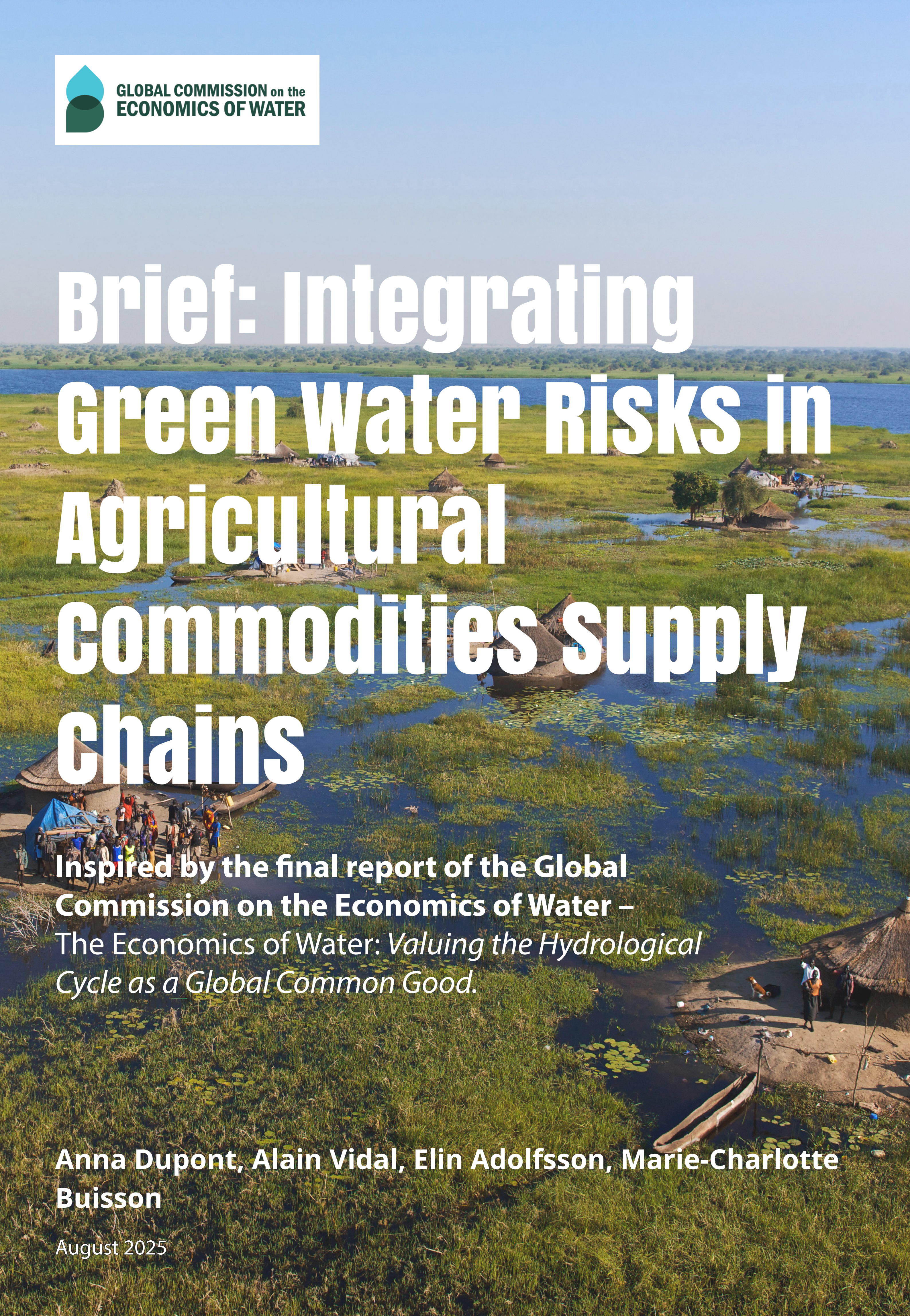

GLOBAL COMMISSION on the ECONOMICS OF WATER

Brief: Integrating Green Water Risks in Agricultural Commodities Supply Chains

Inspired by the final report of the Global Commission on the Economics of Water –
The Economics of Water: *Valuing the Hydrological Cycle as a Global Common Good.*

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The Global Commission's report sets out the shifts required to drive radical changes in how water is valued, managed, and used.

