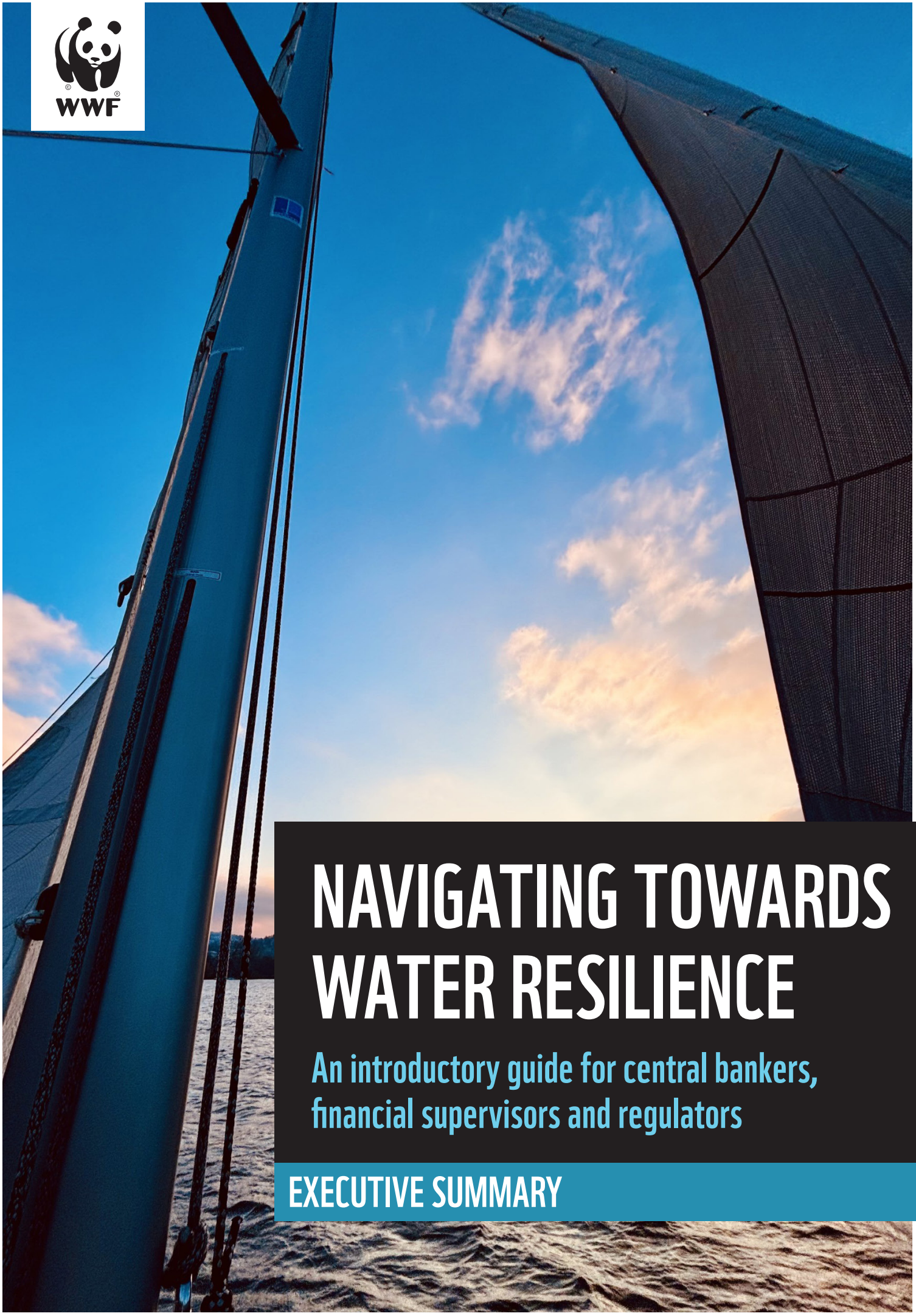

NAVIGATING TOWARDS WATER RESILIENCE

An introductory guide for central bankers, financial supervisors and regulators

EXECUTIVE SUMMARY

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THE GLOBAL WATER CRISIS

The global water crisis threatens price and financial stability – the core mandates of central banks, financial regulators and supervisors. Economic foundations – from food and energy security to public health, industrial activity and trade – rely on a stable hydrological cycle, reliable supplies of clean water and resilient freshwater ecosystems.

