

Key Points

- Climate physical risks—acute (e.g., floods, storms) and chronic (e.g., droughts, heatwaves)—threaten banks, affecting asset quality, collateral values, and client operations.
- International frameworks developed by the Network for Greening the Financial System, the International Sustainability Standards Board, and the Basel Committee on Banking Supervision set reference points for climate-related supervision and risk management.
- Banks can strengthen physical risk management by applying the insurance sector's tripartite approach: accepting diversified risks, making assets and clients more resilient to climate risks, and transferring high-impact risks via catastrophe bonds and insurance-linked securities.
- Case studies include resilience-linked loans, parametric-triggered credit facilities, agricultural credit with weather-indexed insurance, and concessional lending for climate-resilient infrastructure.
- Persistent barriers—technical capacity gaps, limited hazard and vulnerability data, fragmented taxonomies, and underdeveloped adaptation finance—are most acute in low- and middle-income countries.
- The convergence of banking and insurance offers a pathway to embed climate adaptation into finance. Moving from awareness to readiness is critical to mobilizing capital for resilience and safeguarding financial stability.

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Mainstreaming Adaptation and Resilience into Banking Practices

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1. Introduction

Climate change is no longer an abstract environmental concern—it has become a direct and material risk to financial stability. For banks, physical hazards, ranging from acute events such as floods, storms, wildfires, and heatwaves to chronic stressors such as sea-level rise and long-term temperature increases, can impair asset quality, erode collateral values, and disrupt client operations. As these risks intensify, integrating physical risks into banking operations has shifted from a conceptual ambition to an operational necessity.

Adaptation, in the context of climate change, refers to adjustments made in response to actual or expected climatic conditions to minimize harm or capitalize on potential benefits. Resilience denotes the ability of systems—financial, social, economic, or ecological—to absorb climate shocks and maintain core functions. These concepts are complementary and essential for banks: adaptation focuses on client and asset-level measures (e.g., financing flood-proofing of a production facility), while resilience focuses on systemic preparedness, including balance sheet protection and capital adequacy under stress.

International frameworks are increasingly providing the structure for embedding adaptation and resilience into banking practice. Building on these concepts, the Network for Greening the Financial System (NGFS) offers forward-looking climate scenarios, including short-term stress pathways, to assess systemic vulnerabilities. The International Sustainability Standards Board's (ISSB) International Financial Reporting Standards (IFRS) S2 Climate-related Disclosures standard sets globally consistent requirements for transparency and comparability. The Basel Committee on Banking Supervision (BCBS) has issued principles for the effective management and supervision of climate-related financial risks, integrating these expectations into prudential oversight. Together, these initiatives offer a shared foundation for central banks and financial regulators, as well as banks and other financial institutions to translate climate risk awareness into concrete governance, disclosure, and capital management practices.

This policy brief was prepared for the June 2025 BIS-ADB-ADBI conference on “Fostering Dialogue on Climate Finance Among Asian Central Banks: Issues in Adaptation and Reserve Management,” as well as for the October 2025 SEACEN-ADBI-MAS Seminar on “Taxonomies and Scaling up Sustainable Finance.” Both events were organized for central banks in Asia.

Building on this foundation, banks are beginning to operationalize these frameworks through enhanced scenario analysis, hazard mapping, borrower-level vulnerability assessments, and integration of resilience metrics into lending decisions. Emerging innovations, such as resilience-linked loans, parametric-triggered credit, and the use of catastrophe bonds, are partially narrowing the insurance protection gap and extending climate adaptation finance to vulnerable communities.

This policy brief examines how banks can strengthen their management of physical risks by leveraging both regulatory guidance and operational tools, with particular attention to insights from the insurance sector. It presents international case studies, identifies persistent barriers—especially in low- and middle-income countries—and outlines pathways for moving from awareness to readiness. The objective is clear: to support a banking sector that not only withstands climate shocks but also actively enables adaptation and resilience across economies.

The brief is organized into seven sections:

- **Section 2** highlights recent work on physical risks by the NGFS, including new risk assessment methods, harmonized supervisory approaches, climate scenarios, a concept note on adaptation, and updated transition planning guidance that now includes adaptation.
- **Section 3** examines the evolving global regulatory landscape for climate-related disclosure standards developed by the ISSB and their application to banks, along with the BCBS approach and recent Pillar 3 disclosure templates updates to improve transparency in managing climate risks.
- **Section 4** focuses on the United Nations Environment Programme Finance Initiative (UNEP FI)'s practical frameworks for setting adaptation and resilience targets, assessing physical risks, and integrating them into governance. It also includes work by the Boston Consulting Group (BCG), which provides a structured pathway to integrate physical risks into financial decision-making.
- **Section 5** reviews insurance-based and capital market-based risk transfer tools—such as parametric insurance and insurance-linked securities—and evaluates their adaptation for sovereign and bank use to hedge extreme weather risks and improve post-disaster liquidity.
- **Section 6** presents real-world examples of banks deploying resilience-linked and insurance-like loans.
- **Section 7** offers concluding reflections.

Through this structure, the brief argues that physical risk is not merely a threat to be avoided, but also an opportunity to innovate financial systems and foster resilient economic and social development. Banks must move beyond conceptual awareness toward operational readiness—embedding climate risk into governance, data systems, product design, and capital management. By drawing from the insurance sector and aligning with evolving regulatory expectations, banks can position themselves as active enablers of climate resilience within the financial system.

2. Macro-Level Physical Risk Assessment and Adaptation: NGFS Approaches

The NGFS is a global coalition of more than 140 financial supervisors and central banks from over 90 jurisdictions that aims to promote green finance and support efforts to enhance climate change adaptation and resilience. The NGFS plays a vital role in helping the financial system address climate risks through central banks and financial regulators. It focuses on both physical and transition risks, while contributing to sustainable development and ensuring economic and financial stability. This section highlights NGFS's development associated with short-term physical risk scenarios recently introduced in addition to long-term scenarios (NGFS 2025a). The section also sheds light on the conceptual note on adaptation, as well as guidance note on transition planning and target setting with regards to adaptation (NGFS 2024, 2025b, 2025c).

2.1 NGFS's First Release of the Short-Term Climate Scenarios

The NGFS has developed a set of long-term climate scenarios to help central banks, regulators, and financial institutions assess both transition risks and physical risks. These include long-term pathways—*Orderly*, *Disorderly*, and *Hot House World*—as well as the new short-term scenarios introduced in May 2025.

Orderly scenarios assume early, coordinated policy action (e.g., carbon pricing, emissions controls) that reduces both transition and physical risks. Currently, the orderly scenarios include Net Zero 2050 (limiting global average temperature to 1.5°C), Below 2°, and Low Demand. *Disorderly* scenarios assume delayed or uneven action, leading to higher transition shocks such as abrupt

technological shifts and higher physical risks. Disorderly scenarios include Delayed Transition and Fragmented World. *Hot House World* scenarios reflect inadequate mitigation, resulting in severe physical impacts; examples include the Nationally Determined Contribution scenario (current pledges) and Current Policies scenario (no new policies), both leading to temperature rises above 3°C.

In addition to these long-term scenarios, the NGFS released its first set of short-term climate scenarios in May 2025 (NGFS 2025a), looking ahead over a 5-year horizon. The short-term scenarios complement the long-term set and model the interactions between climate policies, extreme weather events, and macroeconomic/financial variables. They include: (a) *Highway to Paris*; (b) *Sudden Wake-up Call*; (c) *Divergent Realities*; and (d) *Disaster and Policy Stagnation*. Of these, the last two incorporate significant physical risk elements, with *Disaster and Policy Stagnation* focusing primarily on compound extreme events such as drought–heatwave–wildfire sequences and major flood–storm combinations.

Under the *Disaster and Policy Stagnation* scenario, regional climate disasters can lead to substantial gross domestic product losses relative to the baseline (based on International Monetary Fund projections), ranging from 5% in Asia in 2027 to as much as 12.5% in Africa in 2026. Global inflation rises by nearly 1 percentage point, while unemployment deteriorates, increasing by less than 2 percentage points in Asia and up to 7 percentage points in Africa above the baseline. Default probabilities rise across all sectors, with agriculture and capital-intensive industries, such as coal production and power generation, being particularly affected. Furthermore, regional extreme weather events can have global economic repercussions through trade and financial linkages. While the physical risk scenario indicates a possible decline in macroeconomic performance, it may not be able to capture complex, dynamic impacts surrounding diverse physical risks and their potential impacts.

In recent years, large, mostly listed financial institutions and companies have faced growing requirements to disclose climate-related and sustainability information. Global standards such as the ISSB framework require these entities to conduct climate scenario analysis. For this purpose, entities can use NGFS scenarios or alternatives such as those developed by the International Energy Agency (IEA). The NGFS's short-term scenarios are especially useful in this context, as they align with the typical timeframe of medium-term business planning, which often spans 3 to 5 years. This integrated scenario

framework underpins the NGFS's broader guidance on transition planning, as explained in Section 2.3, in which banks are encouraged to use scenario analysis to set climate-related targets, manage exposures, and identify adaptation opportunities.

2.2 NGFS' Conceptual Note on Adaptation to Promote Adaptation Finance

The NGFS published a report titled *Conceptual Note on Adaptation* in 2024 to stress the importance of incorporating adaptation and resilience into the work of central banks and financial regulators as part of their risk management to achieve financial stability (NGFS 2024). While these financial authorities have been working on climate mitigation risk for some time, the equivalent efforts should be made to prepare for and respond to the physical impacts of climate change. As climate change worsens and extreme weather events increase, the financial system is becoming more vulnerable to physical risks. Accordingly, financial authorities should encourage banks and other financial institutions to better manage physical risks.

A. Adaptation and Resilience in the Face of Physical Risks

The NGFS report highlights the urgent need to close the insurance protection gap—the difference between the total economic damage caused by climate-related disasters and the amount covered by insurance. In many developing and vulnerable countries, most disaster-related losses are uninsured (Shirai 2025). Even in advanced economies, coverage for disasters due to natural hazards is being reduced, premiums are rising, and some insurers, unable to maintain profitability, are withdrawing their businesses from certain stress regions. This leaves governments, companies, and individuals, often financially fragile, bearing a growing share of the costs. Closing this gap is critical to building financial resilience and minimizing long-term economic damage from climate events.

Beyond closing the insurance protection gap, it is becoming increasingly important to expand adaptation activities. The NGFS defines adaptation as actions taken either reactively, in response to actual climate impacts, or proactively, to reduce exposure and vulnerability to physical risks. Both approaches aim to strengthen resilience by enhancing the capacity of financial, social, economic, or ecological systems to anticipate, absorb,

respond to, and recover from climate shocks while maintaining core functions. To manage physical risks effectively, greater adaptation and resilience finance is essential—funding that enables governments, companies, and communities to prepare for and cope with climate impacts.