Green water, soil moisture, evapotranspiration, and rainfall, underpins agricultural production but remains unaccounted for in traditional water and supply chain risk models. Yet, failure to integrate green water management threatens food security, market stability, and ecosystem resilience.

This policy brief demonstrates that integrating green water into impact assessments and resilience strategies is essential for both policymakers and businesses. Advancing granular research, upgrading monitoring, and leveraging new digital tools are critical steps toward closing the green water data gap and making supply chain more adaptive to water and climate risks.

By acting on green water intelligence and aligning procurement, reporting, and policy frameworks around these metrics, companies enhance supply chain resilience and redirect financing towards landscape resilient regenerative models. This brief calls for a paradigm shift in water-smart supply chain governance.

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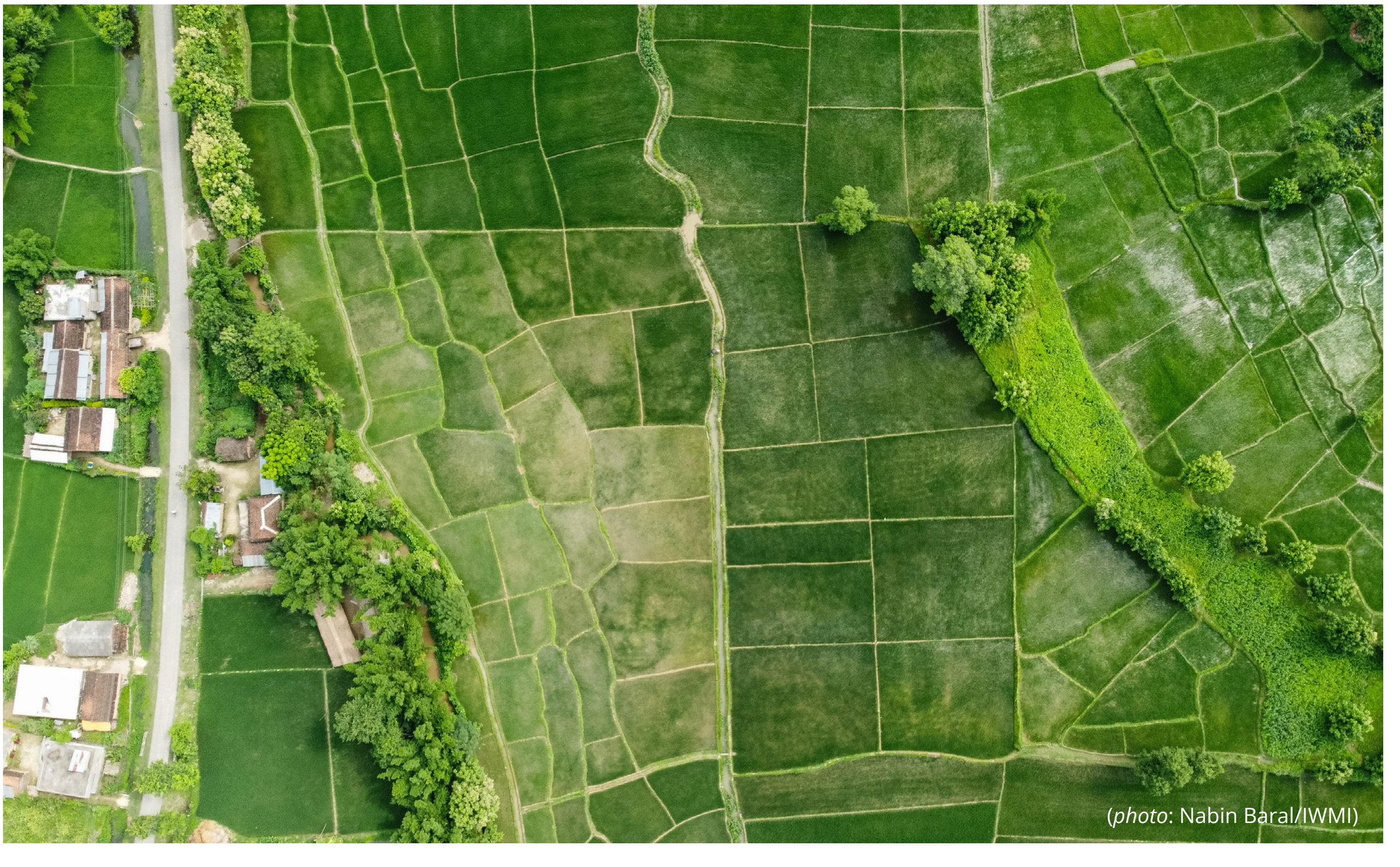
Key messages

