Guiding Principles for Using Water as Leverage for Climate Resilience

"Water is to adaptation what energy is to mitigation, meaning that reliable, clean water resources are essential in absorbing and adapting to changes brought on by the climate crisis."

This brief aims to guide effective country-driven water adaptation to reduce vulnerability and build water resilience. It intends to enhance the political buy-in for water as an enabler and connector to build climate resilience. The brief proposes a set of guiding principles deemed critical for using water to leverage climate resilience. It was developed through a review of existing literature and a consultation process with relevant experts.

The Climate Crisis Is a Water Crisis

The World Economic Forum's Global Risk reports from the years 2016 to 2022 list water crises and climate inaction as the top global risks.[1] *"By 2050, the number of people who lack sufficient water for at least one month per year will soar to more than 5 billion from 3.6 billion today, causing unprecedented competition for water."*[2]

As illustrated in Figure 1, increased warming of the atmosphere will alter the hydrological cycle and amplify the exposure of small islands, low-lying coastal areas, and deltas to the risks associated with sea-level rise, saltwater intrusion into freshwater systems, and increased incidence and intensity of extreme weather events. Compounded with rising development pressures from increased population growth, economic activities, and associated land-use change, these risks also alter the quality and quantity of water available.

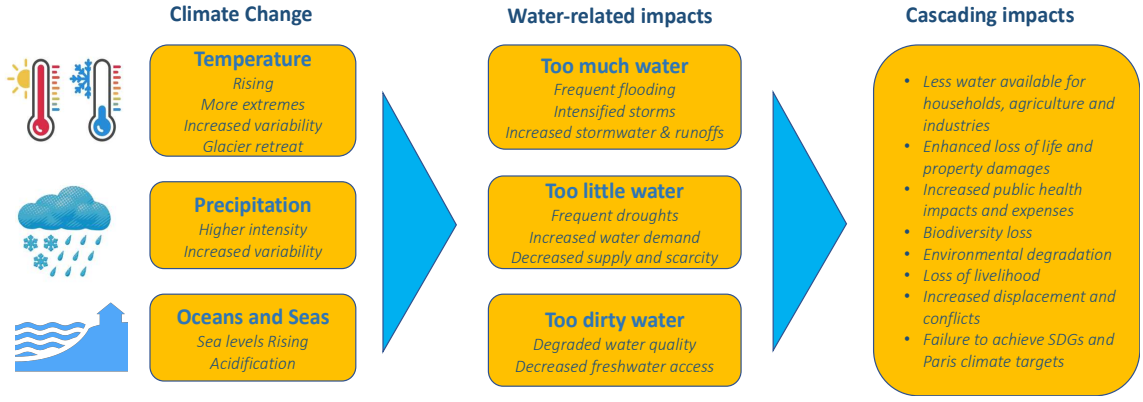

Figure 1. Climate change impacts on water

An overwhelming "90 per cent of climate disasters are water-related – either too much, too little, or too dirty"[3] and under the influence of climate change these are likely to become more frequent and intense. The overall annual economic losses from weather-related disasters for 1995-2015 were estimated to be between US$ 250 billion and US$ 300 billion. During this period, as many as 205 million people were affected annually.[4]

Droughts and floods already have an impact on society and many of its critical functions, all of which increasingly demand a share of the available water resources.

In an overview of 136 coastal cities, Hallegate and colleagues[5] reported that global average flood losses owing to population and asset growth, climate change and subsidence will increase tenfold from $6 billion per year in 2005 to over $60 billion in 2050. The land area subject to increasing water stress is projected to be more than double, and an estimated 0.5-3.1 billion additional people will be living with water scarcity due to climate change.

Climate change will most likely have severe societal impacts and consequences on water. Declining water availability, lower crop productivity and impacts of sea-level rise and storm surges on livelihoods are expected to disproportionately affect disadvantaged and marginal populations, and spur displacement to deepen existing inequalities and further disempower them. Thus, the climate change impacts manifested through water resources and systems act like a risk multiplier. Failure to account for those impacts and linkages will affect social, economic, and political stability across the globe.