For central banks and financial regulators, both **physical resilience** (e.g., infrastructure protection) and **financial resilience** (e.g., access to insurance or post-disaster credit) are indispensable. The NGFS notes that while adaptation efforts vary across countries and sectors, they ultimately contribute to making the global economy and financial system more resistant to the growing physical risks of climate change.

B. Defining Adaptation and Resilience Activities to Promote Finance

To measure and track adaptation and resilience finance, clearly defining what counts as adaptation and resilience activities is necessary. The key is to understand the purpose of the activities—namely, helping governments, businesses, communities, or systems adjust to climate change, or reducing physical risks.

The NGFS identifies three types of financial activities that support adaptation and resilience based on the Resilience Taxonomy developed by the Climate Bonds Initiative (CBI):

NGFS Category 1: Activities that directly manage physical risk by reducing exposure and vulnerability to extreme weather events and hazards. This represents the most widely recognized form of adaptation activities.

- **Examples:** Building flood seawalls or levees to protect against floods in coastal cities; adopting early warning systems for extreme weather events to enhance preparedness and reduce losses and damages; and using drought-resilience crops.

NGFS Category 2: Activities that are adapted to physical risks (so-called “Adapted Activities”), even if adaptation is not their primary objective. These activities contribute to reducing the adverse impacts of physical risks and the severity of related hazards. In some cases, however, they may not be officially classified as adaptation or resilience activities.

- **Examples:** Constructing roads designed to withstand heavy rainfall, even though the primary objective is to develop transport infrastructure; upgrading electricity systems to prevent outages during heatwaves, while the core purpose is to enhance energy infrastructure; and building houses with elevated structures in flood prone areas, even though the main goal is to provide housing.

NGFS Category 3: Activities that enable or support adaptation (so-called “Enabling Activities”). These are activities that do not directly reduce physical risks but help create the conditions for promoting adaptation and resilience.

- **Examples:** Funding research and development of drought-resistant crop varieties; supporting the development of physical risk assessment tools and data platforms that might improve decision-making capacity in adaptation planning; providing technical assistance to local governments on climate-resilient urban planning; and financing training programs for farmers on climate-smart agriculture practices

Despite its reference to CBI’s approach, NGFS’s classification of adaptation and resilience activities is not fully in line with the approach developed by the CBI. Rather, the classification appears to reflect various existing approaches, as exemplified below:

- Rio Markers developed by the Organisation for Economic Co-operation and Development (OECD) Development Assistance Committee (DAC)
- Joint Methodology for Tracking Climate Change Adaptation Finance developed by multilateral development banks
- European Union (EU) Taxonomy for Adaptation
- Proposal on Framework to Develop UK Green Taxonomy by the Land Use, Natural Assets and Sustainability (LNAS) Advisory Group to the UK Government
- Resilience Taxonomy developed by the Climate Bonds Initiative (CBI)

It may be ideal to promote some convergence among these approaches to increase transparency on adaptation and resilience finance data. Below are some features related to classification of adaptation and resilience activities adopted by international organizations or developed under the taxonomy frameworks (for details, see Shirai 2025):

1. **OECD DAC classifying activities based on principal or significant objective using Rio Markers** (OECD 2024b)

- **Activities with the principal objective** refer to activities whose objective (i.e., adaptation) is explicitly stated in the documentation as one of the principal reasons for undertaking it. Activities would not have undertaken without this objective. 100% of the financing is counted toward climate finance. An example is a project focused on constructing flood-resistant infrastructure in a vulnerable area.
- **Activities with the significant objective** refer to activities when the objective (i.e., adaptation) is explicitly stated and integrated in the design but is not the principal reason for undertaking the activity. The activity would have been undertaken anyway, but it has been adjusted to include a climate factor. Only the estimated share related to the adaptation component is counted as climate finance. An example is a rural development program where one component includes building farmers' capacity to adapt to changing rainfall patterns.

2. **The Joint Methodology for Tracking Climate Change Adaptation Finance classifying Type 1 activities, Type 2 activities, and Type 3 activities** (European Investment Bank 2022).

- **Type 1 (activities that are adapted)** refers to activities that integrate measures to manage physical risks and ensure that the project's intended objectives are realized. These activities include adjustments to ensure that the project performs well against climate impacts. Adaptation is not the primary objective of the activity.
- **Type 2 (activities with shared objectives of adaptation and development)** refers to activities that directly reduce physical risks and build the adaptive capacity of the system within which the activity takes place. These activities are themselves adjusted to cope with experienced and anticipated impacts of climate change. Adaptation is one of the objectives of the activity.

- **Type 3 (activities that enable adaptation)** refers to activities that contribute to reducing the underlying causes of vulnerability at the systemic level and/or removing knowledge, capacity, technological and other barriers to adaptation. As the activities are themselves adjusted to cope with climate impacts, adaptation is the primary objective of the activity. 100% of finance is counted as adaptation finance.

3. **EU's Taxonomy-aligned activities covering adapted activities, enabling activities, and adapted-enabling activities** (European Commission 2022).

- **Adapted activities** refer to those that have adapted themselves to physical risks. The focus of the activities is on protecting the activity or asset itself from extreme weather events and their impacts (such as hurricanes, floods, heatwaves, droughts). For these activities, only the capital and operational expenditure associated with putting in place the adaptation solutions should be counted as Taxonomy-aligned.
- **Enabling activities** refer to activities providing adaptation solutions that help other people, systems, or sectors to become more resilience to physical risks. These activities are limited to the following activities: (a) engineering activities and related technical consultancy dedicated to adaptation; (b) close-to-market research, development and innovation; (c) nonlife insurance; (d) underwriting of climate-related perils; and (e) reinsurance.
- **Adapted-enabling activities** refer to dual-purpose activities that adapt themselves to material physical risks and help others to adapt to such risks. An example of these activities includes an expansion of public services (such as ambulances and fire departments) with the primary objective of public safety that could strengthen resilience to disasters.

4. **The LNAS Advisory Group classifying activities into adapted activities, and enabling type 1 and type 2 activities** (Green Finance Institute 2024).

- **Adapted activities** refer to those that have taken steps to reduce the direct physical risks to the asset or activity. These are activities that have taken steps to reduce the direct physical risks to themselves regardless of whether adaptation is primary or secondary purpose.
- **Enabling activities** refer to those which help reduce climate impacts or increase the resilience to climate change of other economic activities, communities, nature and assets). Adaptation is the primary objective of the activity. These activities are further decomposed into the following two types:
 - **Enabling Type 1 activities** (direct adaptation activities): Activities which directly reduce physical risks on communities, nature, physical assets or other economic activities. An example of activities is manufacturing drop irrigation systems to help farmers better cope with drought.
 - **Enabling Type 2 activities** (addressing systemic obstacles to adaptation): Activities that help remove broader barriers preventing others from adapting to physical risks. Examples are developing weather forecasting models to support better crop planning, and training local governments on how to implement adaptation strategies.

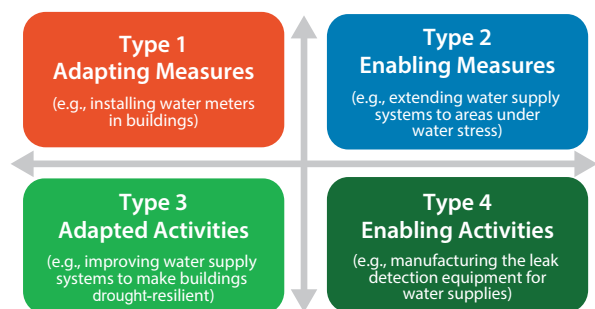
5. **CBI Resilience Taxonomy classifying basic investment types using adapted activities and enabling activities and differentiating activities and measures** (CBI 2024).

- An activity is defined as an activity delivering goods or services while a measure refers to specific intervention within an asset, activity or entity. These concepts provide the basis for the identification of climate resilience-related costs within investments. All investments within the taxonomy have been categorized or tagged under one of the following four investment types (Figure 1):
 - ✓ **Type 1 adapting measure (measure and adapted)** refers to direct investment

to improve resilience. The term “adapting” is used instead of “adapted” to emphasize that the focus is on whether the measure enhances the resilience of the overall activity in which it is implemented. An example is installing leak detection equipment or water meters in residential buildings to address water stress. Eligible finance should include only the cost of the adapting measure itself.

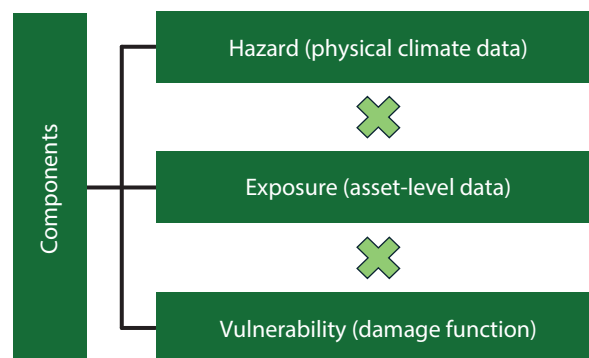
- ✓ **Type 2 enabling measure (measure and enabling)** refers to a specific action or measure within an economic activity that is primarily intended to enhance the resilience of other economic activities. Examples are extending existing water supplies to water-stressed locations (as opposed to improving existing supply systems) or expanding the reach of mobile health clinics in flood-affected areas (rather than just enhancing the health system itself). Eligible finance should include only the costs directly related to implementing the enabling measure.
- ✓ **Type 3 adapted activities (activities and adapted)** refer to an economic activity whose primary purpose is to enhance the resilience of that specific activity. Examples include upgrading a building to be more drought-resilient by improving its water supply systems, or providing healthcare services designed to remain functional during extreme weather events.
- ✓ **Type 4 enabling activities (activities & enabling)** refer to an activity whose primary purpose is to enhance the resilience of other activities or systems. Examples include manufacturing leak detection equipment for water distribution networks or producing health information technology systems to strengthen the resilience of healthcare services during disease outbreaks caused by climate change. Eligible finance counts the entire cost of the activity.

Figure 1: Four Types of Investment Under Climate Bonds Initiative Resilience Taxonomy



Source: Prepared by the author based on CBI (2024).

Figure 2: Physical Risks Driven by Hazard, Exposure, and Vulnerability



Source: Prepared by the author based on IPCC (2022a, 2022b).

C. Encouraging Banks to Perform Physical Risk Management

Following the Intergovernmental Panel on Climate Change (IPCC)'s approach on physical risk management, the NGFS encouraged financial institutions to make physical risk assessment through examining the interaction of three factors: **hazards**, **exposure**, and **vulnerability** (IPCC 2022a, 2022b), as shown in Figure 2 below. These factors are complex, change over time, and relate non-linearly.