- **Green water stocks (soil moisture) and flows (water vapor from evapotranspiration), and rainfall are vital inputs for all terrestrial ecosystems and agriculture, including both rainfed and irrigated systems.**
    - Green water scarcity, when moisture in soil and vegetation is insufficient to meet the crop water demand and ecosystem needs, is a material risk, with impacts on biodiversity, agriculture, climate resilience, constraining agricultural productivity, and threatening agrifood value chains.
    - While blue water infrastructure remains vital, managing green water stores purposefully as natural buffers strengthens resilience by retaining soil moisture that stabilizes crops, ecosystems, and livelihoods.
- **Industrial activities and the intensification of agriculture are major drivers of hydrological change, altering water availability and quality across scales. However, these sectors also present a crucial solution space.**
    - Advancing the use of data tools for mapping and understanding green water dependencies and atmospheric water basins analysis, to catalyze cross-sector collective action schemes across scales.
    - Collective action frameworks hold the key to guide the design of incentives and co-financing schemes for the protection and restoration of the water cycling process across scales.
- **Using localized data, companies could:**
    - Quantify and transparently disclose green water dependencies across supply chains and investments; integrating robust green water metrics into procurement, risk management, reporting, and decision processes.
    - Embed green water metrics into sourcing and supplier evaluation.
    - Integrate water cycle health into risk management, investments, and supplier relations, and collaborate with stakeholders along the value chain, farmers, communities, and the public sector.
    - Co-invest in upstream and upwind land conservation and restoration as precipitation support.
- **The regulatory environment, including the adoption of traceability standards (e.g. EUDR) and iterative, evidence-based risk maps, can drive value chain accountability and responsible sourcing regarding hydrological impacts.**
- **Financial innovations such as premiums for regenerative practices, water credits, and partnership-based co-financing mechanisms to protect key precipitation source natural habitats, should be scaled up.**



(*photo*: Nabin Baral/IWMI)

Context

In 2024, the Global Commission on the Economics of Water (GCEW) highlighted a critical gap in the water scarcity debate: it overlooks green water cycles, which are the main source of water for food, feed, fiber, timber, cosmetics, pharma ingredients, and bioenergy production.

While blue water (surface water and groundwater) has traditionally dominated water policy due to its visibility and accessibility for human extraction, green water, which accounts for the majority of terrestrial freshwater, has been largely overlooked and unmanaged. In alignment with GCEW missions, this policy brief expands the discourse on water scarcity and global production systems by incorporating the latest data on growing hydrological imbalances and highlighting the role of atmospheric basins, green water stocks, and flows. This brief sets out a framework for integrating green water risks into agricultural commodity supply chains, making the case that improving green water stewardship is an essential pillar of business resilience, climate adaptation, and mitigation. By highlighting overlooked dependencies across geographies and actionable guidance, the brief supports the GCEW's call for a food systems transformation (mission 1), promoting sustainable water and land use. It also aligns with the conservation and restoration of natural habitats (mission 2), critical to generating green water.

Key challenges and implications

Shifts in precipitation, ecosystems, and the future of agricultural resilience: the global reach of local water cycles

As a consumer of green water, agriculture depends on and alters its availability across spatial and temporal scales, affecting evapotranspiration and rainfall feedback loops. In many countries and regions, as blue water supplies for irrigation become increasingly constrained, it becomes increasingly critical to strengthen the management of green water as a key resilience strategy, enhancing soil moisture retention and rainwater use. Certain areas, by virtue of their land cover and climate, serve as green water source regions, sustaining precipitation-dependent systems elsewhere through their evaporation patterns. These findings underscore that no country or region is hydrologically self-sufficient. Instead, they rely on a complex web of interdependencies across geographies, in which the evaporation in one region influences rainfall and water availability in another. These complex water dependencies also confer on these regions and countries a specific role in the regional and global water cycling dynamics, since precipitation and evaporation patterns extend beyond borders.

