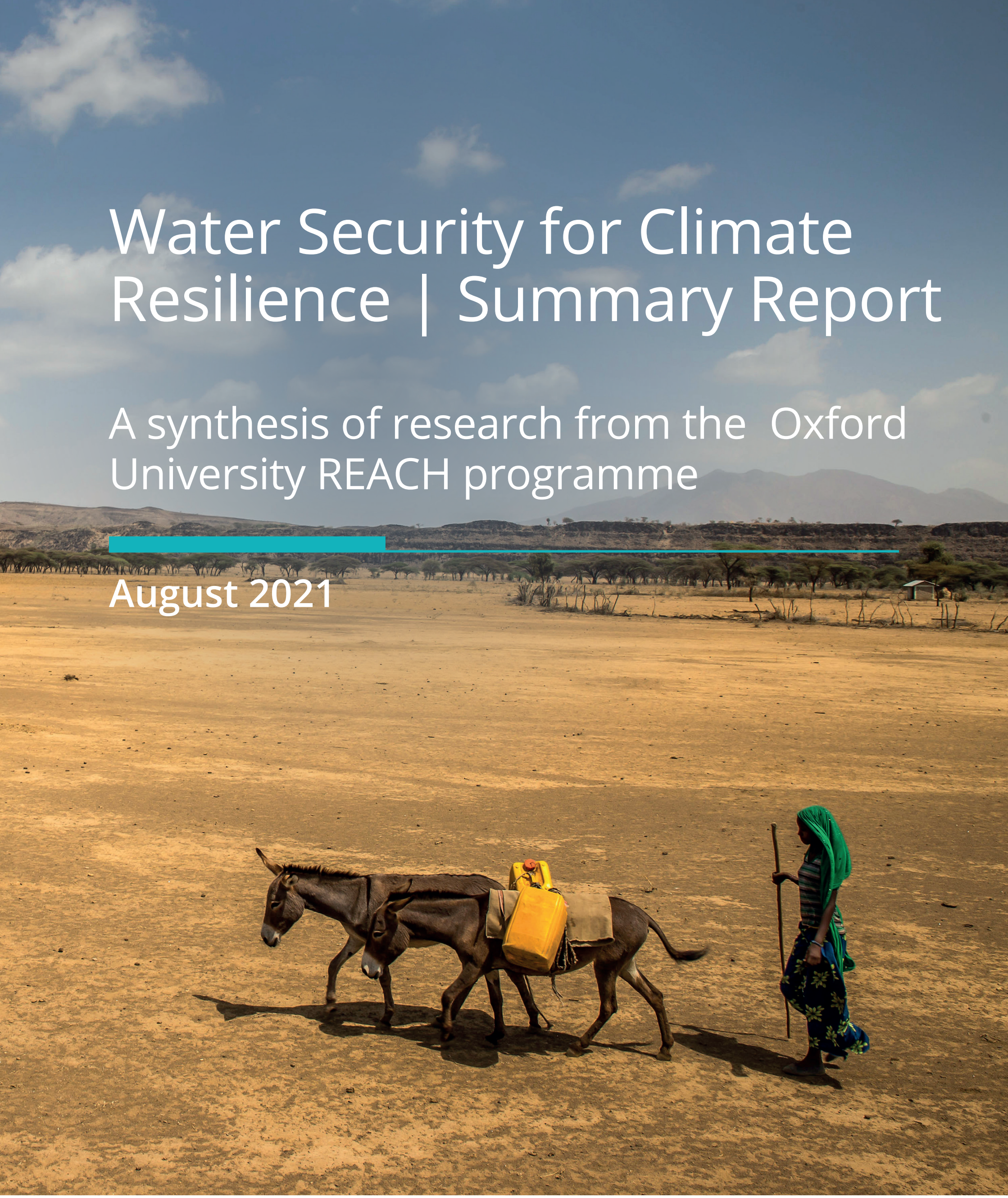

Water Security for Climate Resilience | Summary Report

A synthesis of research from the Oxford University REACH programme

August 2021

Foreign, Commonwealth & Development Office

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References

Hoque, S.F. and Hope, R. (2021). Data from REACH Kitui Water Diary study (2018–19). University of Oxford, UK.