- **Hazard** refers to the potential occurrence of events such as floods, heatwaves, droughts, sea-level rise, and rising temperatures that can cause loss of life, health impacts, and damage to property, infrastructure, ecosystems, and other assets. Hazards affect both financial institutions' own operations and their investment and lending portfolios. While mitigation efforts to reduce greenhouse gas emissions can slow the emergence of future hazards, emissions already accumulated in the atmosphere have locked in many current risks for institutions and their counterparties.
- **Exposure** is associated with the presence of people, ecosystems, buildings, factories, infrastructure, or cultural assets in locations where hazards may occur.
- **Vulnerability** is related to the propensity to be adversely affected. Vulnerability encompasses a range of factors, including sensitivity or susceptibility to harm, as well as limitations in the capacity to cope and adapt to hazards.

Both the degree of exposure and vulnerability can be reduced through effective adaptation and resilience actions. However, despite increasing physical risks and the resulting economic and social losses worldwide, adaptation and resilience efforts remain insufficient. This shortfall reflects limited awareness among governments, companies, and communities of physical risks and the need to take necessary actions.

Adaptation and resilience efforts often take the form of preventive investments, which can reduce the impact of physical risks on financial stability and inflation. Central banks and financial regulators can support these efforts by promoting stronger risk management across the financial and banking system. Accelerating adaptation and resilience efforts can lower long-term costs and reduce expected social and economic losses, supporting both price and financial stability. Unlike mitigation, adaptation and resilience often require greater involvement from central and local governments, particularly in areas like infrastructure development, city planning, hazard mapping, expanding public services to cope with extreme weather conditions, strengthening land-use and building regulations, and raising community awareness.

In practice, companies may be already involved in government-led adaptation activities, while some banks and other financial institutions may be playing a supporting role by providing funding. To fully strengthen overall resilience, however, it is crucial to raise awareness of physical risks among companies and encourage them

to integrate these risks into their core risk management processes and disclose relevant data. Central banks and financial regulators can help banks and other financial institutions to assess material physical risks using such corporate data and their potential impacts on operations and portfolios. Physical risks can be incorporated into their risk management and detailed preventive action plans including engagement with their client counterparties can be included in transition plans which currently focus more on mitigation.

The NGFS encourages central banks and financial regulators to support large banks and other financial institutions in assessing the costs and benefits of adaptation and resilience with tools, data, and climate scenario analyses. Adaptation and resilience should be factored into financial investment decisions, recognizing its long-term benefits despite generating upfront costs. A key challenge is that financing timelines set by banks may not align with the long-term nature of climate risks, potentially leading to misaligned capital allocation. Meanwhile, financial authorities could explore integrating adaptation and resilience issues into supervisory frameworks, ultimately including consideration to capital risk weights, if adaptation and resilience actions are shown to reduce risk over the relevant time horizon.

Finally, the NGFS' Note identifies four key areas for future work by financial supervisors:

1. developing better metrics and tools for measuring the impact of adaptation and resilience activities and disclosing those efforts;
2. enhancing regulatory and supervisory frameworks;
3. creating an enabling environment for adaptation finance; and
4. promoting international collaboration with attention to local needs.

2.3 NGFS's Work on Transition Plans and Target Setting

Building on the scenario framework outlined in Section 2.1, the NGFS's July 2025 guidance (NGFS 2025b, 2025c) calls on banks to integrate both mitigation and adaptation into their transition planning. In the face of heightened physical risks affecting all sectors, banks should use scenario analysis to assess portfolio vulnerabilities, support client resilience, and identify new business opportunities, while avoiding exclusionary or divestment practices that could worsen existing vulnerabilities.

The NGFS distinguishes between **transition planning**, i.e., the internal process of preparing strategies to achieve climate targets and manage related risks, and a **transition plan**, i.e., the tangible product that sets out how the bank will align its business with specific climate outcomes, including adaptation goals. Understanding this distinction is important for central banks and financial regulators, suggesting that they should assess not only the content of transition plans prepared by banks but also their capacity and process to develop, revise, execute, and monitor the plans, namely, transition planning, over time.

For adaptation, targets should be informed by physical risk assessments and designed to strengthen resilience at both client and portfolio levels. Metrics may range from input indicators (e.g., finance mobilized for adaptation projects) to outcome indicators (e.g., reduced exposure of assets in high-risk regions), as illustrated in Table 1.

Moreover, the NGFS published a report titled *NGFS Input Paper on Integrating Adaptation and Resilience into Transition Plans* in 2025 in order to refine the aforementioned guidance note by focusing on adaptation and resilience. This report provides a structural framework for incorporating adaptation actions into transition plans (NGFS 2025c). The G20 Sustainable Finance Working Group positions this report as supporting the priorities set for 2025. While adaptation is increasingly viewed as an integral part of transition planning by the NGFS, the G20, and others, its actual integration has been limited so far as compared with mitigation. Thus, the report was written to offer a practical approach for banks to integrate adaptation and resilience into their transition plans. The NGFS also stresses that central banks and financial regulators should recognize the importance of understanding the transition plans prepared by companies as banks' clients. Many elements of the proposed transition planning approaches can be applied to both financial and non-financial entities.

This paper points out that the following five building blocks with regards to the existing transition plan frameworks—Governance; Foundations; Implementation Strategy; Engagement Strategy; and Metrics and Targets—are useful for banks to incorporate adaptation and resilience considerations.

1. **Governance:** Installing effective government structures is essential to monitor whether adaptation objectives are integrated into transition planning and sustainability targets reporting.

Table 1: Examples of Metrics Used for Adaptation Target Setting

Target Type	Description
A. Portfolio level targets	
Physical risk assessment and management	These targets measure the physical risk assessments completed for the portfolio. Advanced measures could include looking at the proportion of the portfolio that is highly exposed to physical risks (geography/sector) and adaptation/resilience measures in place to manage the risks.
B. Real economy activity-based targets	
Climate-resilient financing targets	These targets measure financing of adaptation/resilience infrastructures (e.g., flood defense, renewable energy installations designed to withstand extreme weather conditions) or by financing resilient assets (e.g., green building standards that include climate adaptation features; sustainable farming practices that increase crop resilience to climate variability).
Climate scoring of clients from an adaptation perspective	These targets measure, based on internal climate methodologies, the extent to which clients are adapting and building resilience to climate change based on their transition plans.
C. Transition plan execution targets	
Engagement targets	These targets measure the level/type of engagement with clients and portfolio companies to encourage them to adopt resilience policies, by a given date.

Source: NGFS (2025b).

2. **Foundational Analysis:** Integrating transition planning could be structured around the following two objectives: (a) managing the bank's exposure and vulnerability to physical risks; and (b) where appropriate, seizing adaptation-related business opportunities.
3. **Implementation Strategy:** Assessment of physical risks and potential adaptation opportunities is turned into effective risk management and actual investment decisions. Risk management strategies may include various actions:
 - ✓ Avoiding risk (e.g., divestment)
 - ✓ Accepting risk
 - ✓ Reducing risk (e.g., implementing adaptation measures)
 - ✓ Transferring or sharing risk (e.g., insurance or other financial products)
 - ✓ Investing in new opportunities (e.g., updated product and service offerings).
4. **Engagement Strategy:** Operationalizing implementation strategy requires engagement with a wide range of stakeholders including the value chain, industry peers, governments at all levels, central banks, financial regulators, nongovernment organizations, and academia.
5. **Metrics and Targets:** Banks may select metrics and targets through stages reflecting data availability, methodologies, and experiences. There is a wide variety of adaptation metrics and targets, ranging in usefulness and use cases.
 - ✓ Banks could start to assess data availability and identify portfolio and location-related data to assess exposures to physical risks.
 - ✓ Subsequently, banks can develop a baseline using simple input or process-level metrics (e.g., the amount of finance mobilized for adaptation projects, or the number of employees trained in conducting physical risk assessment and implementing adaptation measures).
 - ✓ As more advanced approaches and quantification of outcomes become feasible, the metrics could be chosen to measure the outcomes or effectiveness from adaptation finance or actions. The targets could also be refined to include timelines and resilience objectives.

3. Global Disclosure Standards for Managing Physical Risks in Banks

Over the past years, there has been a significant international push to integrate climate-related financial risks into the regulatory and disclosure frameworks that govern the banking sector. This effort is driven by the growing recognition that climate risks—physical risks and transition risks—can materially affect the stability of banks and other financial institutions and the broader financial system. The ISSB provides standardized

climate-related disclosure requirements applicable to both companies and financial institutions (ISSB 2023). Complementing this, the BCBS has incorporated climate-related financial risks into its supervisory expectations over internationally active large banks (BCBS 2022, 2024). The BCBS has also developed enhanced disclosure templates under Pillar 3 of the Basel framework to promote greater transparency in how banks manage climate risks (BCBS 2025). This section focuses on these initiatives focusing on physical risks that form an evolving global framework aimed at strengthening the climate resilience of banks through consistent disclosure, risk management, and supervisory oversight.

3.1 ISSB Climate-Related Standards on Banks

The ISSB IFRS S2 Climate-related Disclosures Standard provides comprehensive guidance on how organizations, including banks, should report their exposure to climate risks. While transition risks and mitigation efforts have received considerable attention, there is a growing recognition of the need to address physical risks and their implications for financial stability. Physical risks stemming from acute and chronic climate events can have direct financial impacts on banks' assets, operations, and counterparties.

Under the Standard, all reporting companies and banks are required to provide information on both mitigation and adaptation measures in their annual reports accompanying financial statements. For adaptation, banks must identify material physical risks both acute (e.g., floods, storms, wildfires) and chronic (e.g., sea-level rise, long-term temperature increase), as well as any related opportunities. They must also disclose the strategies and actions they are undertaking to manage these risks and leverage adaptation-related opportunities.

Disclosures are structured around the four pillars of climate-related financial reporting: Governance, Strategy, Risk Management, and Metrics & Targets. While the framework applies to all sectors, certain requirements are particularly important for banks due to the nature of their business and the structure of their emissions.

Governance

- **Oversight structure:** Banks should describe the governance structure overseeing physical

risks and adaptation, identifying relevant board committees (e.g., Risk Committee, Sustainability Committee) and specific responsible officers (e.g., Chief Risk Officer, Chief Sustainability Officer).

- **Management roles:** The role of management in assessing physical risks, integrating adaptation strategies, and monitoring progress must be detailed.
- **Reporting frequency:** Disclosure should include how often the board is briefed on physical risk exposure (e.g., quarterly) and how the effectiveness of adaptation measures is evaluated.
- **Incentives:** Where applicable, banks should explain links between remuneration policies and climate-related performance, such as bonuses tied to milestones in climate resilience or adaptation finance deployment.
- **Example:** A bank might disclose that its Risk Committee reviews portfolio exposure to flood-prone regions twice a year, and that the Chief Risk Officer is accountable for ensuring adaptation measures—such as changes to lending criteria in high-risk areas—are implemented.