Water Adaptation

Water adaptation is defined in this brief as the process of adjusting society and societal behaviour by using water related measures to minimize the negative impacts of climate change and water related risks, while simultaneously building long term climate resilience.

Although the urgency to address climate change through water adaptation is well recognized, it is yet to be translated into concrete action. Although water as a central means for adaptation is garnering attention, it still remains underrepresented in national plans and in international investment portfolios and implementation is lagging.

Actions on climate change adaptation must therefore be translated into water adaptation, and its implementation and country-driven actions must be accelerated. By finding the leverage points[6] for valuing water and related ecosystems as ways of building climate resilience, a range of innovative actions can be initiated to create fundamental shifts and not merely repackage business-as-usual development. Understanding water's complex interlinkages, valuing the resource appropriately, and managing it in an inclusive way can offer "inspiring leverage for impactful and catalytic change".[7]

The COVID-19 crisis has underscored that resilient water systems are crucial to ensure sustained livelihoods and the well-being of communities, and political buy-in and awareness building can be achieved through concerted efforts at different scales, from global to local. Water was a prominent issue at COP26 in Glasgow, and there is increasing public pressure to act on the current climate emergency. Therefore, upcoming COP27 and the 2023 UN Water Conference offer critical and exciting opportunities to transform the political buy-in for water as an enabler and connector for building climate resilience.

Guiding Principles For Water Adaptation

1. Mainstreaming Water Adaptation: Going Beyond Stand-Alone Measures to Address Climate Risks Across Sectors

Water is critically important and interestingly complex as the hydrological changes induced by climate change create risks for society directly through alterations of the water cycle. Additionally, there are indirect risks for human health, energy production, urbanization, food security, environment and economic development, and social inequalities.

Mainstreaming water adaptation entails systematically incorporating and considering water and its interconnectedness across various sectors and systems in decision-making and planning processes as opposed to implementing 'stand-alone' measures. This requires more attention to cross-cutting coordination spanning the entire water cycle, encompassing policies which provide resilience for several levels and sectors. For example, it means acknowledging linkages across adaptation, mitigation, disaster risk reduction (DRR) and the Sustainable Development Goals (SDGs).

Mainstreaming is important because while water is frequently considered a stand-alone sector, it is in fact a connector of all socio-economic sectors and is both directly and indirectly linked to all the SDGs (Figure 2)[8]. Due to the cross-sectoral nature of water, policy avenues for promoting synergies between water adaptation and existing development strategies should be encouraged. Therefore, water adaptation must be embedded in the broader sustainable development context, recognizing climate change as an added challenge to reducing poverty, hunger, diseases and reversing environmental degradation.

2. Managing Uncertainty Through Enhanced Resilience

Climate change will fundamentally alter hydrological cycles, rapidly introducing uncertainty to global and regional weather patterns, and making it hard to predict the future based on past trends.

The water community has access to a diverse range of tools for managing water. However, these are mostly designed or devised considering 'stationary climate'. These highly optimized solutions and standard practices in planning, policies, regulations, infrastructure design and operations that are developed based on risk predictions, calculated using historical observations and statistical analysis likelihood approaches, may not be effective and even exacerbate vulnerabilities often leading to maladaptation.[9]

As climate change becomes increasingly apparent, it is now imperative for water institutions and infrastructure managers to recognize its dynamic nature and align their plans and strategies accordingly, to sustain economic growth and resilience. This can be accomplished by adopting approaches for decision-making under uncertainty. Water managers, engineers and planners need to prepare for a wide range of possible futures. Addressing uncertainty calls for more attention to diverse and blended design approaches to enhance flexibility and robustness. To be effective in the face of deep uncertainty, resilience-building must also encompass no-regret

approaches that allow us to persist, adapt, and transform in the face of climatic impacts.