However, the world is facing a growing water crisis on multiple fronts: too much water, too little water, too dirty water, exacerbated by failing green and grey infrastructure and weak governance. Already, this is slowing economic growth, fuelling inflation, straining public budgets, disrupting import-export dynamics, and undermining business revenues, asset values and credit quality.

By 2050, nearly half of global Gross Domestic Product (GDP) may be generated in areas facing high water risk, expected to cause significant economic losses in some regions (WWF, 2020).

MACRO-FINANCIAL TRANSMISSION CHANNELS

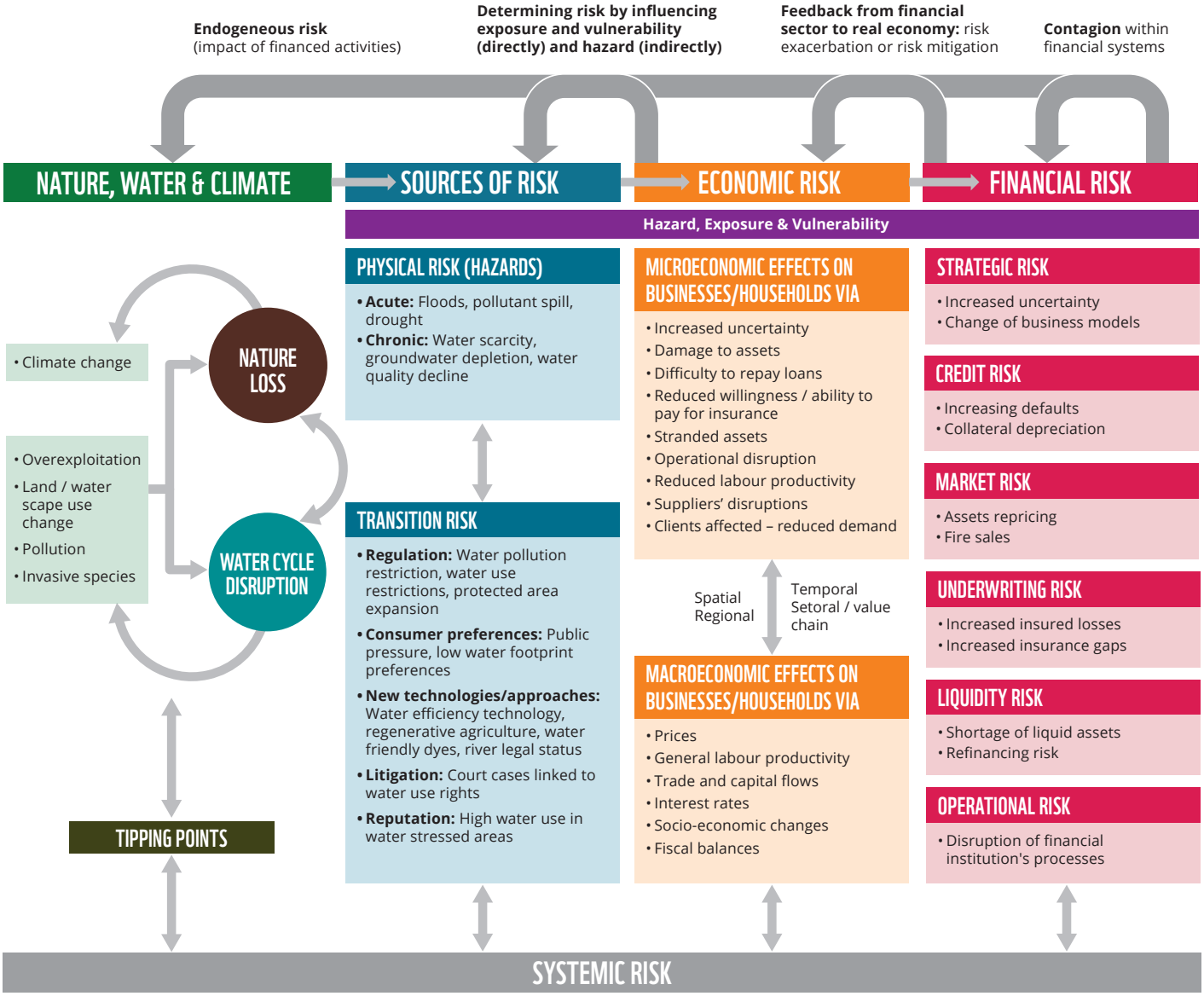
Water scarcity may materialise across multiple macro-financial transmission channels, including credit exposure, insurance losses, market repricing, sovereign risk and declining collateral values, as illustrated below.