Strategy

- **Material risks:** Banks must describe physical risks that could reasonably be expected to affect their business model, client base, portfolio quality, and capital adequacy.
- **Time horizons:** Both current and expected future impacts across short-, medium-, and long-term horizons must be addressed.
- **Scenario analysis:** Banks must disclose results of climate scenario analyses showing portfolio resilience under scenarios with heightened physical risks (e.g., severe flooding or prolonged drought scenarios).
- **Adaptation responses and transition plans:** For banks, disclosures should include strategies such as developing climate-resilient lending and investment products, adjusting collateral valuation methodologies to incorporate physical risk assessments, and reallocating capital toward financing climate-resilient infrastructure and adaptation projects. While IFRS S2 does not require banks (and other entities) to have a formal transition plan, it encourages disclosure of any existing adaptation-related elements within broader strategic or transition planning frameworks, to enhance transparency and comparability.

- **Example:** A bank might report that it anticipates increased hurricane risk in certain coastal regions to affect property-backed lending portfolios, and, in response, is tightening lending standards and expanding financing for flood-defense infrastructure.
- **Recent ISSB initiatives on transition plans:** The ISSB announced in June 2024 its plan to incorporate the Transition Plan Taskforce, a United Kingdom (UK)-based body that developed a best-practice framework for corporate climate transition plans, into the IFRS Sustainability Knowledge Hub and to develop educational material to support transition plan disclosures under IFRS S2 (ISSB 2024). In June 2025, the ISSB published official guidance on disclosing climate-related transitions, including transition plans, under IFRS S2, promoting consistent and comparable reporting practices (ISSB 2025).

Risk Management

- **Risk identification processes:** Banks must describe the processes used to identify and assess physical risks in both their own operations and in their lending and investment portfolios. This includes using tools such as hazard maps, climate risk models, and geographic information system-based exposure analysis for loan collateral and financed projects.
- **Integration into bank's overall risk management:** Banks must explain how the assessment of physical risks is incorporated into their overall risk management framework, their modelling of credit risk, and their capital planning.
- **Prioritization of adaptation actions:** Banks should disclose the criteria they use to prioritize adaptation measures to reduce physical risks. This may include prioritizing by economic sector, geographical location, or the vulnerability of borrowers and assets to climate-related hazards.
- **Stakeholder engagement:** Banks should report on how they work with clients, employees, other stakeholders, and public authorities to reduce physical risks in the assets they finance.
- **Example:** A bank could describe how it uses flood hazard data to adjust loan-to-value ratios for mortgages in high-risk areas and how it collaborates with insurance companies to encourage borrowers to obtain climate risk coverage.

Metrics and Targets

- **Exposure to physical risks:** Banks must disclose quantitative and qualitative metrics that describe their exposure to physical climate risks within their operations and lending, investment, and insurance portfolios. Examples include the proportion of outstanding loans, investments, or insured assets located in areas identified as high flood, wildfire, or heat-stress risk.
- **Adaptation-related targets:** Where set, banks should disclose targets aimed at reducing exposure to high-risk sectors, geographies, or counterparties over defined time horizons, as well as targets for increasing adaptation or resilience-related financing.
- **Monitoring and oversight:** Disclosures should explain how these metrics and targets are tracked, how performance is assessed over time, and how results are reviewed by senior management and the board.

For banks, physical risk and adaptation disclosures under IFRS S2 go beyond operational impacts, requiring a portfolio-level perspective that integrates governance, strategy, and risk management with robust metrics. This enables stakeholders to understand both the bank's vulnerability to physical risks and the effectiveness of its adaptation strategies, while aligning with the broader transition to climate-resilient financial systems.

3.2 Foundations of Climate Risk Supervision: BCBS Principles

In recent years, central banks and financial regulators have increasingly focused on climate-related financial risks and their potential impact on large, internationally active banks and overall financial stability. The BCBS, which comprises around 45 central banks and financial regulators from 28 jurisdictions, is an international regulatory body aiming at strengthening banking regulations and enhancing global financial stability. Over time, the BCBS has expanded its frameworks by integrating various aspects of risk management, capital adequacy, and market transparency.

To promote a resilient and stable global banking system, the BCBS has developed a comprehensive regulatory framework known as the **Basel Framework**. This framework establishes international standards for the regulation,

supervision, and risk management of internationally active banks. At its core, the Basel Framework aims to strengthen the soundness of the banking sector by ensuring that banks maintain adequate capital buffers, implement robust risk management practices, and operate with a high degree of transparency. To achieve these objectives, the framework is structured around the following three mutually reinforcing pillars:

- **Pillar 1: Minimum Capital Requirements** – Mandating banks to maintain sufficient capital to absorb unexpected losses arising from credit, market, and operational risks.
- **Pillar 2: Supervisory Review Process** – Encouraging banks to develop and enhance internal risk management practices for risks not fully captured under Pillar 1, such as interest rate and liquidity risks. Supervisors (namely, central banks and financial regulators) are required to assess these practices and may require additional capital if deemed inadequate.
- **Pillar 3: Market Discipline** – Promoting transparency by requiring banks to regularly disclose comprehensive information about their risk exposures, capital adequacy, and risk management practices. Pillar 3 aims at improving market discipline by making banks more transparent and providing investors and other stakeholders with key information.

This framework faced an important turning point in 2022, when the BCBS acknowledged that climate-related financial risks, encompassing both physical and transition risks, can be treated as drivers of traditional risk categories such as credit, market, liquidity, and operational risks. Consequently, the BCBS published *the Principles for the Effective Management and Supervision of Climate-Related Financial Risks*, comprising 18 high-level principles—12 directed at banks and six at supervisors (BCBS 2022). These principles aim to provide a common baseline for large banks and financial supervisors while allowing flexibility to accommodate varying practices and evolving methodologies. Some of the main principles are highlighted below:

- **Principle 1:** Banks should establish robust processes to understand and assess the potential impacts of climate-related risk drivers on their businesses and operating environments. They should consider material climate-related financial risks over various time horizons and integrate these risks into their overall business strategies and risk management frameworks.

- **Principle 5:** Banks should identify and quantify climate-related financial risks and incorporate those assessed as material over relevant time horizons into their internal capital and liquidity adequacy assessment processes, including stress testing programs where appropriate.
- **Principle 12:** Banks should utilize climate scenario analysis to assess the resilience of their business models and strategies against a range of plausible climate-related pathways, determining the impact of climate-related risk drivers on their overall risk profile.

Banks are expected to enhance their internal risk management, assess capital and liquidity adequacy, and conduct risk analyses, including climate scenario analyses and stress tests, under both business-as-usual and stressed scenarios, as pointed out in Section 2.1. Climate scenario analysis serves as a forward-looking tool to evaluate the resilience of banks' business models and strategies against various climate-related scenarios, determining the impact of climate-related risk drivers on their overall risk profile.

Meanwhile, financial supervisors play a crucial role in overseeing these practices to ensure financial stability in the face of climate risks. Some of the principles are pointed out below:

- **Principle 13:** Financial supervisors should ensure that banks' incorporation of material climate-related financial risks into their business strategies, corporate governance, and internal control frameworks is sound and comprehensive.
- **Principle 14:** Financial supervisors verify that banks can adequately identify, monitor, and manage all material climate-related financial risks as part of their assessments of risk appetite and risk management frameworks.
- **Principle 15:** Financial supervisors determine the extent to which banks regularly identify and assess the impact of climate-related risk drivers on their risk profiles, ensuring that material climate-related financial risks are adequately considered in managing credit, market, liquidity, operational, and other types of risk.
- **Principle 18:** Financial supervisors should consider using climate scenario analysis to identify relevant risk factors, size portfolio exposures, identify data gaps, and inform the adequacy of risk management approaches. Supervisors may also consider the use of climate stress testing to evaluate a firm's financial position under severe

scenarios and, where appropriate, disclose the findings of these exercises.

The BCBS emphasizes the need for financial supervisors to enhance their knowledge and expertise to better assess how effectively banks manage climate-related financial risks. Increasing banks' awareness of key risk indicators and encouraging them to collect data from counterparties, as highlighted under the Pillar 3 framework, are crucial for supervisory operations. Supervisors must ensure that banks adequately consider the potential impacts of climate risks in developing and implementing business strategies, evaluating the resilience of business models to material climate-related financial risks across various time horizons, and assessing how these risks may affect their ability to achieve strategic objectives.

In April 2024, the BCBS updated the Core Principles for Effective Banking Supervision, marking the first revision since 2012 (BCBS 2024). Among various changes, the updated Core Principles now officially recognize climate-related financial risks as key emerging threats, alongside the digitalization of finance. This update underscores the growing importance of integrating climate risk considerations into the supervisory framework to maintain global financial stability.

3.3 BCBS's Pillar 3 Templates to Enhance Disclosure for Prudential Regulation

Some further encouraging developments occurred in May 2025 when the Group of Central Bank Governors and Heads of Supervision (GHOS)—the oversight body of the BCBS—reached a key decision regarding climate-related financial disclosures. GHOS agreed that the proposal on a Pillar 3 disclosure framework for climate-related financial risks, published by the BCBS in November 2023 for public consultation, could be adopted as a voluntary disclosure framework by jurisdictions. Based on this decision, the BCBS finalized and published the voluntary framework for the disclosure of climate-related financial risks in June 2025, incorporating revisions based on stakeholder feedback received during the consultation period (BCBS 2025). Since the disclosures are for banks to improve risk management, not only physical and transition risks but also concentration risks are covered in the disclosure framework. A total of six templates for disclosures are prepared for banks:

- Template CRFRA: Providing qualitative information on government, strategy, and risk management on climate-related financial risks.
- Template CRFRB: Providing qualitative information on transition risk, physical risk, and concentration risk.
- Template CRFR1: Providing information on transition risk exposures and financed emissions by sector.
- Template CRFR2: Providing information on inflation related to physical risk exposures.
- Template CRFR3: Providing information on transition risk real estate exposures in mortgage portfolios by energy efficiency level.
- Template CRFR4: Providing information with regards to transition risk emission intensity per physical output and by sector.

Among these, there are two templates related to physical risks:

Template CRFRB requires a bank to provide qualitative information on transition risks, physical risks, and concentration risks. The items below focus on physical risks and concentration risks relevant to physical risks.

- For physical risks, banks should explain the methodology used to identify exposures affected by material physical risks, including:
 - ✓ key chronic and acute events, and reasons why those were chosen based on the bank's business model;
 - ✓ the criteria used to determine the level of geographic detail for assessing each event's risk;
 - ✓ description of how sector-specific factors were considered in line with the bank's portfolio;
 - ✓ the time horizons and climate scenarios used in the risk assessment; and
 - ✓ description of how exposures were assigned to physical risks based on the location of the counterparty's activities.
- For concentration risks, banks should describe the following:
 - ✓ how exposures to counterparties facing material physical risks could impact the bank's overall risk and financial performance;

- ✓ how the bank identifies and assesses vulnerable or concentrated exposures, including key indicators and criteria used;
- ✓ whether and how the bank monitors material concentrations by sector or location; and
- ✓ how climate-related concentration risks affect the bank's strategy and decisions, including the bank's response and adaptation efforts.