For example, infrastructure plays an important role in building the resilience of the water sector. However, traditional gray infrastructure is often inflexible and designed to be fail-safe using static future predictions. The failure of this infrastructure can often have catastrophic consequences. An alternative can be a safe-to-fail design approach where infrastructure is designed to lose function in a controlled manner. Such infrastructure systems remain adaptable and can provide new services more readily than fail-safe designs.[10]

Blended design approaches that combine gray infrastructure with Nature-based Solutions (NbS) could offer these attributes and may save costs and reduce emissions over their operational lifetime. In China, the 'Sponge cities' initiative uses a combination of green and gray infrastructure to improve water availability in urban settlements. One of its key objectives is to absorb 70 percent of rainwater through improved water permeation, retention and storage, purification and drainage, as well as water saving and reuse.[11]

At the same time, data and information collection is important for evidence generation, advancing water and climate information systems to monitor changes in the system, and making more informed decisions to manage uncertainty.

BOX 1. Room for the River Programme, Netherlands

To cope with the elevated risk of flooding induced by climate change, the Dutch government has implemented the Room for the River Programme instead of strengthening or raising the height of the embankments (Zevenbergen et al. 2013). This safe-to-fail method includes a range of measures to provide more space and room for rivers to flow, increase their disposal and storage capacity, and improve the spatial quality of the landscape along rivers (Zevenbergen et al. 2013). As part of the program, at a sharp bend on the River Waal, a dike was moved inland by 350 meters in the village of Lent to create room for a secondary channel which could reduce the water levels by up to 35 cm along the river during high water. By doing so, the program intentionally expanded flood-prone areas into nearby farmlands to transform them into a vegetated flood buffer during high water events and into recreational parks at other times, thereby reducing risks of catastrophic damage (Kim et al. 2019).

However, such approaches should be implemented taking local contexts into consideration. Moving the dike meant that nearly 150 houses had to be relocated (Rajamony and Rakesh 2018, p.52). Potential conflicts owing to relocation of affected community members were resolved through community and stakeholder consultations, inputs from residents and discussing their concerns with experts in spatial design, engineers and policy makers. In developing countries, large shares of informal settlements along rivers and canals would need to be moved to accommodate a strategy such as Room for the River. Furthermore, there is also risk of elite capture or abuse in implementing safe-to-fail approaches.

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3. Multi-Level Governance – Management at the Right Scale(s)

Ensuring effective action on resilience and climate change adaptation can be a complex task, requiring coordinated efforts from the highest levels of the government to individual households and firms.

No program, actor or investment can single-handedly address the climate change issues related to water. For water adaptation to be effective, a combination of top-down and bottom-up governance approaches are required. Inclusive decision-making that allows engagement and participation of multiple partners and actors at all levels - including those at the community and grassroots levels - would be crucial. Some specific points can be highlighted concerning scales:

- Political leadership is needed to set the mainstreaming agenda high on the priority list, linking water-related actions and their budget processes (e.g., in NDCs, NAPs, the SDGs). This in turn guides all other strategic planning processes.

- Water's own boundaries in catchments and river basins, and if relevant, transboundary river basins, need to be recognized. Often catchment management is needed to ensure a sustainable water resource flows to downstream areas and for flood mitigation.

For example, climate change adaption has been integrated into planning processes in the transboundary Chu-Talas basin in Kazakhstan and Kyrgyzstan. This demonstrates how joint bodies have provided platforms for discussing problems and finding solutions, thereby playing a crucial role for climate change adaption in these river basins. Transboundary adaptation strategies can also support national adaptation, sectoral strategies and nationally determined contributions (NDCs), and vice versa. Furthermore, as adaptation measures are implemented at the local level, encouraging local stakeholders to discuss them facilitates communication with decision-makers at national and transboundary levels.[12]

4. Enhancing the Effectiveness of Water Governance Through Innovation and Capacity-Building

Effective water governance should strive to empower local stakeholders to lead in water adaptation efforts whenever appropriate. This calls for establishing strong institutions that can incentivize collaboration and partnerships between the public and private sectors and the community, thereby accelerating co-produced adaptation actions.