DIMENSIONS	EFFECT
ECONOMIC OUTPUT AND GROWTH	**Water insecurity reduces GDP growth:** Since a large share of corporates and loans are critically dependent on freshwater ecosystem services, extreme water risks such as droughts could jeopardize up to 15% of Eurozone output, disrupting agriculture, manufacturing, hydropower and shipping (Ceglar, Danieli, et al., 2025).
MARKETS, PRICES AND INFLATION	**Water insecurity triggers inflationary pressures:** Hydrological shocks like droughts reduce crop yields and disrupt trade routes, increasing commodity price volatility and inflation. For instance, Italy's 50% rice yield drop in 2022 due to the Po River drought (Spaggiari, 2024), or droughts induced reductions in water traffic in the Panama Canal traffic (Associated Press, 2024; IMF, 2022).
FISCAL BALANCES	**Water insecurity elevates sovereign credit risk, placing additional burdens on already strained public budgets:** In economies reliant on water-intensive sectors or experiencing floods and water stress, states face reduced revenues and higher spending. Moody's have found one-third of assessed states are already facing material water-related credit risks (Reuters, 2024).
EMPLOYMENT AND LABOUR MARKETS	**Water insecurity undermines workforce health and resilience:** Droughts and heatwaves lower productivity in sectors like agriculture and construction, as documented in Spain (see AMCESFI, 2023). Rising antibiotic use, projected to increase by over 30% by 2030 for human consumption, will likely worsen public health challenges, potentially causing up to 10 million deaths per year by 2050 and significant productivity losses. Antimicrobial resistance, for which water is a major vector, may cost the world between US$300 billion and US$1 trillion annually by 2050 (CDC, 2013; Ranger et al., 2024).

TYPES OF WATER-RELATED RISKS

Water-related risks impacting economies and financial systems stem primarily from two sources: physical risks and transition risks, often intensified by the complex and unpredictable nature of water systems. Physical risks arise from acute events like floods and droughts, or chronic shifts such as declining water quality and altered rainfall patterns. Transition risks arise as governments, markets and industries respond to water stress via new policies, regulations, technologies and evolving consumer behaviour.

Moreover, water-related shocks – from scarcity to pollution – transcend national borders; rapidly propagating through global supply chains, commodity markets and capital flows. Critically, water systems risk crossing tipping points, where cumulative pressure leads to sudden and potentially irreversible ecological changes. These non-linear, unpredictable dynamics can amplify losses and increase the risk of extreme weather events, especially in concentrated regional or sectoral exposures.



Water-related financial risk framework. Source: Authors adapted from NGFS (2024b)

ENDOGENOUS RISKS FROM FINANCE

Freshwater ecosystems provide vital natural defences against extreme weather and long-term environmental changes, however prevailing business-as-usual economic activities are progressively eroding this function. Financial flows supporting environmentally harmful activities substantially exceed those directed toward nature-based solutions, with recent estimates suggesting an imbalance of approximately 30 to 1 (UNEP, 2026).

