

OPINION

# Bridging water, health and climate: A call to action

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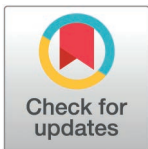
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2024 was the warmest year on record [1]. Projections indicate that increasing temperatures will have a profound impact on the hydrological cycle with cascading effects on ecosystems, economies, and societies [2]. For people experiencing these changes, the combined effects can result in multiple and varied societal health risks, particularly for the most vulnerable [3]. These risks can only be effectively managed through a holistic approach that directly addresses the interconnected dynamics of water, health, and climate.

## Connecting water, health, and climate

Many of the pathways linking climate and health are mediated through water. In some cases, these pathways are straightforward. For example, greater variability in rainfall can reduce the availability of water, impacting health and undermining food and livelihood security. Other pathways are more complex and operate through cascading effects which can produce novel and unexpected outcomes. Droughts and floods can cause power shortages, which can force communities to use ad-hoc water storage onsite, enabling mosquitoes to breed and allowing diseases such as malaria and dengue to spread [4]. Bats that experience increased viral shedding at higher temperatures may feed on insects that, in turn, feed on microbiota in surface waters contaminated by antiviral residues, increasing the likelihood that emergent viral strains are resistant to current treatments [5,6]. These are interconnected processes that encompass interactions across complex systems that include environmental change, infrastructure resilience, governance, and social vulnerability.



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Systems-based approaches that link these interconnections are not new. Frameworks such as Integrated Water Resources Management, One Health, and the more recent Planetary Health Approach all recognize the deep interconnections among human, ecological, social, and political systems. Each promotes collaborative, cross-sectoral strategies, policies, infrastructure, and institutions to anticipate, prevent, and respond to public health and environmental threats. But each also struggles with entrenched institutional and disciplinary silos, fragmented governance and narrowed funding structures, and the absence of frameworks that translate systems thinking into actionable policies. And, while water, health, and climate are found across these approaches, the explicit linkages between the three are often absent.

### **Prioritizing the water-health-climate nexus**

To address this critical gap, we recommend specific steps to align incentives across sectors, support transdisciplinary collaboration, and build shared funding, data, and evaluation infrastructures around the nexus of water, health, and climate. By framing systems integration across these three - not only as a conceptual imperative but as an institutional and operational goal - we can better address the emergent challenges at the nexus of these complex systems.

### **Strengthening literacy and collaborative research**

Advancing transdisciplinary research and building strong partnerships are essential for translating knowledge into practical solutions that enable communities to adapt and thrive sustainably. Dedicated funding and strategic incentives for research at the nexus are critical to strengthening literacy and fostering effective cross-sectoral collaboration. For example, the European Union-funded University of the West Indies Climate Change and Health Fellowship programme provides interdisciplinary training for mid-career professionals from 13 Caribbean countries [7]. Fellows come from diverse disciplines, including water management, safety, and security, and the programme develops competencies in collaboration, stakeholder engagement, and science communication, bridging research, policy, and community action to cultivate leaders capable of addressing interconnected challenges.

### **From response to readiness**

Prevention is widely recognized as less costly and more protective than post-crisis response. However, we remain challenged by limited data on emerging risks and well-documented behavioral and institutional biases that delay preventive action even when credible information exists [8]. The interconnected threats of extreme weather events, water insecurity, and climate-sensitive disease outbreaks require proactive, systems-based preparedness. Institutions and financing mechanisms must therefore enable both the early identification of compound risks and the timely mobilization of preventive measures - such as pre-positioning WASH supplies and personnel, maintaining power to water pumps, and flood-proofing health facilities [9].

## Centering justice and knowledge

Climate hazards amplify inequities, often exacerbating existing health injustices. Marginalized and Indigenous communities frequently reside in areas of heightened exposure and depend on climate-sensitive livelihoods. When climate hazards strike, they face disproportionate losses of lives, housing, income, and food security, alongside reduced access to healthcare and recovery resources. Indigenous and local knowledge holders must play an active role in climate resilience. Meaningful collaboration requires that researchers, policymakers, and practitioners work with these communities as equal partners in coproducing knowledge and action. When done right, Indigenous and local leaders define research priorities, guide data interpretation, and co-design adaptation strategies that reflect their cultural values and ecological understanding while embracing rigorous science [10].

## Measuring and managing shared risks

Robust indicators and incentives are necessary to track risk, measure progress, and drive programming towards achieving intersectoral benefits. While sector specific data is generally being collected, integrated indicator data is sparse or absent. Data collection efforts across climate, water, and health should be prioritized and focus on integrated, decision-relevant information that supports risk assessment, real-time monitoring, and forecasting. Countries and development partners should adopt output, outcome and process indicators that track co-benefits across climate, water and health and create incentives that reward the achievement of intersectoral benefits. These indicators and incentives, including those related to the capacity and resilience of institutions and stronger social cohesion, should be embedded within ministries and overseen by an intergovernmental committee or planning group [11,12].

## A call to action

Climate change is a force-multiplier, exacerbating challenges at the water and health nexus. Achieving the vision of a sustainable and equitable future [13] requires coordinated action that addresses intersectoral risks and creates new and more effective strategies to improve and protect global health. Governments should lead the way by strengthening institutions and policies that promote intersectoral goals and approaches, provide funding across sector priorities, and adopt new goals and indicators that reflect and drive holistic responses at the local, national, and global levels. The scientific community can contribute by generating integrated evidence, developing shared metrics, and co-producing knowledge with practitioners and communities to inform joint decision-making. Civil society and community organizations must lead and support public engagement, ensure accountability, and translate national policies into locally relevant action.

While health considerations have long been embedded within the water supply sub-sector, the key challenge now lies in integrating this public health orientation with the broader water resources and climate communities to deliver holistic, systems-based responses.

## Author contributions

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