Sustainably managed ecosystems that regulate terrestrial moisture flows and enhance green water stores are vital for economies reliant on rain-fed systems. Protecting and restoring the hydrological functions of key source landscapes is essential for local water supplies and ecosystem health, as well as for maintaining a safe operating space for the hydrological cycle (aligned with planetary boundaries and water availability thresholds).

Management tools for atmospheric water basins: untangling the precipitationshed concept

Recent research reveals ([1] ; [2]) underappreciated dependencies between upwind and downwind regions and nations, connected through atmospheric green water flows.

Satellite data and technologies can now reveal the economic consequences of disruptions to green water stocks and flows, and allow mapping[1] of an atmospheric basin with:

- precipitation-sheds - where the rain falling on a given territory originates from (blue in Figures 1 and 2).
- evaporation-sheds - where the evapotranspiration from that territory transforms into rainfall (red in Figure 2).

[1]Mapping precipitation- and evaporation-sheds is a dynamic analytical process: these vary by year, season, and even day, reflecting changes in atmospheric and land-surface conditions. Mapping these must be regularly updated to capture shifting hydrological connections and water origin-destination pathways.

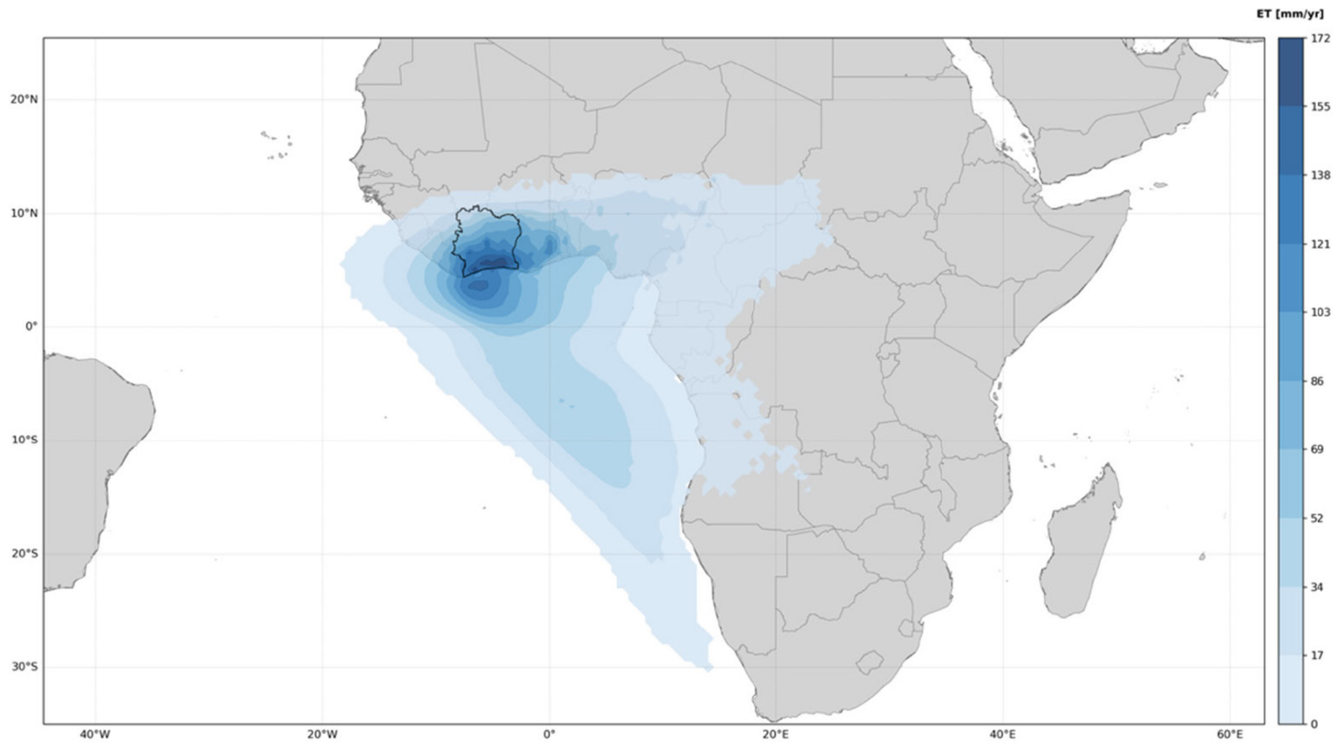


Figure 1. The Côte d'Ivoire's precipitationshed, showing where rainfall in the country originates from: most of the 'domestic moisture recycling' is located in the southern part of the country, which coincides with the cocoa production area, hence if soils have lost their organic matter after decades of cocoa intensive cultivation, the resilience of the cocoa production system may be extremely low on dry years, as poor soil retention can further disrupt local moisture recycling and rainfall patterns [3], as well as in wet years (such as 2023). An assumption yet to be confirmed by further research (*Source*: Courtesy of Simon Felix Fahrländer, PIK Potsdam).