Template CRFR2 requires a bank to disclose quantitative information on its gross carrying values subject to physical risks classified by geographical region or location. The information (e.g., loans, debt securities, and equity instruments in the banking book) should cover exposures to companies, as well as small and medium-sized enterprises (SMEs) that meet the regulatory criteria, as presented in Table 2:

In addition to the decision to provide mandatory climate-related disclosure templates, the GHOS tasked the BCBS in May 2025 with prioritizing further analytical work on the financial impacts of extreme weather events. In response, the BCBS announced plans to operationalize this mandate in the coming months. These efforts build on the BCBS's broader principles for the effective management and supervision of climate-related financial

risks. Given that such disclosures often highlight banks' exposures to counterparties and sectors vulnerable to physical risks, banks are expected to enhance portfolio-level transparency and resilience.

4. Adaptation Target-Setting and Quantitative Assessment for Banks

In recent years, both international policy institutions and leading consulting firms have taken significant steps to guide banks in addressing the rising risks of climate change. This section focuses on UNEP FI, which has developed practical, action-oriented frameworks to help banks set adaptation and resilience targets, assess physical risks, and integrate these elements into governance and operations (UNEP FI 2023). Complementing this, this section also includes information from the work of BCG, which takes a similar approach but explicitly focuses on turning physical risks into a source of business opportunity (Castoldi et al. 2024). Together, these approaches offer both practical and strategic direction and analytical rigor for banks to strengthen their climate resilience.

Table 2: Basel Committee on Banking Supervision Template on Banks' Exposures to Physical Risks

	a	b	c	d	e	f	g	h	i	j
	Gross Carrying Values		Allowance/Impairments		Residual Maturity					
	Total	%	Of Which: Non-performing Exposures	Total	Of Which: Non-performing Exposures	<= 5 Years	> 5 Years <= 10 Years	> 10 Years <= 20 Years	> 20 Years	Average Weighted Residual Maturity
1	Geographical region or location subject to climate change physical risk									
2	Of which: corporates									
3	Of which: loans collateralised with residential or commercial immovable property									
...	...									
X	Total geographical regions or locations subject to climate change physical risks									
Y	Total geographical regions or locations not subject to climate change physical risks									
Z	Total geographical regions or locations where the bank is unable to judge whether or not they are subject to climate change physical risks									
Total	100									

Source: BCBS (2025).

4.1 Guidance for Banks' Adaptation Target Settings

The UNEP FI provides a policy framework to help financial institutions address physical risks, recognizing that hazards such as floods, storms, heatwaves, and sea-level rise can destabilize banking portfolios and erode long-term asset value. Developed with 27 Principles for Responsible Banking signatories in 2023, this guidance positions adaptation and resilience as strategic imperatives for the banking sector.

At its core, the framework emphasizes “SMART” targets—Specific, Measurable, Achievable, Relevant, and Time-Bound—as a way to translate broad adaptation ambitions into actionable objectives. It distinguishes between Practice and Impact Targets:

- **Practice Targets** – focus on improving internal processes, such as integrating climate risk into credit assessments or enhancing governance oversight.
- **Impact Targets** – focus on measurable improvements in resilience outcomes for clients, communities, and ecosystems.

The target setting framework is comprised of the following four core action areas:

1. **Internal Policies and Processes** – embedding adaptation into governance, operational risk assessments, and strategic planning.
2. **Client Engagement** – supporting clients in identifying physical risks, creating adaptation plans, and securing resilience finance.
3. **Business Opportunities and Financial Flows** – aligning lending and investment portfolios with adaptation goals, including resilience-linked loans and parametric insurance.
4. **Partnerships and Advocacy** – collaborating with governments, peers, and civil society to advance systemic resilience.

A defining feature of the UNEP FI framework is its phased implementation pathway. Implementation follows a phased pathway from early to advanced stage:

- **Early stage** – focus on high-risk regions/sectors, track incremental progress via process-level indicators.
- **Advanced stage** – shift to outcome and impact metrics (e.g., reduced loss ratios, shorter recovery times) as data and methodologies mature.

This evolution reflects the dynamic nature of climate risk management, which must adapt to emerging scientific insights, technological innovations, and policy developments. Successful adoption requires integration into governance structures, risk management systems, and business strategies—ensuring adaptation is both a risk mitigation measure and a driver of innovation.

4.2 Five-Step Process for Setting Adaptation Targets—Step 1 to Step 2

The UNEP FI framework translates the concept of adaptation target-setting into a practical, sequential process that banks can follow. This process is designed to move from understanding the broader policy and risk context to implementing and monitoring concrete adaptation measures. Each step can be strengthened with procedural enhancements drawn from BCG, whose analytical tools and quantitative focus add operational depth.

Step 1: Understanding context and risks. The first step requires banks to gain a comprehensive understanding of the policy, market, and environmental context in which they operate. UNEP FI advises institutions to review international agreements such as the Paris Agreement, the Sustainable Development Goals, and the Sendai Framework for Disaster Risk Reduction 2015–2030. The Sendai Framework for Disaster Risk Reduction is a UN-adopted global blueprint for reducing disaster risk, developed in Sendai, Japan, outlining four priority actions: understanding risk, strengthening governance, investing in risk reduction, and building back better.

At the national and regional levels, banks should examine adaptation plans, climate strategies, and relevant taxonomies that define what constitutes an adaptation-aligned investment. Regulatory expectations, including supervisory guidance and disclosure obligations under frameworks such as the ISSB S2 standards, must also be taken into account.

Step 2: Establishing a baseline for physical risk assessment. Physical risk assessment enables banks to understand their current and future exposure to climate change. This includes identifying the climate-related hazards affecting their operations and portfolios and determining which regions, sectors, and client types (such as companies or individuals) are most vulnerable.

For banks operating in jurisdictions where regulations or supervisory expectations are limited or absent, the UNEP FI guidelines recommend the following baseline steps:

1. Conducting a desk study of historical climate-related vulnerabilities in the portfolio and identify potential sources of data for all steps of the risk assessment. This includes publicly available national or regional-level assessments.
2. Screening physical risks at the portfolio level by considering the geographical footprint and identifying high-risk sectors and regions. Qualitative risk scores and heat maps may be used for this purpose.
3. Conducting a more granular risk assessment for high-risk clients, sectors, and regions, considering: (i) Proportionality – focusing on the most material impacts; (ii) Context – reflecting regional and sector-specific complexities; (iii) Client and counterparty vulnerabilities; and (iv) Comprehensiveness – covering a broad range of hazards and analyzing exposures and vulnerabilities.
4. Assessing the impacts of adaptation and resilience-building solutions, as well as actions to manage residual risks. For physical risk assessments, the use of the IFRS S2 Disclosure Standard (or other applicable mandatory disclosure standards) is recommended. Time horizons should include both the material time horizon for the bank's exposures and a longer-term horizon—ideally through 2050. Scenario analysis could incorporate high-impact scenarios, such as those from NGFS or IPCC.

Regarding data collection and use, banks need to understand the availability, quality, coverage, and cost of relevant data or data providers. In the case of data gaps, proxies or estimates should be used where appropriate. Effective risk management requires a bank to prepare the following data: (a) **hazard data**; (b) **exposure data** (of clients, projects, and assets); (c) **vulnerability data** (including building structure, protection measures, insurance coverage, risk management capacity); and (d) **damage functions** to support more advanced financial risk.

The BCG takes a similar approach but provides additional elements. In order for banks to integrate physical risks into financial decision-making, the BCG stresses that banks should have a clear, quantitative methodology across credit, market, and operational risks—comprising exposure, hazard, vulnerability, and economic impact. In particular, economic impact can be measured by translating the identified hazard metrics into an expected

percentage of asset damage or operational disruption. This is conducted based on damage functions. Damage functions are developed internally by banks generating models used to estimate financial losses (such as profits or collateral value). Damage functions should be specific to a sector or asset archetype and can be adjusted with clients' adaptation and resilience measures if the information is available.

For example, the adverse economic impact of a manufacturing center can be assets per type of hazards (e.g., flood, storm, precipitation, wildfire, heat, water scarcity, frost, sea-level rise) and in terms of physical assets (such as building, equipment, and inventory) or operations (such as disruption to logistics, productivity, and infrastructure). These impact assessments may use scores (e.g., 1 the lowest and 5 the highest). In addition, damage functions are generally comprised of the following four key elements:

- (a) Shape of the damage function (e.g., log, exponential, or linear);
- (b) Slope representing the expected speed of the damage, which is dependent on asset archetypes;
- (c) Activation threshold above which damage starts (e.g., the percentile or absolute value of a key variable); and
- (d) Maximum damage threshold, i.e., the maximum percentage of damage caused by a given hazard.

These measures promoted by the BCG could help banks to integrate physical risks into credit systems including loan pricing, credit approval thresholds, risk-weighted asset calculations, and capital allocation. It is desirable to start with prioritized high-risk portfolios, such as real estate and facilities in stressed or coastal areas. It is important for banks to be aware that physical risk assessment also helps to identify new business opportunities that could contribute to clients' adaptation and resilience activities, including adaptation and resilience financing, green infrastructure financing, or advisory services.

4.3 Five-Step Process for Setting Adaptation Targets: Step 3 to Set Adaptation Targets

Building on Steps 1 and 2, the bank will now enter the stage of setting the adaptation targets, which are comprised of practice targets and impact targets:

Step 3: Setting adaptation targets

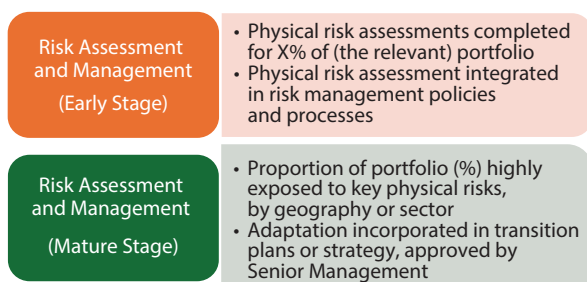
Target-setting is the core of the adaptation process. UNEP FI emphasizes the importance of aligning these targets with the “SMART” criteria, ensuring that each is specific in scope, measurable in its outcomes, achievable within the institution’s capacity, relevant to both business and societal needs, and time-bound to enable progress tracking. A crucial aspect is distinguishing between practice targets and impact targets, as stressed above.