To do so, adaptation can and should build upon the numerous water management measures which are already available, while also remaining open to innovative governance approaches. One of the critical shifts needed is to move away from top-down and reactive planning measures towards more collaborative and preventive ones. The innovation in this would be "less about engineering or inventing something, rather (it) actually lies in combining a region's cultural, social, economic and physical needs and opportunities into solutions that are partly physical, but also drive policy change and political reform".[13]

Other components of effective water governance include institutional strengthening and capacity-building based on the principles of equitability, transparency and decentralization. Capacity-building initiatives must recognize indigenous and local realities, build on the diversity of experiences and sets of knowledge and facilitate development of long-term in-country capacities. This could be achieved partly by sharing best practices and cross-learning among different countries via South-South and South-North knowledge transfers (in addition to the traditional North-South knowledge transfers).

5. Water to Facilitate Low Carbon Climate Resilient Development

Using water as an entry point to assess typical adaptation measures through a cross-cutting lens can help identify mitigation benefits, and such practices can be transformative compared to current practices that typically focus solely on adaptation or mitigation. For example, treating organic matter from wastewater prior to disposal reduces the risk of both surface water degradation and greenhouse gas (GHG) emissions. Hence, despite not being explicitly mentioned in the Paris Agreement (2015), a closer look at water resources and climate action reveals that water is actually a key enabler for its implementation.

Resilient water management can produce win-win solutions for climate change adaptation and mitigation (Box 2). The water–energy–food– environment nexus is helpful to understand this dimension.

Box 2. Water Saving Approaches Can Offer Both Adaptation And Mitigation Benefits

- Smart Irrigation Water Management

Using technology and proper management irrigation can offer both adaptation and mitigation benefits. Water-saving technologies such as alternate wetting and drying (AWD) for rice production reduce water requirements by up to 20-50 percent and reduce greenhouse gas emissions by 30-50 percent (Kumar and Rajitha 2019). AWD has been found to enhance yield, soil quality and incomes while reducing vector borne diseases (Allen and Sander 2019). Another smart irrigation technology which combines solar pumping with drip irrigation has also been reported to offer similar co-benefits. In Benin this method reportedly enhanced food security in addition to providing emission-free pumping (Burney 2010).

- Circular Water Management

Circular water management can enable industries and water utilities to become more water-efficient, cope with rising water stress and minimize GHG emissions (UNESCO, UN-Water, 2020). A circular water management approach changes the linear process of water collection, treatment, consumption, and disposal into a circular one in which water is recirculated for continual use (Stuchtey, 2015). Several leading industries have already embraced circular water management approaches. Tangshan Iron & Steel (TIS) in China has water treatment facilities that reuse 60 percent of industrial water. This enables TIS to meet strict regulations and save costs through reduced freshwater intake (Veolia, 2014). Generating energy from biogas and fertilizer from biosolids can also yield mitigation-adaptation co-benefits.

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Investing in low-carbon water technologies and practices could serve to leapfrog investments in carbon-intensive technologies and help achieve multiple competitive advantages, such as improved management of natural capital, enhanced competitiveness in the face of global mitigation policies, increased market access, and a range of environmental and health co-benefits.

Typically, adaptation is a priority in vulnerable and developing countries. Linking adaptation to mitigation might render mitigation options more attractive to policymakers in developing countries and encourage them to adopt a low-carbon pathway for economic transformation. However, those working towards resilient water management should also be aware of and minimize trade-offs, as measures narrowly focused on climate mitigation and adaptation can have direct and indirect negative impacts on nature and nature's contributions to people.