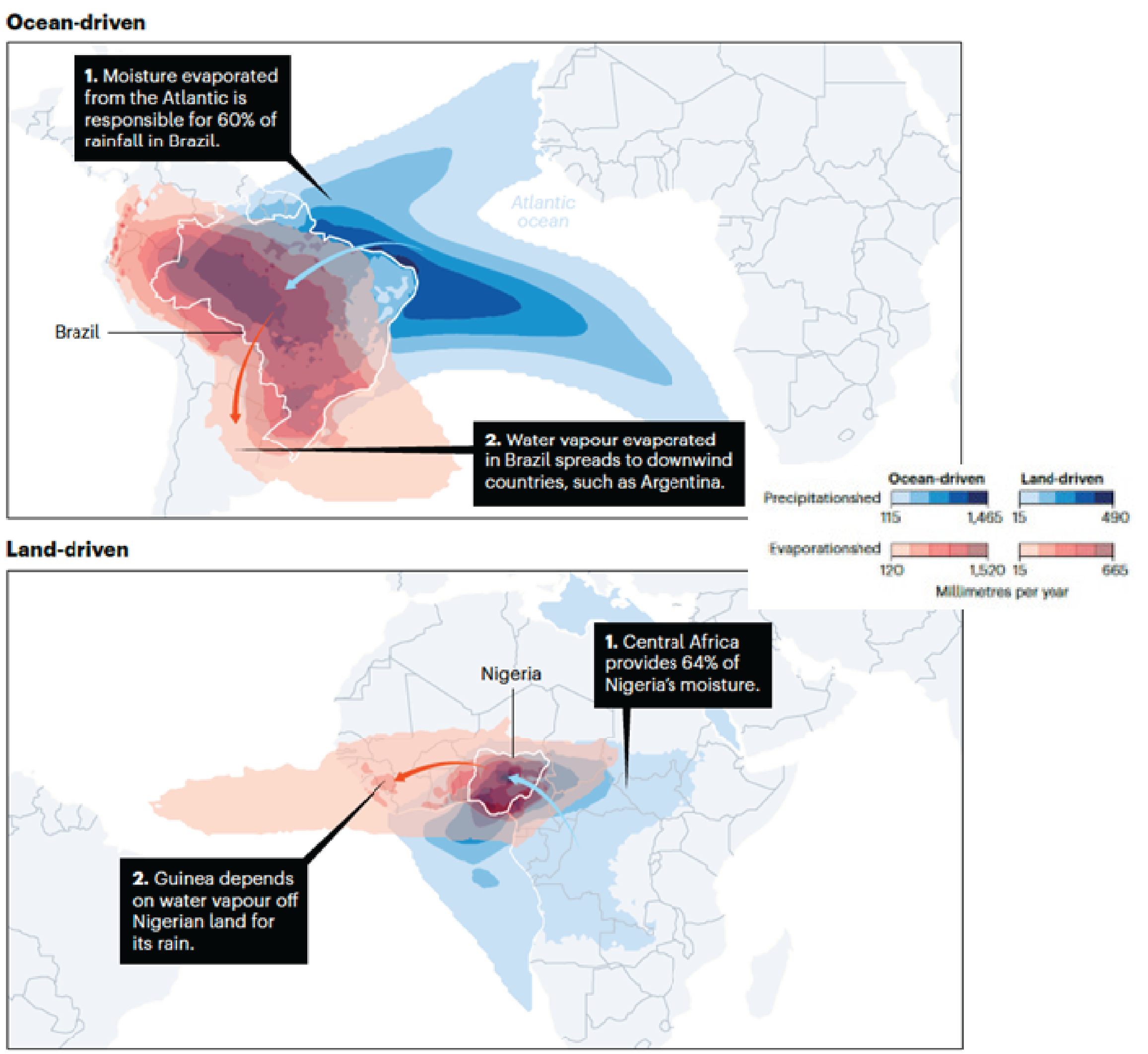


Figure 2. The atmosphere harbours precipitationsheds and evaporationsheds [4].