Practice Targets focus on improving a bank’s internal systems, risk assessment processes, and engagement with clients. They include actions—enhancing physical risk assessment and management processes; integrating adaptation and resilience issues into client engagement strategies; and developing new financial products or financial services that support clients’ adaptation and resilience activities. Practice Targets are primarily process-oriented and essential for building the institutional capacity to address physical risks and grasp opportunities. The examples of Practice Targets mentioned above are described in Figures 3, 4, and 5, with guiding examples.

By contrast, **Impact Targets** aim to deliver measurable improvements in clients’, sectors’, or regions’ ability to adapt to climate change and withstand physical risks. Banks should focus on supporting adaptation in vulnerable regions, avoiding strategies such as divestment that may exacerbate existing vulnerabilities. Examples of metrics include:

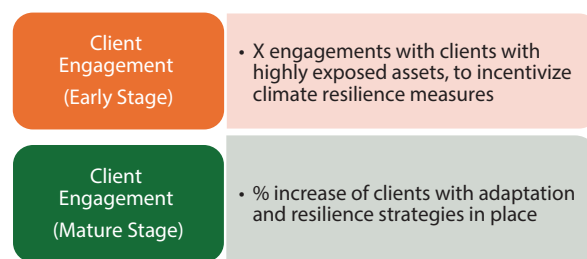
- (i) **Reduced climate vulnerability:** e.g., percentage of people or assets with lower vulnerability due to adaptation measures.

Figure 3: Practice Targets Related to Internal Policies and Processes of Risk Assessment



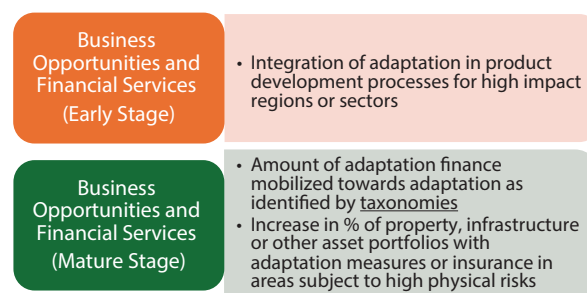
Source: Prepared by the author based on UNEP FI (2023).

Figure 4: Practice Targets Related to Engagement to Gather Information and Support Clients’ Options



Source: Prepared by the author based on UNEP FI (2023).

Figure 5: Practice Targets Related to Business Opportunities and Financial Flows



Source: Prepared by the author based on UNEP FI (2023).

- (ii) **Increased climate resilience:** as defined in the Introduction, the capacity to maintain core functions and recover from climate shocks. It can be measured by, for instance, expanded insurance coverage or upgraded infrastructure.
- (iii) **Improved climate adaptation outcomes:** measuring progress in specific projects, such as flood protection, drought loss reduction, or water conservation.

Banks should screen for social and environmental negative impacts from adaptation and resilience actions considering the possibility of maladaptation. Considering negative impacts should pay attention to Do No Significant Harm principle, in particular, with regards to the potential impacts of the activity on vulnerable communities and ecosystems; the long-term sustainability of the activity; and the consistency of the activity with overall adaptation goals and policies. Taxonomies for adaptation and resilience, such as the

EU Taxonomy on Adaptation, the proposal by the LNAS Advisory Group, and the Resilience Taxonomy developed by the CBI as mentioned in Section 2.2, may provide useful guidance for banks in identifying appropriate adaptation and resilience activities.

4.4 Five-Step Process for Setting Adaptation Targets: Shifting to Step 4 to Develop Action Plan

After setting adaptation targets, banks must design an action plan that outlines the pathway to achieving them:

Step 4: Developing an action plan: UNEP FI recommends that these plans specify governance structures, assign clear roles and responsibilities, identify key performance indicators, and define milestones for progress assessment. Action plans should also articulate how adaptation measures will be financed and integrated into existing business processes.

Banks could prepare Core Indicators to track progress on adaptation and resilience actions. Banks could start with the indicators most relevant to their business and data availability, and improve them gradually. It is also important to encourage banks to align their indicators with national and international frameworks. The UNEP FI guidelines identify the following three types of Core Indicators:

- (a) **Output Indicators:** Measuring the *direct results of bank actions* (e.g., How many clients engaged in adaptation and resilience discussions? How much financing services provided to support such activities?)
- (b) **Outcome Indicators:** Focusing on the *real-world impact of banking activities* (e.g., Are clients improving physical risk management practices? Is the overall vulnerability of the bank's portfolio decreasing?)
- (c) **Impact Indicators:** Evaluating the *long-term, systemic changes resulting from the bank's activities* (e.g., enhancing resilience of communities or ecosystems and reducing their vulnerability to climate-related hazards)

These indicators can be classified according to banks' potential channels and actions pointed out above—namely, Internal Policies and Processes; Business

Opportunities and Financial Flows; Client Engagement; and Partnerships and Advocacy. Moreover, core indicators output, outcome, and impact indicators can be based on these four possible channels and actions.

Core Indicators reflect both Practice Targets and Impact Targets. Practice Targets are essentially **process-oriented** and are thus used to strengthen the institutional capacity to address physical risks and opportunities. As a result, Practice Targets are often assessed using **Output Indicators** (e.g., number of clients engaged, adaptation finance provided).

By contrast, Impact Targets are **performance or results-oriented**, focusing on actual improvement in resilience for clients, sectors, or regions. Impact Targets tend to reflect banks' contribution to positive outcomes as pointed out above, including increasing clients' adaptive capacity, reducing physical risks in high-stress regions, and supporting activities that generate ecosystem or community resilience benefits. As a result, Impact Targets are assessed mostly by using **Outcome and Impact Indicators** (e.g., increased resilience of clients, reduced climate vulnerability at the portfolio level). The UNEP FI guideline identifies the following nine Core Indicators based on these combinations (see Figures 6, 7, 8, and 9):

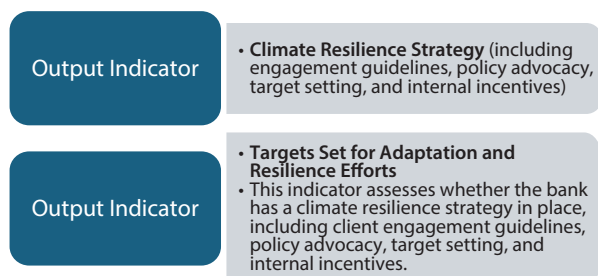
4.5 Five-Step Process for Setting Adaptation Targets: Entering into Final Step to Implement Actions

The final step involves embedding adaptation actions into the institution's operations and continuously monitoring their effectiveness.

Step 5: Implementing and Monitoring: UNEP FI highlights the importance of integrating adaptation into core banking functions, ensuring that climate risk considerations influence lending, investment, and operational decisions across all business units. Client engagement should be proactive, offering advisory services and incentives for the adoption of resilience measures. Transparent disclosure under frameworks such as ISSB S2 is essential for demonstrating progress and maintaining stakeholder trust. Implementation includes banks' four actions, as described below:

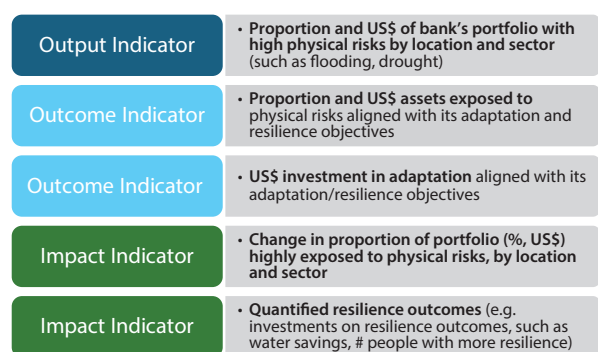
- ✓ **Internal Policies and Processes:** Banks should develop an Adaptation and Resilience Plan, which includes targets, core indicators, action plans,

Figure 6: Core Indicators Related to Internal Policies and Processes



Source: Prepared by the author based on UNEP FI (2023).

Figure 7: Core Indicators Related to Client Engagement



Source: Prepared by the author based on UNEP FI (2023).

and assigning responsibilities for implementing strategies across various operational units. Institutionalizing monitoring progress and target delivery is crucial. Banks may need to adjust their existing strategies to reduce vulnerability to physical risks by considering how to deal with the risks borne by clients and developing new services to support clients' adaptation and resilience actions. Disclosing information based on the ISSB Standards will be useful to promote risk management and grasp opportunities. Capacity-building and training should be provided to their employees to effectively perform the corporate climate plan.

- ✓ **Client Engagement:** Banks can support their clients to improve their adaptation and resilience practices in various ways—for example, providing access to data, physical risk assessment tools, and training; providing financial incentives to

Figure 8: Core Indicators Related to Business Opportunities and Financial Flows



Source: Prepared by the author based on UNEP FI (2023).

Figure 9: Core Indicators Related to Partnerships and Advocacy



Source: Prepared by the author based on UNEP FI (2023).

promote adaptation and resilience actions (e.g., lowering interest rates on loans, lengthening repayment durations); supporting clients to develop and implement adaptation plans.

- ✓ **Business Opportunities and Financial Flows:** To grasp business opportunities and develop a new segment of financing services, banks should identify risks and opportunities. The upfront costs that banks have to pay in implementing their plans must be carefully compared with potential greater future costs caused by loss and damage. For banks with global portfolios, a macro-level analysis of climate impacts and adaptation needs can be performed for the economies where the bank operates in order to estimate loss and damage costs, as well as adaptation needs. At micro level, the effective way to identify opportunities is through engaging with clients and the costs of implementing adaptation solutions should be compared with the cost of inaction over the relevant business horizon. Financial products can be developed within the existing thematic bond and loan framework (such as green, social, and sustainability), as well as more comprehensive overview of financial

services (debt financing, equity financing, risk management, wealth management). Risk management includes letter of credit, insurance, credit guarantees, bridge loans.

- ✓ **Partnerships and Advocacy:** Effective forward-looking policy and regulatory frameworks on adaptation and resilience may encourage banks to take actions early to prepare for upcoming policy and regulatory changes by aligning their business strategies. Banks can act proactively not only by responding to policy and regulatory changes in a timely manner but also by advocating more effective policies to strengthen resilience of countries, regions, communities, and businesses. Governments and regulators could consider financial incentives—such as tax breaks, subsidies, guarantees, or lower capital requirements for adaptation-related investments. Public-private collaboration through joint planning and partnerships should be promoted.