6. Enhancing Water Adaptation by Placing Justice, Equity And Inclusion at its Core

Climate change will disproportionately affect low-income countries, and poor and marginalized groups are often more vulnerable to these effects. Globally, about 1.47 billion people are exposed to substantial risks during 1-in-100 year flood events, 89 percent of whom live in these countries.[14] A recent World Bank report[15] indicates that without concrete climate and development action, climate change could internally displace more than 216 million people by 2050, hitting the poorest and most vulnerable the hardest, and threatening overall development gains.

Thus, gender, race, economic and political inequities, which are often the root causes of vulnerability, should be placed at the core of adaptation planning and action for developing inclusive approaches. An important step is to ensure that programs are designed to enable local communities to exercise agency and lead decision-making processes wherever appropriate.

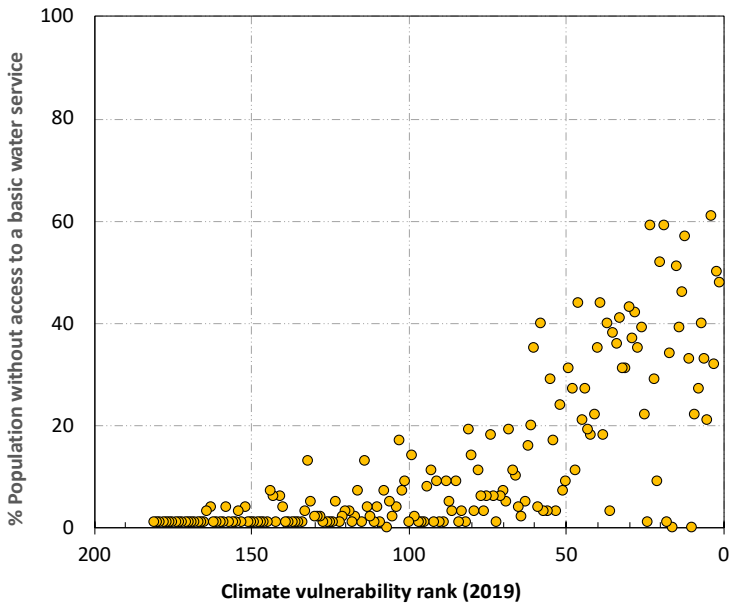

Figure 2. Correlation between access to basic water services and climate vulnerability ranking of countries

Governments, in collaboration with donors, multilateral agencies and local communities could devise water supply and management focused adaptation programs, and thereby reap development dividends and ensure water security for local communities (Box 3).

Box 3. 'Mazhapolima' Participatory Well Recharge Program in Kerala, India

'Mazhapolima' (Bountiful rain) is a community-based roof-rainwater harvesting and open well recharge project launched in Thrissur district in 2008 and later scaled up as a program across Kerala state in response to declining water availability and quality owing to droughts, rainfall variability, rising salinity, and contamination by sewage. Designed by jointly by the Thrissur District Administration and the local gram panchayats (village-level local governments), it involved artificially recharging groundwater. Channelling harvested rainwater directly into an open well or recharge pits constructed next to an open well led to cleaner water after rains and reduction of salinity in coastal areas. Between 2008 and 2018 about 100,000 wells recharge units were implemented benefiting nearly 500,000 people. Due to the success of the project, rainwater harvesting is now emphasized both in state and national policy.

Political ownership, affordability and linking water security with livelihood were the key factors behind the project's success. The process began with the mobilisation of gram panchayats, but eventually, the State Government provided a lot of support for this project. It was demand-driven from local communities, utilized local knowledge and labour in designing and installing the rainwater harvesting systems. The program is an example of an innovative nature-based solution for water security challenges where novelty is not about engineering or inventing something new. Instead, it innovatively linked a region's cultural, social, economic and physical needs and opportunities to solutions and enabled communities, civil society and governments to collaborate and drive policy reform.

