Climate change, water, sanitation and hygiene and resilience

A briefing paper from SWA Research and Learning Constituency

Introduction

Water and sanitation are basic human needs and essential for functional societies but are threatened by climate change. The Covid-19 pandemic has highlighted societal risks, uncertainties and inequalities, while also highlighting the critical role of access to safe water and sanitation services to ensure recovery and resilience. However, climate change is a threat to the delivery of sustainable water and sanitation services.

The water cycle is a primary way that climate change impacts society. According to the recent IPCC AR6 2021 report, "*continued global warming is projected to further intensify the global water cycle, including its variability, global monsoon precipitation and the severity of wet and dry events*."[i] These changes are already affecting water and sanitation services, such as disrupted water supply, and sewers and pit latrines overflowing, requiring increased attention to strengthen their climate resilience. As we approach COP27 in Egypt in November 2022, with its focus on adaptation, bringing water and sanitation into the picture is a key imperative.

This brief was prepared by the SWA Research and Learning constituency in support of the 2022 Sector Ministers' Meeting (SMM) '*Building Forward Better for Recovery and Resilience*.' This brief seeks to make available the latest research evidence on climate change, resilience and water, sanitation and hygiene for the preparatory processes leading up to the SMM and to support evidence-based follow-up action.

Key terms

Resilience: The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or re-organising in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation.[ii]

Climate-related hazards: Floods, droughts, hurricanes and cyclones occurring at greater frequency, with greater intensity or in different places than historically; coastal erosion, salinisation of groundwater and flooding due to sea level rise.

Adaptation: The process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities, entailing a process of iterative risk management[iii]

Loss & Damage (L&D): Climate change impacts that are not avoided through mitigation and

adaptation; the negative effects of climate variability and climate change that people have not been able to cope with or adapt to.[iv]

Fair Water Footprint: Refers to the 'embedded' water of commodities within globalised supply chains. A fair water footprint means: Zero pollution; Sustainable and equitable withdrawal and water use; Full access to safe water, sanitation and hygiene for workers; Working with and protecting nature; Planning for droughts and floods.[v]

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Importance of water and sanitation for societal resilience

Water and sanitation services are essential to address societal climate vulnerabilities.[vi] Water and sanitation services comprise a backbone of critical infrastructure for a country's population. This means safe, sufficient, and reliable water and sanitation services for all. They therefore must be resilient to risks that arise from the interdependence of water and sanitation services and other critical societal functions such as health care.[vii] The failure of WASH services due to climate-related disasters can result in a cascade of other failures hampering daily life and economic activities. For example, the NOWATER project showed water supply failures at healthcare facilities caused failure of other critical health infrastructure, contamination of water used for medical procedures, and resulted in overall reduced functionality of healthcare systems.[vii]

Inequalities in access to water and sanitation are a threat to societal resilience.[viii] Those without safe and affordable water and sanitation services generally spend more money to meet their needs, increasing their risks and decreasing their ability to cope with other shocks in the future, reinforcing poverty.[ix] In addition, as IPCC AR6 2021 report mentions, where inequalities are high and governance weak, water insecurity can contribute to social unrest. This is because individual coping mechanisms of better-off groups do not necessarily contribute to greater collective services. Vulnerabilities and exposures to climate change hazards are worse for women and girls who already face widespread inequalities in access to water, sanitation and hygiene.[x] Inclusive water, sanitation and hygiene can reduce the gender inequalities that will be exacerbated by climate change by ensuring women are influential in decision-making roles related to water, sanitation and hygiene.

Water and sanitation services strengthen health system resilience and reduce economic losses. The Covid-19 pandemic has highlighted the importance of water and sanitation services in disease prevention. Climate change is expected to increase the risks of diarrheal disease and cholera outbreaks in many regions.[xi] The IPCC highlights how these risks have increased regionally due to higher temperatures, increased rain and flooding, and water and sanitation services are critical to prevention and reducing burdens on the health system.[xii] This has economic implications: health care savings and reduced losses in productivity due to illness. Note that already at this moment, economic losses due to poor sanitation and water supply in developing countries account for around US$260 billion or 1.5% of countries' GDP.[xiii]

Water and sanitation are a good investment for broader climate action. Investing in water and sanitation services reduces climate vulnerability and increases resilience. These investments will pay off in short and long-term positive economic impacts such as increased household incomes, more resilient health care systems, healthier populations and reducing forced displacement. Investments can have the most impact in areas where high exposure to climate hazards overlap with low access to water and sanitation, especially in the least developed countries.[xiv] In some areas water and sanitation investments also present mitigation opportunities, such as growing urban areas.[xv]