Furthermore, the BCG stressed that banks are uniquely positioned to unlock a range of new business opportunities by embedding forward-looking climate risk insights into their core operations. These opportunities can be grouped into four strategic domains:

- **Innovation in product design and loan structuring:** By leveraging granular exposure, hazard, and vulnerability data, banks can design new financing instruments tailored to the specific needs of clients facing physical climate risks. These may include resilience-linked loans with interest rates adjusted based on clients' implementation of adaptation measures, green mortgages that reflect location-specific flood risks, or insurance-linked credit products that bundle lending with climate catastrophe coverage. BCG suggests that such financial innovations can simultaneously reduce portfolio risk and open access to previously underserved or high-risk client segments.
- **Development of climate risk analytics and advisory services:** The data infrastructure and models developed to assess physical risks (e.g., geospatial hazard mapping, damage functions, vulnerability scoring) can evolve into marketable services. Banks can provide third-party climate risk advisory to clients—particularly SMEs or municipal entities—that lack the internal capacity to assess or mitigate their own exposures. These services may include scenario analysis, asset-level risk dashboards, or tailored resilience planning. According to BCG, monetizing these

capabilities can diversify revenue and enhance client stickiness.

- **Strategic capital allocation and asset repricing:** Physical risk data enable banks to re-evaluate the risk-return profile of their portfolios, leading to more climate-aligned capital allocation. For instance, banks may reduce exposure to high-risk real estate while expanding lending to sectors that invest in adaptation solutions (e.g., water management, resilient agriculture, or green infrastructure). Additionally, asset-level repricing based on climate-adjusted collateral values supports more accurate provisioning and loan pricing. BCG notes that integrating this into risk-weighted asset calculations and capital planning enhances both financial soundness and climate resilience.
- **Blended finance and multi-stakeholder coordination:** Banks should act as facilitators of adaptation finance by bridging public, private, and concessional capital sources. Banks can structure blended finance mechanisms—such as resilience bonds or adaptation-linked securitizations—that enable investment in infrastructure and ecosystem-based solutions in high-risk areas. These efforts can also align with National Adaptation Plans or Sustainable Development Goals, enhancing banks' positioning in sustainability-focused markets and with institutional investors.

More broadly, the paper by the BCG highlights that banks which integrate physical climate risk into their strategies early can gain reputational advantages under evolving regulatory and disclosure frameworks (e.g., ISSB, NGFS). These banks are also better equipped to anticipate transition dynamics and to influence emerging norms for risk management and adaptation finance. In this way, climate risk assessment becomes not only a tool for protecting value, but also a platform for creating it.

In addition, BCG strengthens this step by advocating for the *regular updating of quantitative indicators*. Climate risk data, hazard probabilities, and vulnerability assessments should be reviewed periodically to reflect new scientific findings and evolving risk landscapes. Scenario analysis should be repeated at set intervals, and adaptation targets should be adjusted when necessary to remain relevant and achievable. This dynamic monitoring process transforms adaptation from a static compliance exercise into a continuous cycle of risk management and opportunity identification.

4.5 Integrated Application for Banks

The integration of UNEP FI's policy-oriented framework with BCG's complementary approach offers banks a comprehensive and actionable approach to climate adaptation target-setting. While the UNEP FI framework provides a strategic anchor for aligning adaptation goals with global policy agendas and internal governance structures, the BCG model translates these ambitions into quantifiable metrics that directly support lending decisions, risk pricing, and capital allocation. Together, they bridge the gap between qualitative ambition and quantitative execution.

A key advantage of this integrated approach is its ability to address both sides of the adaptation equation. On the one hand, UNEP FI ensures that adaptation strategies are aligned with international agreements, national priorities, and stakeholder expectations. On the other, BCG's methodology provides the analytical rigor to measure, monitor, and refine these strategies in financial terms. This dual perspective ensures that banks' adaptation targets are both *credible*—because they are grounded in science and policy—and *actionable*—because they are tied to measurable financial outcomes.

In practical terms, banks can use this combined approach in several ways:

- **Risk-informed lending:** By applying hazard, exposure, vulnerability, and economic impact scores at the asset or client level, banks can adjust interest rates, collateral requirements, or loan tenors to reflect actual physical risks.
- **Product innovation:** Quantified risk data can support the development of resilience-linked loans, catastrophe-contingent credit facilities, or insurance-linked bonds, whose terms are directly tied to the achievement of adaptation milestones.
- **Capital allocation:** Portfolio-level risk modelling allows banks to allocate capital preferentially toward sectors, regions, or projects with high adaptation benefits, thus optimizing both resilience and return.
- **Client engagement and advisory:** By providing clients with quantified risk assessments, banks can position themselves as partners in adaptation, offering not only financing but also technical guidance on reducing vulnerability and enhancing resilience.

Strategically, this integration transforms climate adaptation from a compliance-driven obligation into a source of competitive advantage. Institutions that can quantify adaptation benefits and integrate them into pricing and product design are better positioned to differentiate themselves in increasingly climate-conscious markets. Moreover, robust adaptation metrics enhance transparency in sustainability reporting, which can strengthen investor confidence and improve access to green and sustainable finance markets.

From a market perspective, banks that adopt this integrated model can also play a leadership role in shaping industry standards. By sharing methodologies and collaborating through industry platforms, they can create a more consistent, comparable, and credible approach to adaptation finance—one that facilitates regulatory alignment, attracts institutional investors, and accelerates the scaling of resilience-focused capital flows.

In conclusion, the UNEP FI–BCG integration equips banks with the tools to set, implement, and verify adaptation targets in a manner that is both strategically sound and operationally robust. It enables a transition from generic climate risk statements to evidence-based, financially grounded adaptation strategies—turning climate resilience into a measurable and bankable asset class. This, in turn, positions the banking sector not just as a passive responder to climate risk, but as an active architect of a more resilient and sustainable global economy.

5. Climate Risk Transfer Mechanisms: Leveraging Insurance and Capital Markets

As physical risks intensify in frequency and severity, the financial system faces mounting pressure to manage exposures and to enable rapid recovery following climate-related disasters. While governments and banks have advanced emissions mitigation and improved risk assessment, comparatively less attention has been paid to risk transfer—mechanisms that shift portions of natural hazard losses to insurers or capital markets. This section examines how parametric insurance and catastrophe bonds (CAT Bonds) are evolving in response to physical risks, and how they can be integrated into sovereign and banking frameworks to enhance financial resilience and reduce systemic vulnerability.

5.1 Overview of Risk Transfer Mechanisms

Climate risk transfer refers to financial instruments and strategies that allow households, firms, and sovereigns to shift climate-related losses to third parties, typically insurers or capital markets. Traditional indemnity insurance—paying based on verified losses—remains foundational but often involves lengthy claims processes, costly assessments, and low penetration in vulnerable regions.

To address these shortcomings, innovative instruments such as parametric insurance, insurance-linked securities (ILSs), and CAT Bonds have gained prominence. These tools can offer faster payouts, greater transparency, and broader access. These instruments do not prevent or reduce disasters; rather, they serve as critical financial buffers. They facilitate faster recovery, dampen fiscal shocks, and support continuity of services, especially in low- and middle-income countries with high climate exposure but limited financial resilience. Challenges include **basis risk** (mismatch between payouts and actual losses), data limitations, and transaction costs.

Parametric insurance offers a mechanism that pays automatically when pre-defined, measurable conditions are met, such as wind speed, cumulative rainfall, or heat index, eliminating the need for post-event loss assessment. This makes it especially suitable for low-capacity environments or regions with weak insurance infrastructure. Parametric products are increasingly deployed in rural or disaster-prone areas with limited access to traditional insurance. For example, a rural hospital can receive immediate funds from a parametric flood product after major inundation. Similar structures are used for droughts, typhoons, and heatwaves.

Meanwhile, ILSs are structured instruments that transfer insurance or reinsurance risks, such as those from catastrophes due to natural hazards, to capital markets. They provide sponsors (governments, insurers, banks) access to alternative capital from investors seeking uncorrelated returns. Since the 1990s, ILSs have become an important part of climate risk management, offering scalability, transparency, and flexibility beyond what traditional reinsurance alone can provide.

ILSs are typically issued through special purpose vehicles (SPVs) that isolate risk from sponsor and investor balance sheets. Investors provide capital to the SPV, which is held in a secured collateral account. If a trigger event occurs, e.g., severe storm, flood, or drought, the SPV releases funds

to the sponsor; otherwise, investors receive principal plus an agreed coupon. Triggers can be parametric (measured environmental conditions), indemnity-based (actual losses of the sponsor), or industry-loss-based (sector-wide estimates by a third party).

The global ILS market has grown substantially, often cited as exceeding \$100 billion in outstanding capital when including collateralized reinsurance as well as catastrophe bonds (Risk & Insurance 2024). Investor interest from pension funds to ESG asset managers continues to expand given diversification and resilience impact profiles. ILS enable faster recovery, stabilize public and private finances, and unlock capital for adaptation investments.

Several types of ILS instruments have been developed to serve different risk profiles and transaction structures, as pointed out below:

CAT Bonds: The most widely recognized ILS type; CAT Bonds allow sponsors (generally insurance and reinsurance companies) to transfer extreme event risks, such as hurricanes, floods, or earthquakes, to the capital markets. Major investors are institutional investors, including pension funds, hedge funds, and asset managers. These instruments are particularly valuable for covering low-frequency but high-severity events and are known for their transparency and standardized structures. CAT Bonds are issued via SPVs, and payouts are triggered by pre-agreed criteria.

Industry Loss Warranties: These are contracts that provide payouts based on aggregate insured losses across an industry, typically calculated by third-party providers. They offer simplicity and avoid the need for sponsor-specific loss verification.

Collateralized Reinsurance: In this structure, investors take on reinsurance risk directly, posting collateral in trusts. It mimics traditional reinsurance contracts but provides reduced counterparty risk and regulatory flexibility.

Sidecars: Used primarily by reinsurers, sidecars allow investors to participate in a defined portion of an underwriting portfolio without taking equity in the insurer. They offer capital efficiency and portfolio diversification.

Mortality and Longevity Bonds: Mortality bonds' payoff depends on unexpected increase in mortality and investors lose some principal to cover the issuer's losses if mortality rates rise above a predefined threshold (e.g., pandemic). The bonds are issued mainly by insurers or reinsurers. Meanwhile, longevity bonds' payoff depends on people living longer than expected. The bonds, which generally pay variable coupons based on the survival of a reference population bonds, are issued by insurers, reinsurers, or pension funds. These two instruments could be designed to pay out when climate change-driven mortality or longevity exceeds expectations.

Among these instruments, CAT Bonds have seen broad adoption for climate resilience. In 2024, global CAT Bond issuance reached a record high of nearly \$17.7 billion, exceeding previous years and bringing the total outstanding market to approximately \$49.5 billion (Artemis n.d.). This milestone underscores the growing role of CAT Bonds as a mainstream tool for transferring climate and disaster risk to capital markets. Much of this growth has been fueled by closer alignment with national climate adaptation strategies and increased demand from ESG-focused investors.

