumption patterns through education, contextual cues, and using social norms to signal consent or disapproval. The tools based on these behavioral nudges do not displace existing policy approaches that target incentives; rather, they complement and enhance them. Some of these approaches may cost little to implement because they depend on nuances in messaging and policy design, while others may entail longer periods of engagement, especially when changes in attitudes and values are involved.

- **Where appropriate, expand water supply and availability.** This includes investments in storage infrastructure such as dams that makes water available when it is needed; water recycling and reuse; and where viable, desalination. While expanding the water supply will be vital in some countries, particularly the driest regions, these tools must be used with caution. Other tools like groundwater recharge and wetlands preservation may offer lower risk, lower costs, and higher returns than other policy approaches. Historically, when supply is increased without corresponding safeguards to manage use, demand rises to meet the new level of supply, resulting in a higher level of water dependence in often arid areas. To be effective, these interventions must be accompanied by policies to promote water efficiency and improve water allocation across sectors.
- **Reducing the impact of extremes, variability, and uncertainty.** A final set of interventions require "*water proofing*" economies to limit the impact of extreme weather events and rainfall variability. Increasing storage capacities and water reuse systems will go a long way towards building resilience. Better urban planning, risk management, and citizen engagement will likewise reduce the exposure of cities to flood risk. In rural areas, expanding crop insurance programs can protect farmers against rainfall shocks. Large capital investments such as seawalls, levees, and dams, meanwhile, can protect coastal cities from storm surges and floods. As the precise impacts of climate change are uncertain and large investments are costly and irreversible, their siting and design must be carefully chosen to minimize regret.

Smart water policy is fundamental to smart climate policy and smart development policy. While adopting policy reforms and investments will be demanding, the costs of inaction are far higher. The future will be thirsty and uncertain, but with the right reforms, governments can help ensure that people and ecosystems are not left vulnerable to the consequences of a world subject to more severe water-related shocks and adverse rainfall trends.

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