ISSUE BRIEF

Governing the Full Hydrological Cycle to Strengthen Water Resilience

Atmosphere river in the Amazon rainforest. Source: Carina Furlanetto.

The governance challenge

The global hydrological cycle is becoming increasingly erratic and disrupted by climate change and human activity. The stability of water systems depends not only on climate patterns, but also on how land, ecosystems, and soils are managed across interconnected landscapes.[1]

Yet governance systems still focus primarily on blue water, including rivers, lakes, and groundwater, while paying far less attention to the green water flows that regulate rainfall, sustain ecosystems, and influence resilience across regions.

Policy decisions on land use, agriculture, ecosystems, climate adaptation, and water management are still often made separately, despite being physically interconnected through the continuous movement of water across landscapes and the atmosphere. As climate disruption intensifies, this fragmentation is becoming an increasing governance risk.

Strengthening governance of the full hydrological cycle, including both blue and green water, is therefore becoming essential for long-term resilience, economic stability, and climate adaptation.

What the data shows

- Recent global assessments show that only one-third of major river basins remained within normal conditions, while glacier regions worldwide recorded net mass loss for a third consecutive year.[2]

1. SIWI, *Indigenous Lands Moisture Tracking Project: A Global Analysis of Terrestrial Moisture Recycling*, 2025. https://siwi.org/publications/indigenous-lands-moisture-tracking-project-a-global-analysis-of-terrestrial-moisture-recycling

Stockholm International Water Institute (SIWI), an independent and non-profit organization, based in Stockholm and working globally, advances water's role in secure, equitable, and sustainable futures. We convene partners across sectors, translate knowledge into policy and practice, and strengthen capacity to co-create lasting water solutions.

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- Nearly half the world's population lives in transboundary river basins where water availability is influenced not only by in-basin rainfall and rivers, but also by atmospheric moisture flows crossing multiple borders. In the Nile basin, for example, precipitation over the Ethiopian highlands is sustained by moisture originating from the Mediterranean, Atlantic, and Indian Ocean regions.
- Groundwater provides one-quarter of all water used globally, yet many aquifers remain poorly monitored, inadequately managed, and insufficiently protected.
- Even as global attention to water governance grows, two-thirds of global river catchments have experienced abnormal discharge patterns in recent years.[2]
- By 2050, floods, droughts, salinization, pollution, and inadequate water and sanitation services could reduce GDP by an average of 8 percent in high-income countries and 10 to 15 percent in low-income countries.[2]

Hydrological realities shaping governance

Blue and green water

Blue water governance has traditionally focused on rivers, lakes, and groundwater. Yet green water, stored in soils and circulating through evapotranspiration, plays an equally important role in regulating rainfall, sustaining ecosystems, and supporting climate resilience. Despite this, green water remains largely absent from most governance and policy frameworks.

Land–atmosphere feedbacks

Forests, soils, and wetlands do not only respond to rainfall, they also help generate it. Decisions on land use, agriculture, and ecosystem management directly influence soil moisture, evapotranspiration, and precipitation patterns across regions. When these interactions are overlooked, governance systems risk addressing symptoms rather than the underlying hydrological dynamics.

Teleconnected water flows

Water does not follow administrative or sectoral boundaries. Moisture evaporated in one region contributes to rainfall in another, linking distant landscapes through atmospheric flows. In the Nile basin, for example, precipitation over the Ethiopian highlands is influenced by moisture originating from the Congo Basin, the Mediterranean, the Indian Ocean, and the Atlantic. This illustrates how governance of the hydrological cycle extends beyond individual river basins and national borders.

The governance mismatch

Existing governance frameworks, including international water law, transboundary basin agreements, Nationally Determined Contributions (NDCs) under the UNFCCC, National Biodiversity Strategies and Action Plans (NBSAPs) under the CBD, and National Adaptation Plans (NAPs) under the UNCCD, remain largely organized around fixed jurisdictions and sectors that do not reflect how water moves through the hydrological cycle. This mismatch increasingly limits effective planning, resilience-building, and adaptation to climate disruption.