Today's water insecurity is a direct consequence of economic activity. Economic activities across key sectors – including food and beverage production, textiles, chemicals manufacturing, metals and mining – are pushing freshwater ecosystems beyond their regenerative capacity heightening prospects for systemic, widespread disruption (see table below). Overextraction, land-use change, freshwater ecosystem conversion, pollution and inadequate governance steadily diminish water availability and the resilience of water systems. Meanwhile, financial flows – via lending, investment and insurance – often fund the very practices that drive the degradation of water systems. This not only fuels systemic vulnerabilities but also increases the risk of reaching irreversible tipping points.

Sectors and industries with the most severe impacts on freshwater ecosystems. Source: adapted from Famiglietti et al. (2022)

GICS SECTOR	INDUSTRY	IMPACT PATHWAYS					
		Supply chain		Direct operations		Product use/end of life	
		Water quantity	Water quality	Water quantity	Water quality	Water quantity	Water quality
CONSUMER STAPLES	Food products	🔴	🔴	🟠	🟠	○	○
	Beverages	🔴	🔴	🟠	🟠	○	🔴
CONSUMER DISCRETIONARY	Textiles, apparel and luxury goods	🟠	🟠	🟡	🔴	○	🟠
ENERGY	Oil and gas	🟠	🔴	🟠	🔴	○	🟡
HEALTH CARE	Pharmaceuticals	○	○	○	🔴	○	🔴
MATERIALS	Chemicals	🟠	🟠	🟡	🔴	○	○
	Metals and mining	🟠	🟠	🟠	🔴	○	○
	Paper and forest products	🟠	🟠	🟠	🔴	○	○
IT	High-tech and electronics	🟠	🟠	🟠	🟠	○	○
	Semiconductors and circuit boards	○	○	🟡	🟠	○	○
	Battery manufacturing	🟠	🟠	○	🟠	○	🟠
UTILITIES	Renewable electricity (hydropower)	○	○	🔴	🟡	○	○

🔴 = very high impact 🟠 = high impact 🟡 = medium impact ○ = not enough available information

No single actor can solve the water crisis alone. It requires coordinated action across governments, businesses and the financial system. Although governments and policymakers play a central role, their efforts will fall short if the financial flows continue to undermine resilience. As guardians of financial stability, central banks, financial supervisors and regulators (CBFRs) are uniquely positioned to drive change. They can:

- Assist the financial sector understand and manage the economic risks linked to water stress.
- Enable capital reallocation from water-degrading activities to more sustainable, resilient solutions.
- Incorporate water security into financial stability, supervisory frameworks and monetary policy.

CURRENT GAPS AND THE PATH FORWARD TO WATER SECURITY

Despite growing awareness of the water crisis and its financial implications, current responses from companies and financial institutions remain inadequate in addressing systemic risks. Key gaps include:

- **Fragmented corporate action:** Although some companies are improving water management practices, these efforts typically focus on their direct operations rather than basin-level collective action, where risks are shared.
- **Limited integration in risk management and disclosure:** Water-related risks are less consistently assessed and disclosed than climate-related risks, and financial institutions seldom evaluate their portfolio-wide exposure holistically.
- **Overlooked impacts:** Few financial institutions systematically evaluate how their activities contribute to long-term water system degradation, or its implications for future financial resilience.

CBFRs increasingly acknowledge that water is macro-critical, yet its integration into financial stability and supervisory frameworks remains at an early stage:

- Water is typically addressed as part of broader environmental or climate risk categories, with little dedicated water-specific guidance.
- Although evidence of financial impact is growing, water risks are not yet fully integrated into financial models. While early disclosure frameworks and exploratory macroprudential pilot studies demonstrate project feasibility, the complexity of hydrological water systems – including pollution and tipping-point risk – remains largely absent from mainstream financial stability analysis.

TOOLS FOR ASSESSMENT

An expanding array of tools, metrics and scenario analyses enables authorities to identify the most exposed sectors and economically vulnerable regions. The primary challenge lies in translating complex hydrological dynamics into clear financial risks, and embedding them within standard risk management frameworks. This includes capturing unpredictable tipping points and non-linear impacts. Enhanced data quality, interoperability, more robust scenario design and result interpretation capability will prove crucial in progressing from early-stage analysis to comprehensive frameworks that support long-term financial resilience. Even where tools, datasets and methods remain under development, CBFRs possess sufficient capabilities to strategically deploy existing resources towards enabling a water-resilient economy and financial system.