Increasing the adaptive capacity of vulnerable and marginal communities is important by improving their access to safe water and sanitation. This provides an opportunity to address climate vulnerability, and the need is evident. For example, countries deemed more climate vulnerable typically have a higher percentage of people without access to safe drinking water (Figure 3)[16]. The value of additional investments needed until 2030 to ensure universal access to safe and affordable drinking water is estimated at $1.7 trillion– about three times the current levels of investment.[17, 18]

7. Financing Water Adaptation Should Offer Both Good Economic and Financial Cases, and Spread Gains Among Many Beneficiaries

The current finance gap, high cost of inaction, and the potential economic and social benefits that can be reaped from water adaptation efforts, signal a critical need for exploring and availing the full range of financing options. While there is abundant evidence of good economic cases for water adaptation, the same is not always true for finance. Thus, there is, a crucial need to create new financing models and/or adapt existing ones. Success stories of targeted and effective financing can attract greater investments from the private sector, which can also offer innovative solutions to address water-related adaptation issues.

In Mexico's Tabasco state, following a flood in 2007, the Federal and State Governments invested approximately US$750 million for an Integrated Hydraulic Plan with both structural and non-structural measures. Structural measures included embankments and reinforcements, while non-structural measures included the development of early warning systems, risk maps and capacity-building. These reduced flood-related damages and losses by 80 percent during an even greater flood in 2010.[19] This demonstrates how smart investments in water can lead to very significant development and economic benefits.

When adequate clean drinking water is available, health costs go down, while gender, equality and education opportunities go up. Global economic losses due to inadequate WASH is US$260 billion every year owing primarily to lost time and productivity.[20] On the other hand, depending on the region and technology involved, the return on water supply and sanitation investments for US$1 invested in WASH US$3-34 for.[21]

Globally, projected damage from flooding is expected to be US$120 billion per year from property damage alone, and in the absence of adaptation, coastal flood risk could increase fourfold, while fluvial flood risk could double by 2030.[22] On the other hand, projections suggest that funding needs for global water infrastructure range from US$6.7 trillion in 2030 to US$22.6 trillion in 2050, again suggesting a major finance gap.[23]

To ensure that financing for water adaptation is adequate, appropriate and effective, it is imperative to have better coordination among funding entities at various levels. Donors, national governments, city governments and local actors need to work together to reduce duplication and achieve optimum benefits.

Moving Forward

As the impacts of climate change soar, there is an urgent need for convergence between water and climate change policy and adaptation. The climate and water communities must collaborate, to deliver robust responses under conditions of climatic uncertainty. In the face of the ensuing uncertainty, everything that needs to be done to have effective water management can theoretically be considered adaptation. As such a shift in perspectives and paradigm can facilitate transformation of the water sector and leverage water's cross cutting attributes to enhance climate action.

Water is an inherently risk-averse sector as the consequences of failure are often catastrophic. Thus, the climate community needs to convince the water community that climate adaptation and mitigation actions are not going to destabilize already engineered systems. The climate community could offer effective policy frameworks, strategies and financing that drive implementation and delivery of water management objectives and goals.

Looking ahead to COP27 and the UN 2023 Water Conference, we solicit the commitment of all relevant stakeholders towards the proposed seven principles to leverage water's cross-sectoral characteristics to accelerate and scale up resilience-building to climate change. Incorporating the proposed principles into water adaptation will entail patient, deep and politically intelligent support, as well as national and local-level buy-ins.

The Water Adaptation Community of the Global Center on Adaptation (GCA) provides a multi-actor forum for peer review and exchange, consultation and soliciting constructive feedback to strengthen water adaptation over time.

In conclusion, climate adaptation may perpetuate unequal development patterns and norms unless there are transformational shifts that dismantle existing imbalances of power and reshape socio-political dynamics in favor of local communities that are on the frontlines of climate change.[24] This places justice and equity concerns at the core of using water to leverage adaptation and underscores the importance of avoiding interventions that merely repackage development.

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