Taye, M.T., Dyer, E., Charles, K.J. and Hirons, L.C. (2021). Potential predictability of the Ethiopian summer rains: Understanding local variations and their implications for water management decisions. *Science of the Total Environment*, **755**: 142604. doi: 10.1016/j.scitotenv.2020.142604

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Introduction

Improving water security is critical to strengthen climate resilience. This summary presents research from the REACH programme, funded by UK Aid Direct from the UK Foreign, Commonwealth & Development Office (FCDO), demonstrating the complex linkages between water security and climate to support better decision-making across policy and practice. REACH has co-developed research through science-practitioner partnerships in Bangladesh, Ethiopia and Kenya, and globally, to advance water security for 10 million people affected by poverty.

This Summary presents the main findings and recommendations of the Water Security for Climate Resilience Report. Through REACH research we demonstrate the unequal, and often hidden, impact of climate on people's lives and livelihoods, which can be counter-intuitive to broad narratives around resilience and adaptation. We reveal the challenges to building anticipatory capacity to avoid the water security risks that result from shifting climate conditions, water use behaviours and policy decisions. We highlight the impact of seasonal fluctuations in weather on surface and groundwater quality. We present a deepened understanding of location- and context-specific climate issues and dynamics, revealing a pressing need to consider and plan for different distributional impacts of climate and climate change.

Climate change will increasingly affect water availability and quality, with devastating consequences for the most vulnerable. Advancing water security by reducing these risks is a fundamental aspect of building climate resilience and supporting adaptation. We provide three recommendations to advance water security for climate resilience: improving access to granular and accurate climate information, measuring the impact of climate on water systems, and demonstrating new institutional models to improve water security for climate resilience.

LARGE URBAN AREAS

- Cities face water security risks from industrial pollution and urbanisation.
- Climate change risks are compounded by growing threats to water quality and availability from industrial pollution and urbanisation.
- Seasonal variation in water availability exacerbates the impact of unregulated wastewater discharges and informal water withdrawals.
- Vulnerability to climate variability is expected to increase as water demands expand.
- To increase climate resilience, large urban areas require better coordination of surface and groundwater supply use, and demand management schemes.

SMALL URBAN AREAS

- Across Sub-Saharan Africa, small urban areas are growing with implications for equitable water security.
- Effective communication of reliable, granular and accurate climate information to decision makers is vital for building climate resilience in these urban areas.
- Building capacity requires investment to analyse climate risks and ensure access to climate information that is appropriate for the local context.
- Seasonal forecasts at the appropriate scale will help water managers better plan to avoid water shortages and therefore minimise inequalities arising from intermittencies in supply.

Climate-related water security risks vary across spatial scales

RURAL AREAS

- Rural lives and livelihoods are highly vulnerable to climate shocks.
- Climate risks are borne unequally, influenced by geography, gender and capacity.
- Water users adapt livelihoods to changing climate without sufficient information on emerging risks.
- Water users rely on multiple sources to mitigate seasonality of availability, with implications for affordability and quality.
- Poor maintenance of water infrastructure increases the vulnerability of rural communities to climate shocks.
- Reliance on multiple seasonal water sources risks undermining financial sustainability for climate resilient sources.

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Figure 1: Correlations of June-August-September (JAS) rainfall in the upper a) and lower b) Awash basin, Ethiopia, with the preceding monthly sea surface temperatures (SSTs) in seven Global SST regions. Correlations are only shown for $p < 0.1$. The figures illustrate the influence of large-scale climate drivers on patterns of rainfall over Ethiopia. The results show that JAS rainfall in the upper Awash is negatively correlated with most of the Pacific Ocean SST region indicators, whilst the lower Awash has positive and negative correlations with SST. Source: Taye et al. (2021).