In Cape Town upgrading of sanitation in an informal settlement was undertaken as multi-level 'climate action' building local partnerships and governance that recognized and engaged community groups, supporting collective action and drawing on site-specific local knowledge.[xvi]

Vulnerability of water and sanitation services to climate change

Water and sanitation services are vulnerable to climate change. Climate-related impacts can weaken, disrupt or destroy WASH services, undermining people's health and livelihoods. The IPCC AR6 confirm that the greatest consequences are borne by the poorest, the marginalised, and women.[xi] In addition to extreme events, other climate hazards that affect WASH services include slow onset changes (e.g. sea-level rise, salinisation), trends (long-term changes in rainfall and temperature) and increased unpredictability and variability (e.g. changing seasons and timing of rainfall). The effect can be direct, or indirect due to increased competition with other water uses. According to EM-DAT* from 2000 to 2019, disasters triggered by natural hazards have almost doubled compared to those registered between 1980 to 1999, with floods and storms the top two most reported disasters.[xvii]

In Indonesia over the last 30 years, climatic trends show increased surface temperatures, increased rainfall, more intense wet and dry seasons, and an increased frequency of extreme events.[xviii]*Climate models indicate these hazards will increase in frequency and intensity, and 40 million people living in low-lying coastal areas of Indonesia are also at risk from sea-level rise.*[xix] *Population growth and urbanisation will increase this risk, with the country's urban poor being most vulnerable.*[xx] *Water availability is expected to be affected,*[xxi] *and impacts of climate hazards on Indonesia's sanitation systems are already documented.*[xxii] *As such, the country's medium term strategy includes a focus on reducing risks from climate change on the water and sanitation sector.*

Numerous studies confirm that climate hazards cause loss of water and sanitation services or unsafe services.[xxiii] The direct impacts are predominantly through intensification of the water cycle (hydrological changes), and there can also be indirect impacts from loss of electricity or road accessibility.

Documented impacts on water supply systems:

- **Reduced or lack of water supply** results from *declining rainfall, water shortages and droughts.*[xxiv] Both piped and non-piped systems can be affected, as both groundwater and surface water supplies may be reduced.[xxv] Retreat of glaciers in high altitudes is also

shown to threaten domestic water supply for some communities.[xxvi]

- **Damaged infrastructure and poor water quality** results from *heavy rainfall and flooding*, including due to landslides and soil erosion, and has been reported in multiple countries and can even affect major urban water supplies.[xxvii] Sea-level rise can also increase salinity affecting coastal communities.[xxviii]
- **Undermined financial sustainability for service providers** results from *seasonal variability* as people make different water source choices, not just from necessity, but from preference for rainwater when available, resulting in reduced demand for managed water supplies.[xxix]
- **Households may switch to unsafe water sources** due to *droughts or seasonal variability* that that force people to use unsafe, unimproved water sources.[xxx]
- **Access may be needed to multiple water sources** to address water scarcity in small-islands suffering from repeated disasters,[xxxi] as well as in many other rural contexts.

The latest national assessment in Bangladesh highlighted the widespread vulnerability of drinking water systems to changes in rainfall and temperature.[xxxii] Increases in faecal contamination were recorded in drinking water with increases in rainfall and temperature over five months of sampling.
In Ethiopia, during drought the water collection times were increased and there was a large-scale reduction in performance of surface and shallow groundwater sources (springs, open sources and protected wells).[xxxiii]

Documented impacts on sanitation services:

- **Faecal contamination of urban environments** occurs when onsite systems are flooded due to rising groundwater or inundation from surface water, or cannot be emptied when road networks are disrupted due to *storm damage*, or when emptying service providers cannot keep up with increased demand during *heavy rainfall and flooding*. [xxxiv] In addition illegal dumping of sludge into waterways has been reported to occur at such times.[xxxv]
- **Sewers are blocked, overflow or backflow** when there is too little or too much water due to either *drought or heavy rainfall and flooding*. Sewer blockages are reported due to solid waste and debris entering the system from *flooding events.*[xxxvi]
- **High risks of pathogen exposure** occur in cities when commonly used combined sewers (sewers with stormwater) overflow during heavy rainfall[xxxvii]
- **People return to open defecation** when their primary toilet is inaccessible due to *flooding or insufficient flushing water*, as was the case in locations in Indonesia.[xxxviii]
- **Pit latrines overflow or collapse** with *heavy rain and flooding*, for instance as seen in Bangladesh.[xxxix]
- **Wastewater treatment plants suffer failures** due to flooding, and road access interruptions and electricity outages from storms,[xl] as well as potential overloading, reducing treatment efficacy.