KEY MEASURES FOR CENTRAL BANKS, FINANCIAL REGULATORS AND SUPERVISORS

CBFRs possess a toolkit within their existing mandates to bolster financial resilience against water-related risks. A first essential step is to recognise the urgency of the water crisis, and its deep links with climate change, biodiversity loss, environmental degradation and economic stability. Concurrently, CBFRs should enhance their analytical capacity to progressively incorporate water risks into financial supervision and monetary policy, fostering greater alignment across policy areas.

IMMEDIATE PRIORITIES

Urgently, authorities should formally acknowledge water-related risks as material to financial stability. Given their potential systemic impact, uncertainty and risk of irreversible tipping points, a precautionary approach is justified, whilst analytical capacity is being developed.

This could include:

- Evaluating system-wide exposure to water stress, holistically addressing the full spectrum of water crises challenges beyond mere water quantity.
- Examining how risks spread through the financial system, particularly how finance itself generates water-related risks (endogenous risk).
- Conducting exploratory stress tests or reverse stress-tests in data-scarce contexts.

Critically, the absence of immediate, visible disruption must not be misconstrued as low risk or lack of materiality, since natural buffers, insurance mechanisms and policy responses may themselves be weakening over time. Bolstering internal expertise, resources and partnerships with scientific and statistical institutions will prove essential for ensuring a resilient financial system.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SHORT-TERM INTEGRATION INTO SUPERVISORY FRAMEWORKS AND MONETARY POLICY

In the short term, water-related risks can be embedded within supervisory expectations, financial stability monitoring, and monetary policy.

- Financial institutions should be required to identify and manage material water-related risks through stronger risk management, scenario analysis, and transition planning—especially in water-stressed regions and water-dependent sectors and activities exacerbating water ecosystem degradation.
- Upon identifying concentrated or correlated exposures, policymakers can consider measures such as capital requirements, concentration limits, or alternative supervisory tools – all within existing regulatory frameworks.
- System-wide, macroprudential authorities should incorporate water scenarios into monitoring frameworks, addressing cumulative environmental degradation and potential tipping-point risks.
- Central banks should set an example by integrating water-related risks into their own monetary policy frameworks.

MEDIUM-TERM ALIGNMENT AND SYSTEM-WIDE RESILIENCE

Over the medium term, greater alignment across microprudential, macroprudential, monetary policy and fiscal policies will be essential to managing both gradual degradation and abrupt systemic shocks.

CBFRs can leverage their policy instruments by:

- Establishing clearer supervisory expectations for financial institutions on water-related risks.
- Strengthening disclosure and risk assessment standards.
- Incorporating water risks in financial stability dashboards and monitoring frameworks.
- Reviewing collateral frameworks and reserve management practices as appropriate.

Finally, international coordination will be essential to manage cross-border spillovers and promote consistent supervisory approaches.

NAVIGATING TOWARDS WATER RESILIENCE

Navigating towards Water Resilience: An Introductory Guide for Central Bankers, Financial Regulators and Supervisors assist CBFRs in navigating the water crisis and their role in mitigating associated systemic risks.

Chapter 1 outlines the fundamentals of the hydrological cycle and freshwater ecosystems and elucidates economic dependencies upon them.

Chapter 2 applies the Network for Greening the Financial System (NGFS) conceptual framework on nature-related risks to demonstrate how water-related risks transmit to economic, financial and systemic dimensions. It also addresses endogenous water risks borne by the financial system, alongside opportunities for proactive sectoral action.

Chapter 3 examines current responses – and persistent gaps – across the real economy, financial sector and financial regulatory landscape.

Chapter 4 surveys tools, data sources and key metrics to facilitate identification, assessment and monitoring of water-related exposures, while reviewing emerging regulatory practices.

Chapter 5 offers policy options for CBFRs to reinforce risk management regimes and foster a just transition to a water-secure resilient economy.

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