Recommendation 1:
More accurate and granular analysis of climate risk to water systems is needed to increase relevance of climate information

- Ensembles of Global Climate Models perform poorly for specific geographies, requiring evaluation of individual models for local policy making. REACH demonstrated that model ability to reproduce key climate features is poor in equatorial Sub-Saharan Africa, with numerous CMIP5 climate model ensemble members missing the equatorial bimodal rainfall season.

- Climate risk analysis of existing data can be improved with topographical impacts, sub-seasonal dynamics and teleconnections. This is particularly important in Africa, where projections of climate change and the impacts on water security are hampered by a lack of data. REACH used sub-seasonal diagnostics with high resolution topography to demonstrate that rainfall in East Africa is driven by low-level jets, improving drought and flood forecasting. Analysis of global climate teleconnections and sea-surface temperatures has provided tools for seasonal forecasting at sub-basin scale in Ethiopia.

- Climate information needed to advance water security varies across scales and by use, requiring targeted products to build climate resilience. Infrastructure contributes to resilience, but only when information is available to allow it to be managed for resilience. For reservoir management, climate information on short-term forecasts and the increased likelihood of precipitation extremes could be used to inform flood management in Turkana County's (Kenya) arid environment and protect damage to drinking water supplies. For drought managers, diverse, basin-wide climate information with availability and distribution of information to users throughout the basin is important.