2. Nyasulu, M.K. et al. *African rainforest moisture contribution to continental agricultural water consumption. Agricultural and Forest Meteorology* 346 (2024) 109867. https://doi.org/10.1016/j.agrformet.2023.109867

Governance in practice

The Nile basin

Atmospheric moisture from the Mediterranean, Indian Ocean, and Atlantic contributes to precipitation over the Ethiopian highlands, which in turn generates much of the Nile's downstream flow. The basin illustrates how water governance cannot be fully addressed through river agreements alone without accounting for the broader atmospheric and terrestrial systems influencing water availability.

The Zambezi basin

The Zambezi basin, shared by eight countries, is increasingly affected by declining green water availability linked to reduced atmospheric moisture transport from the Congo Basin.[2] In response, the Zambezi Watercourse Commission (ZAMCOM), together with SIWI, has worked to strengthen awareness of the role of improved land management and Nature-based Solutions in supporting the productivity and resilience of rainfed agriculture. This led to the adoption of a Statement of Intent on Rainfed Agriculture by the ZAMCOM Council of Ministers in April 2024.

The Amazon "flying rivers"

Evapotranspiration from the Amazon generates vast atmospheric moisture flows that sustain rainfall across the La Plata basin and agricultural regions as far as São Paulo. Ongoing deforestation is already reducing regional precipitation, demonstrating how ecosystem degradation can create direct economic, agricultural, and food security risks, while also highlighting the importance of restoration and land stewardship.

The Mekong-Lancang basin

The Mekong-Lancang basin is shared by six countries, with regional precipitation influenced by atmospheric moisture originating from the Bay of Bengal and the Indian Ocean. The Mekong River Commission provides an existing multilateral platform that could evolve toward more integrated hydrological governance, including greater consideration of green water and land-atmosphere interactions.

Tis Abay (Blue Nile Falls), West Gojjam, Ethiopian Highlands, Ethiopia. Source: Shutterstock.

Policy priorities

1. Integrate green water into land-use, agricultural, climate, and biodiversity frameworks

Soil moisture and evapotranspiration should be recognized as policy-relevant components of water governance rather than treated as secondary byproducts of ecosystem management.

2. Protect and restore moisture-recycling ecosystems as critical water infrastructure

Forests, wetlands, and grasslands that sustain regional precipitation should be recognized and financed as essential water infrastructure within national planning and international climate finance frameworks.

3. Expand transboundary water governance to include atmospheric moisture-source regions

Basin-level governance institutions should broaden their mandates to account for the green water processes and land-use dynamics that influence water availability across borders, not only the rivers and aquifers they directly manage.

4. Align NDCs, NBSAPs, NAPs, and climate finance with full-cycle hydrological realities

Climate and water risk assessments should capture how soil moisture, evapotranspiration, and ecosystem change affect food systems, energy production, infrastructure, and resilience. Better alignment across planning and investment frameworks can help reduce maladaptation risks.

5. Use the UN 2026 Water Conference to strengthen full-cycle governance within the global water agenda

The 2026 Conference provides an important opportunity to embed the blue-green water continuum within multilateral water commitments and strengthen connections across the Rio Conventions, the Ramsar Convention, the Sustainable Development Goals, and regional governance processes.

Moving forward

- Support a dedicated agenda item on full hydrological cycle governance at the UN 2026 Water Conference.
- Strengthen collaboration among governments, basin organizations, and development finance institutions through emerging platforms focused on hydrological governance, knowledge exchange, and capacity support.
- Support the development of a dedicated UN-Water workstream on atmospheric water governance that strengthens linkages across the Rio Conventions, the Ramsar Convention, SDG 6 monitoring processes, and the post-2030 agenda.
- Call on regional bodies and river basin commissions to pilot governance frameworks that integrate green water, land stewardship, and moisture-source region dynamics into shared management approaches.

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