In rural Mozambique, a study found that many people did not rebuild latrines that became unusable due to flood damage, depending on their education, soil conditions, social cohesion, perception of risk and confidence to rebuild.[xli]

Documented impacts on hygiene practices:

- **Menstrual hygiene is a key challenge** for women and girls in disaster settings, suffering from displacement, including by climate events, and has been reported to detrimentally affect women in flood-prone areas in Kenya.[xlii]
- **Water-borne and water-washed diseases increase during droughts.**[xliii] Handwashing behaviour reduces with water scarcity, leading to increases in diarrhoea and has been shown to reduce the safety of food handling in South Africa, and is a risk factor for spreading cholera. [xliv]

Lack of climate resilience in water and sanitation services negatively affect health and well-being. Water-borne disease increases with floods and heavy rainfall,[xlv] which are widely associated with increases in waterborne diseases such as cholera, cryptosporidiosis, rotavirus, typhoid and other diarrhoea.[xlvi] Increases in faecal contamination and diarrhoea with heavy rainfall are widely reported, including piped water systems, and also due to increased temperatures.[xlvii] Injury and gender-based violence risks can increase in droughts, as people travel long distances for water, particularly women.[xlviii] Outbreaks of dengue have occurred during droughts in Brazil and in East Africa due to unsafe water storage that provided breeding sites for mosquitos.[xlix] Water insecurity has also been found to reduce hygiene behaviours such as handwashing required to limit COVID transmission in a five-country study in Cambodia, Laos, Myanmar, Thailand and Vietnam.[l]

Vulnerable and disadvantaged groups bear a greater burden. The impacts of these events are inequitable, with the poorest most often exposed with the least capacity to adapt to these shocks and secure alternative safe WASH services.[li] For instance, low-income households are more likely to be affected by sewerage and septage overflows and are more likely to use lower-quality sanitation systems more easily disrupted by climate hazards.[lii] In South Africa, intense droughts and flood create intermittent water supply created increase cost for water provision as well as threatened tourism and farming activities.[liii] In Bangladesh, poor households in water-stressed coastal communities face major trade-offs in drinking water quality, accessibility and affordability.[liv]

Despite these known impacts and severe consequences, water and sanitation are absent in most national climate policies. Water and sanitation service delivery are not well represented in climate policy and climate finance, and hence there is a need to increase awareness of the importance of these services for societal resilience more broadly. An analysis of the inclusion of sanitation and wastewater in the Nationally Determined Contributions (NDCs) indicated that only 2% and 3% of activities included in the NDCs dealt with sanitation access and wastewater respectively.[lv] These were largely adaptation activities, which have also received lower priority than mitigation for climate finance.

Lastly, accountability is needed for damage to water and sanitation services in climate-affected countries. Inequalities apply also at the global level, as states are not equally vulnerable to the effects of climate change. Historical emissions from rich industrialised nations have caused the majority of global heating, yet WASH services low- and middle-income countries (LICs and LMICs) suffer the brunt of climate change impacts. Calls from the Alliance of Small Island States (AOSIS) and the Climate Vulnerable Forum (CVF) for specific funds to address losses and damages arising from climate change (including to critical WASH infrastructure) have gone largely unheeded by historic polluters.[lvi]

How to deliver climate resilient water and sanitation services

Climate resilient water and sanitation services are those services with the capacity to cope with climate risks and trends. Delivering climate resilient WASH services is not just key to SDG 6 and realising the human right to water and to sanitation, but also to realizing SDG 1.5 - to increase resilience of societies especially the poor and vulnerable.

To achieve climate resilience in water and sanitation it is critical to focus on the service, and the continuity of the service. Key elements of climate resilient water and sanitation services are the right *institutions, infrastructure and investment*, elaborated below. It is not enough, nor advisable to solely aim to 'climate-proof' infrastructure. Rather, institutions and communities must be equipped to plan, to adapt, to cope and to respond, and investments must include those that improve adaptive capacity.

Institutions. To ensure the resilience of water and sanitation services, policy-makers and managers need to be able to plan for changes in hazards, and to respond quickly during events.

At the policy level, this includes:

- Strong laws and regulations that establish clear institutional mandates to provide water and sanitation services that are climate resilient and protect water resources[lvii]
- Coherent strategies to manage water-related climate risks that support integration of knowledge and planning on water resources management, disaster response and recovery.[lviii] This includes ensuring water and sanitation are prioritised in National Disaster Risk Management Plans (NDRMP) and National Adaptation Plans (NAPs).
- Intersectoral coordination mechanisms between service delivery actors with those managing water resources such as lakes and aquifers,[lix] as well as with other sectors (e.g. health, energy and agriculture).
- Ability to target responses to support the most vulnerable, and involve marginalized and disadvantaged in decision-making, including addressing gendered norms,[lx] prioritising services for those communities most exposed to climate hazards
- New ways to configure the water cycle in terms of a circular economy and nature-based solutions, including consideration of wastewater reuse in water-scarce areas.[lxi]
- Functioning accountability mechanisms, wherein roles and responsibilities are clearly defined so that duty bearers can identify and respond to problems.[lxii]