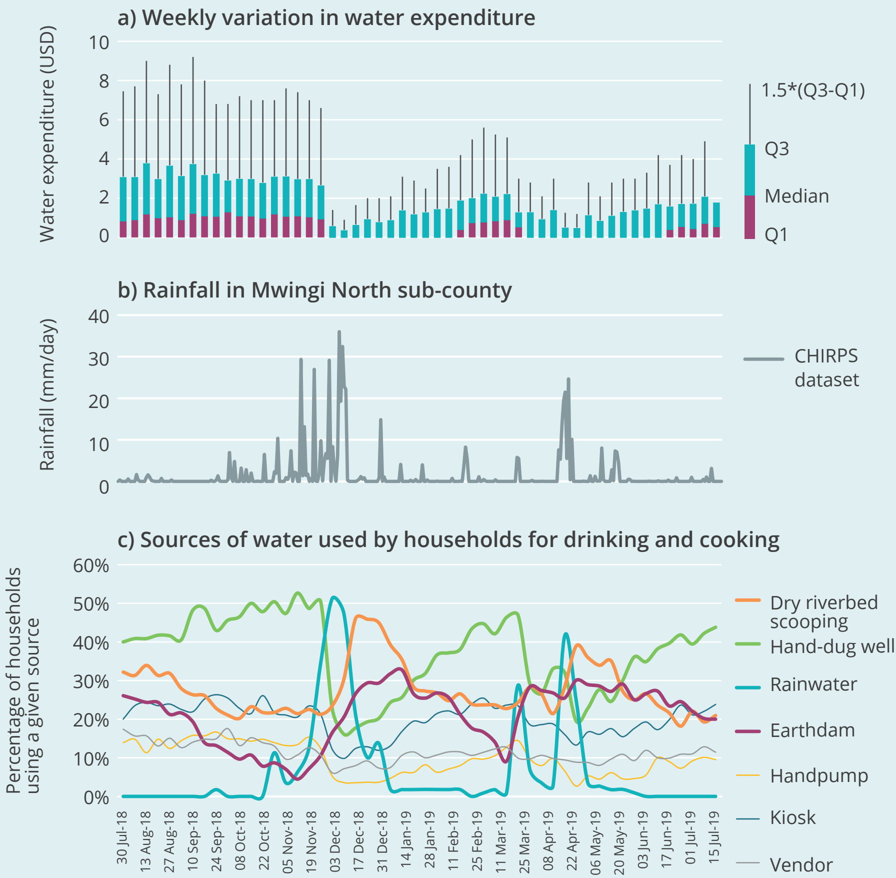

Figure 2: In Mwingi-North sub-county, Kenya, 115 households were trained to record their water sources, amount, and expenditures in pictorial charts every day for a 52-week period between August 2018 to July 2019. Findings reveal that household choice of water sources and expenditures closely mirrored rainfall patterns, with sharp shifts from groundwater to surface sources following onset of the 'short rains' in late November. When earthpans dry up, people shift to dry riverbed scooping followed by hand-dug shallow wells, though there is considerable spatial heterogeneity based on availability of water supply infrastructure. Water crisis and expenditures peak during June to September, with many reporting payment difficulties and increasing salinity in groundwater sources like handpumps and shallow wells. Source: Hoque and Hope (2021).

Recommendation 2: Metrics for monitoring climate resilience for water systems are critical to track progress and inform investments for water security

- Rainfall, particularly extreme events, increase faecal contamination in drinking water quality, threatening safe drinking water supply globally. Seasonal changes in water quality occur in many water systems. Infrastructure alone is not enough to achieve climate resilience, as water quality from piped systems and boreholes deteriorate in the wet season. The scale of the impacts are poorly understood because of a lack of risk-based measurements.
- Water pollution is exacerbating water scarcity. Increasing urbanization and industrialisation are placing stress on water systems, raising demand for more variable water resources. Increasing pollution is reducing access to fresh water which can be readily treated. In periods of low flow and droughts, water quality becomes toxic, destroying ecosystems, making water untreatable, and exposing the poorest who rely on river water to increasingly severe health consequences.
- To advance water security for climate resilience, we need measures that track water quality, reliability, and behavioural responses. REACH has demonstrated how households use multiple water sources to address issues of reliability and seasonality, with financial and quality implications. Achieving and sustaining universal access to safe drinking water will require investment in risk-based monitoring to inform investments to improve absorptive capacity of water systems to climate risks.

New work in Bangladesh with SafePani is developing institutional models of rural water supply management to build the absorptive capacity of water supplies to deal with climate risks.

Since 2016, REACH has worked with UNICEF and the Government of Bangladesh to develop the SafePani (safe water) model based on research and discussion. Bangladesh faces multiple water quality risks that are affected by seasonal variability and extreme events. SafePani will work to address these climate risks through climate resilient water safety planning in the coastal region where over 20 million people face risks from increasingly saline aquifers, seasonal freshwater scarcity and faecal contamination, and flooding from the monsoon and storm surges from cyclones which affect water quality and damage water infrastructure.

REACH has also worked on institutional models of rural water supply management in Kenya with FundiFix to improve reliability of services.

Figure 3: In Bangladesh, heavy rainfall, flooding events and warmer temperatures increase the risk of faecal contamination of drinking water supplies. Photo: Sustainable Sanitation.

Recommendation 3: New institutional models that improve water security will be critical for climate resilience

- To improve water security, institutions need to address the complex ways in which climate, water systems and behaviour interact, and motivations and barriers to integrating climate data in water management decisions at different scales. Uptake of climate information to inform decisions requires appropriate skill and awareness of political barriers, supporting users who take on liability risks.
- Climate resilient institutions for water management need to target support for the most vulnerable. Climate risks are not borne equally, with exposure varying across scales from geographical to intra-household. Adaptation mechanisms include multiple source use, changing livelihoods, and short- and long-term migration, with intergenerational impacts on health, education and wellbeing.
- Climate resilient institutions for water management must recognise seasonal behaviour and affordability to be financially sustainable. To ensure sustained access to safe drinking water, water prices should reflect the water user's ability to pay and be priced at affordable thresholds that encourage regular use and user payments, even in wet periods. The revenue generated by payments should be re-invested in water services to guarantee timely repairs and maintenance of the water infrastructure.
- Climate resilient institutions for water management must recognise that climate change is affecting rural water usage and payment behaviours. To ensure sustained access to safe drinking water, water tariffs should be affordable to promote safe water use in dry and wet periods. Rural user payments will rarely meet full operational costs requiring new funding models to guarantee timely repairs and water safety for communities, healthcare facilities and schools.

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