Recalibrating water-related risks: accounting for green water in agrifood systems

When companies calculate the water footprint of their upstream value chain, they become acutely aware of their reliance on green water resources and recognize that soil water retention underpins the success of their agricultural practices.

In the cosmetics sector, for instance, most ingredients are derived from rainfed commodities, such as palm oil, shea butter, guar, castor, and argan oil. The sector is more than 90% dependent on green water. Persistent changes in rainfall can lead to supply shortages, price volatility, and financial losses [5]. Given the connections to other ecosystem services through green water, both "upwind" (steady evapotranspiration flow from healthy landscapes, e.g., natural forests) and "downwind" (green water retention by healthy soils), securing water stocks and flows is key to strengthening a company's supply chain resilience. However, up to half of the green water supply for some products originates upwind, often beyond a company's territorial remit and sometimes in neighboring countries.

Companies may start by exploring the following questions:

- Large multinational companies: Where are the supply chain 'hotspots' most dependent on green water? What are the precipitationsheds of these hotspots, and how can we sustain their green water flows through collaboration with governments, other companies, or conservation of forests, wetlands, mangroves, grasslands, or irrigation projects? Which landscapes or communities contribute significantly to rainfall in key production zones? What co-financing or collective investment frameworks can support agroforestry, soil restoration, or systemic conservation to stabilize local-to-regional precipitation patterns?

- Medium-sized companies: With more limited influence upstream / upwind, how can producing farmers be supported in adopting regenerative practices to increase soil water retention and strengthen value chain resilience to droughts?

- Financial actors engaged in corporate water, climate, and nature risk rating: How can we establish new shared-value models that reward actors across the supply network for protecting hydrological cycles at multiple scales to restore the degraded water-land feedback loop?

Corporate water risk and the integration of green water

Business models that ignore hydrological volatility are not just exposed; they are structurally at risk. Estimates indicate that droughts in Europe account for 55% of agricultural losses [6], and the EU's agricultural imports from Brazil will be exposed to 35% more drought by 2050 [7]. Although governmental policies are essential to achieve sustainable supply chains, companies have a critical role to play in managing the risks associated with outsourced pressure on water resources. Companies' sourcing decisions (where to source) shape their final water footprint. This requires a shift from reactive risk management to proactive, science-based actions, supported by partnershipbased finance, across scales.

Furthermore, standards and auditable frameworks for water stewardship help farms, factories, and other waterusing sites understand their water use and impacts, and take credible, verifiable action (e.g., Alliance for Water Stewardship).

(*photo*: Artem Tkachuk/ShutterStock)

Key recommendations

Pathways towards regenerative and restorative systems and a more resilient economy

Embedding green water into the risk mitigation hierarchy helps businesses and investors by emphasizing the best practice of first avoiding and reducing negative impacts, and only then restoring and regenerating [8] systems.

The collective action scheme must align farming practices with the preservation of terrestrial moisture recycling functions. Industrial agriculture can transition from water-intensive monocultures to diversified, water- and climate-resilient systems that enhance green water retention in soils and vegetation. Agroforestry, regenerative agriculture, and soil-conserving practices can increase landscape capacity to store and (re)cycle green water, help restore disrupted green water stocks, sustain and amplify green water dynamics, making agroecosystems more resilient to droughts (while simultaneously improving soil health, biodiversity, and eventually ecosystem stability). Furthermore, by incentivizing farmers through premiums and facilitating supply chain transitions toward regenerative practices, companies and buyers help buffer agricultural production against climate volatility, regulatory changes, and water scarcity, thus promoting resilience and long-term stability for economies facing rainfall uncertainty and green water limitations.

Towards a regenerative and restorative economy

A regenerative and restorative economy, as called for by the Kunming-Montreal Agreement [9], cannot be achieved without repositioning green water at the top of the water agenda, recognizing its critical economic value for all activities and sectors that heavily rely on water resources (Table 1).