At the management level, this includes:

- Water managers able to access, understand and plan based on climate information to ensure decision-making informed by climate risks and vulnerabilities,[lxiii] including early warning systems
- Risk-based management of water and sanitation services[lxiv] and of water resources, based on water or sanitation safety plans,[lxv] to prioritise responses to changing risks and to focus resource oversight on activities that present the highest priority risks of pollution or over-abstraction.
- Ability to monitor and respond to interruptions to services due to skilled, trained operators, reliable supply chains and expertise for maintenance and repairs.[lxvi]

- Awareness raising and capacity development activities with the community to improve preparation, communication and response to shocks.

Indonesia a recent study in four cities co-developed actionable adaptation strategies to improve climate resilience of sanitation services with city governments. Strategies included using data on historical hazards to understand the most relevant climate risks and incorporating risk assessments into city planning. Also, to put in place flexible management arrangements with in-built in redundancy, raise community awareness and strengthen intersectoral action across water resources, publics works, health and disaster management agencies.[lxvii]

Infrastructure. Designing climate resilient water and sanitation services needs to consider how services are delivered by existing infrastructure as well as how to design infrastructure for future conditions.[lxviii] An estimated 90.1% of the global population have access to basic or safely managed drinking water, however, it is not known how much of this water and sanitation infrastructure has exceeded its design life expectancy, increasing the vulnerability of the users to climate hazards.[lxix] New WASH infrastructure should be designed with resilience and adaptation in mind, based on local future climate projections.

Infrastructure resilience can be enhanced through ensuring redundancy and flexibility in design, robustness and through decreasing dependency on water.[lxx] The appropriate infrastructure will vary depending on the climate hazards and institutions to manage the infrastructure. For example, a flexible septic tank system may be immersed in water during flooding but still continue to function. Protected boreholes offer more resilience to changes in water quality during rainfall than protected dug wells.[lxxi] 'Low regrets' approaches, those that adopt infrastructure that will be beneficial regardless of the climate scenario, are also an important way forward.[lxxii]

Investment. Preventive and responsive financing to improve institutions and infrastructure is key to achieving climate-resilient water and sanitation. In LMICs, providing universal water and sanitation access by 2030 at the current resilience level was estimated to cost from $116 billion to $229 billion a year for capital investments and from $32 billion to $69 billion a year for maintenance.[lxxiii]

Prevention requires additional up-front costs for more resilient infrastructure assets, which can double the construction cost, depending on the asset and the hazard, and also requires investment in maintenance,[lxxiv] but which also ultimately results in substantial savings. Investment in operations and maintenance is expected to reduce the total life-cycle cost of water and sanitation infrastructure by more than 50 percent.[lxxv] Figures show that one dollar invested in prevention actions can save between 6 and 15 dollars on future disaster loses and post disaster recovery.[lxxvi] Responsive financing is an important complement, in the form of accessible disaster-response funds that can be mobilised at short notice.

Climate-resilient WASH needs investment in both in urban and rural areas. Figures from OECD DAC 2000-2018 show that climate finance priorities are dominated by large infrastructure for water resources management and WASH. In contrast, rural and community-scale water and sanitation receive a 10th of the total.[lxxvii]

Governments and other stakeholders must collaborate to deliver these solutions in a timely manner. Mobilization of financing for resilient water and sanitation infrastructure managed by climate-sensitive institutions must be prioritized to ensure societal resilience. Achieving resilience can also be aligned to efforts to address mitigation and reduce emissions. The directions set out in the UNFCCC Water Climate Action Pathway to contribute to the Paris Agreement include (i) the protection and restoration of freshwater resources for ecosystems and people; (ii) the sustainable use and distribution of water for agriculture, energy, industry, and human settlements; and (iii) the reuse of freshwater and wastewater at a global scale. These are all directions that can align with the above proposed approach to climate resilience in WASH institutions, infrastructure and investment.

Glasgow Declaration 2021: Water footprint assessment stimulating action and investment in water security

During COP26 a coalition of national governments, development agencies, corporations and investors signed the Glasgow Declaration for Fair Water Footprints. This initiative sets out how water footprint assessment and accounting provide new ways to understand, communicate, and stimulate action for water security, tracking embedded virtual water across globalised supply chains.

Fair water footprints are essential to regulate economic activity for climate resilience. They are defined as water uses which:[v]

- *Cause zero pollution*
- *Use water within sustainable limits*
- *Respect the human right to water and sanitation*
- *Protect nature and increase climate resilience*

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