(*photo*: Pradeep Liyanage/IWMI)

Table 1. Actions toward a regenerative and restorative economy

Types of action	Examples of actions	How green water supports action	How action influences green water	Key enablers and players
Avoid	Halt deforestation and natural land conversion (wetlands, peatlands, grasslands)	Most water-scarce river basins and a significant share of the atmospheric water basins and source landscapes are in ecoregions where nature is already degraded and should be prioritised when implementing zero conversion.	Deforestation and land conversion are major drivers of green water cycle degradation.	• Global Biodiversity Framework Target 3 reinforcing SDG 15. • Reporting mechanisms and regulations such as EUDR are key in pushing companies to radically improve value-chain traceability and halting land conversion. • Some companies (e.g., extractive and hospitality sectors) are purchasing land to ensure its no-conversion, often in countries where regulations remain weak.
Reduce	Reduced tillage in agriculture Reduced fertiliser losses	With improved soil health and organic matter, fertilisers are better absorbed by plants, reducing losses.	Reduced tillage helps conserve organic matter and, in turn, increases green water in agricultural soils.	• Fertiliser companies are evolving their business models towards more services to farmers and improved fertilisation management. • Carbon credit schemes provide an incentive to farmers to increase soil organic matter. • EU Farm to Fork strategy aiming to reduce fertilizer losses by half.
Restore	Afforestation, natural habitat restoration	Restoring forests and natural habitats relies on green water cycle only.	Forest and natural habitats restoration regenerates the green water cycle (evapotranspiration enhanced by those habitats).	• Reporting mechanisms (SBTi FLAG, SBTN) are key in pushing companies to restore degraded land and habitats. • Some companies (e.g., extractive and cosmetics sectors) purchased and restored converted land. • Asian Development Bank's Glaciers to Fork program supports sustainable land management practices, conservation and restoration, to improve soil water retention and hydroconnectivity.
Regenerate	Regenerative agriculture	Regenerative agriculture strongly relies on green water. Regen ag enhances soil moisture retention[2] (especially in rainfall seasons) - more data is needed.	Agroecological approaches, including better retention of green water through increasing soil organic matter and (semi-) natural habitats (hedges, riparian vegetation, wetlands, small woods, flower stripes, and other agroforestry practices).	• Many companies have engaged in regenerative agriculture with improved green and blue water balance. • EU Nature Restoration Law fosters regenerative agriculture through its key key outcome indicators (soil carbon, land sharing).

[2] Green water is "closely linked to soil health as soil in good condition with a high infiltration capacity absorbs and retains more green water" [10]

(*photo:* Hamish John Appleby/IWMI)

Recommendations

Advance data, research and understanding

- Integrate granular, place-based nature of hydrological flows into policy and planning.
- Address the knowledge gaps around how land-use change is affecting moisture flows across regions, with metrics to guide the integration of green-water in risk assessment and resilience interventions.

Upgrade monitoring tools to assess risks and dependencies across value chains

- Integrate green water into corporate impact management, using existing reporting mechanisms and regulations to guide traceability and responsible sourcing.
- Mainstream the use of dynamic digital tools and data-driven decision-making within (green) waterdependent supply chains.

Promote green water-smart land use and production systems

- Halt deforestation and conversion of natural ecosystems, prioritizing zero-conversion policies, especially in degraded but high-value hydrological regions.
- Restore soil rebuild, soil structure, and organic matter, boosting soil water retention and stabilizing local green water availability.

Mobilize mission-driven investment and multi-stakeholder financing frameworks

- Invest in the protection of forests, wetlands, grasslands, and other “natural habitats”, leveraging the interconnectedness of atmospheric basins, to maintain the part of the water cycle where rainwater infiltrates soil and is held there for plants to use.
- Invest in nature-based solutions at scale (especially natural water storage), regenerative hydrology and regenerative farming practices, vegetation restoration, in key source landscapes, with the private sector, to stabilize local-to-regional water cycles.
- Support farmers with premium incentives for regenerative practices to strengthen supplier resilience.
- Establish partnership-based investment vehicles to guide funding schemes and incentives for stewardship in both upwind (source) and downwind (receptor) regions.

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Front cover photograph: Traditional village in the Sudd swamps of the White Nile near Bor, Bor county, Jonglei, South Sudan (*photo*: HOPE PRODUCTIONS/Yann Arthus-Bertrand/Getty Images)

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