In developed markets such as the United States (US), CAT Bonds have proliferated because risks like earthquakes and hurricanes are relatively well modeled and lend themselves to standardized trigger mechanisms. Earthquakes are rare but highly destructive, while hurricanes occur more frequently yet can be forecast and parameterized to some degree. By contrast, in many developing countries, the potential relevance of CAT Bonds is high given their vulnerability to climate-related hazards such as floods, droughts, wildfires, and temperature extremes; however, these perils are far more complex to model, their impacts are less predictable, and reliable loss data are often scarce, making it difficult to design transparent and investable structures. As a result, while CAT Bonds in advanced economies tend to concentrate on earthquake and hurricane risks, their application in developing economies to climate change-driven disasters remains limited and experimental.

In addition, persistent structural barriers against CAT Bond issuance remain. Setting up a CAT Bond requires complex legal contracts and sophisticated financial structuring, which make transactions expensive and time-consuming—often too costly for small developing

countries. Once issued, these bonds trade only in a very thin secondary market, so investors cannot easily sell their holdings before maturity, reducing liquidity. Designing clear and objective payout triggers is also technically challenging: if the trigger rules are too simple, payouts may not match actual losses (i.e., basis risk), while overly complex rules make it harder for investors to understand and trust the financial product. Moreover, CAT Bonds typically carry high coupons (or yields) and thus exert impacts on budgetary expenditure, as investors demand substantial compensation for assuming uncertain and potentially very large risks. Many developing countries also struggle with limited disaster data and modeling capacity, which makes it harder to convince investors of the reliability of risk assessments. All of these factors limit the broader use of CAT Bonds despite their potential benefits.

5.2 Integrating Risk Transfer into Sovereign Frameworks

Building on the concepts introduced in Section 5.1, this section explores how climate risk transfer tools, such as parametric insurance and CAT Bonds, can be systematically integrated into sovereign fiscal planning. The aim is to move beyond small-scale pilots toward scalable, resilient financial systems capable of withstanding climate-related shocks.

Generally, the primary issuers of CAT Bonds are insurance and reinsurance companies in developed countries. However, most developing countries do not have large domestic insurers and reinsurers that could directly issue CAT Bonds to global investors. This reflects low insurance penetration and thus small premium volumes, as well as limited technical modeling capacity. Since most climate-related losses are uninsured, governments must absorb most of the disaster costs, such as rebuilding public infrastructure, and providing food aid, temporary housing, healthcare, and cash transfers. This may severely deteriorate public budgets unexpectedly through sudden increases in spending and simultaneous revenue shortfalls.

Moreover, even if these governments may wish to issue CAT Bonds directly in the capital market, low credit ratings make it difficult to do so internationally. This is why developing countries often rely on the support of multilateral development banks such as the International Bank for Reconstruction and Development (IBRD) of the World Bank Group, whose AAA rating allows them to intermediate sovereign risk transfer to capital markets.

The IBRD issues CAT Bonds under its **Capital at Risk Notes program**. Funds from CAT Bond issuance are held in a World Bank trust account and invested in safe, liquid assets such as short-term US Treasuries. Investors receive coupon payments, which are comprised of returns from these assets and risk premium paid by governments in developing countries. If no disaster occurs, investors receive their coupon regularly and principal in full at maturity. If a disaster trigger event occurs, investors lose part or all of their principal managed under the trust account, which is transferred to the sponsoring government as an insurance-like payout. To participate in this program, governments pay annual premiums to the World Bank, which are used to fund the coupon payments to investors.

At the sovereign level, embedding climate risk transfer into fiscal policy allows governments to pre-finance disaster response and recovery, rather than relying on unpredictable post-disaster aid or time-consuming sovereign bond issuance. Integrating these instruments into national budget frameworks ensures that payouts are triggered automatically when disaster thresholds are met, improving speed, predictability, and transparency in public finance. Governments must also clearly define their national climate risk appetite to determine the optimal balance between risks they retain and those they transfer to markets.

Several countries have implemented such models:

- **Mexico** – Through its Natural Disaster Fund (FONDEN), established in 1996, Mexico combined annually budgeted reserves (allocating premiums each year from the budget to the World Bank) with market-based risk transfer instruments such as parametric earthquake and hurricane insurance. FONDEN is Mexico's contingency fund for disasters to provide immediate post-disaster financing for federal and state governments. For smaller or frequent disasters, FONDEN provides immediate liquidity. For extreme disasters, large payouts are provided from the World Bank trust account. The IBRD supported FONDEN by issuing CAT Bonds on behalf of Mexico with the Bank's AAA credit rating. This hybrid structure enabled post-disaster funding to be disbursed within weeks, improving predictability, reducing reliance on ad hoc donor assistance, and serving as a replicable model for other countries (World Bank 2012).
- **The Philippines** – In 2019, the Philippines became the first country in Asia to issue a sovereign CAT Bond, providing \$225 million in coverage against

severe tropical cyclones and earthquakes under the IBRD Capital at Risk Notes Program (World Bank 2022). Payouts are triggered by parametric thresholds—maximum sustained wind speed and affected geographic area—allowing funds to reach the government within weeks. The bond was fully aligned with the country's Disaster Risk Financing and Insurance Strategy, enhancing both fiscal integration and appeal to ESG-oriented investors. The OECD (2024a) notes that this was the first multi-hazard sovereign CAT bond in Asia and remains the only one issued by an ASEAN (Association of Southeast Asian Nations) member to date.

- **Jamaica** – In 2024, Jamaica issued a second \$150 million CAT Bond through the IBRD Capital at Risk program, providing four hurricane seasons of coverage (2024–2027) and renewing an earlier 2019 transaction (World Bank 2024, 2025). The bond used an innovative “cat-in-a-grid” parametric trigger, where payouts are made if a hurricane passes through predefined grid cells around Jamaica and meets specified intensity thresholds. This design enables rapid, pre-agreed disbursements while limiting payouts to severe events. Supported by the World Bank and international investors, the transaction was fully aligned with Jamaica's disaster risk financing strategy, enhancing fiscal resilience against major hurricanes.

The cases of Mexico, the Philippines, and Jamaica highlight how sovereigns are embedding risk transfer instruments into their core fiscal planning. In each case, governments pay annual premiums from their budgets, which fund the coupon payments to investors. While Mexico's model combines a contingency fund with insurance, the Philippines and Jamaica examples are pure sovereign CAT Bond structures. Including Jamaica alongside Mexico and the Philippines provides a more up-to-date and diversified picture of how sovereigns are adopting these tools in different contexts.

To institutionalize such tools, governments must undertake a series of policy and legal reforms:

- Budget frameworks should explicitly pre-allocate premium payments and define trigger-based disbursement protocols.
- Legal provisions must authorize sovereign entities to issue insurance-linked securities or enter into parametric insurance contracts with global reinsurers.

- Instruments should be aligned with national adaptation strategies, such as National Adaptation Plans or Nationally Determined Contributions, ensuring coherence across climate and fiscal policy objectives.

CAT Bonds represent only one element of a broader set of disaster risk financing tools. In practice, no single instrument can meet all the funding needs that arise from climate-related disasters. For this reason, governments and development partners are encouraged to combine several instruments in a complementary way. The main components of such a layered approach include the following:

- Budget reserves and national disaster funds: Governments allocate part of their annual budgets to cover smaller, more frequent events such as localized floods or storms. These reserves act as self-insurance and can be deployed immediately.
- Contingent credit lines: Pre-arranged credit facilities offered by multilateral development banks, such as the World Bank's Catastrophe Deferred Drawdown Option or the Asian Development Bank's Contingent Disaster Financing, provide rapid liquidity once a disaster is declared. The Catastrophe Deferred Drawdown Option is a pre-arranged loan that a country can rapidly draw upon when a disaster due to natural hazards or health-related emergency occurs. Contingent Disaster Financing is policy-based loans with deferred drawdown option, which enables countries to rapidly draw down after a disaster due to natural hazards or health emergency. These credit lines are not risk transfer in the strict sense but are an essential layer of pre-arranged financing.
- Regional insurance pools: Neighboring countries cooperate to purchase insurance collectively, spreading risks and lowering premiums. The Caribbean Catastrophe Risk Insurance Facility, African Risk Capacity, and the Southeast Asia Disaster Risk Insurance Facility (SEADRIF) are examples. These schemes often use parametric triggers such as wind speed or rainfall thresholds, enabling quick and predictable payouts. SEADRIF, which is supported by ASEAN Secretariat, World Bank, Japan, and other development partners, is a regional financial facility designed to help ASEAN countries access insurance and risk financing against disasters due to natural hazards. The first insurance product under the SEADRIF was the flood insurance for Lao People's Democratic Republic launched in 2021.

- Highest-risk layer: For the most severe and rare disasters, such as mega-earthquakes or category-5 cyclones, countries typically rely on international markets, through traditional reinsurance or, as described above, CAT Bonds.

By combining these instruments, governments could create a layered strategy: small, frequent shocks are financed with domestic funds; medium-scale disasters are managed through contingent loans or regional pools; and extreme events are shifted to international markets. For example, Mexico's aforementioned model uses CAT Bonds as an international capital market risk transfer and a contingency fund as a domestic budgetary buffer. Covering both extreme catastrophes and smaller disasters, Mexico's blended approach reduces gaps in coverage and strengthens national disaster resilience. This structure improves speed, affordability, and predictability in disaster response, while reducing reliance on uncertain post-disaster aid.

5.3 Banking Sector Integration of Climate Risk Transfer

For banks, participating in ILS and CAT Bonds is not only a way to manage their own climate-related exposures but also an opportunity to innovate, strengthen their role in sustainable finance, and contribute to systemic resilience. Unlike contingent credit lines offered by multilateral development banks, which provide governments with post-disaster liquidity, banks' involvement in ILS and CAT Bonds is about sharing risk with investors, whether by purchasing these instruments, sponsoring them, or embedding them into lending products. In this context, banks can play multiple roles as distributors, financiers, data providers, and risk-sharing partners. They can bundle parametric coverage into agricultural, SME, or mortgage loans to enhance household and enterprise resilience; collaborate with insurers to develop region-specific indices; and use transaction data with remote sensing to reduce basis risk. CAT Bonds, in particular, offer several practical roles for banks:

- **As investors**, banks can purchase CAT Bonds linked to climate perils such as flooding, drought, or cyclones. Because payouts are triggered by measurable environmental conditions rather than financial market fluctuations, these instruments diversify portfolios and support rapid recovery in affected regions.
- **As sponsors or co-sponsors**, banks can securitize climate risk by pooling loans or other assets with

high physical exposure, such as mortgages in coastal zones or agricultural loans in drought-prone areas, into an SPV. The SPV then issues a CAT Bond to investors. If a disaster triggers the bond, investor funds are released to the bank, helping it absorb losses and maintain lending. In this way, banks effectively securitize climate risks, shifting part of their exposure to global investors.

- **As product developers**, banks can embed parametric triggers directly into lending products, as pointed out in Section 6 in detail. For example, a farm equipment loan might automatically extend repayment terms if rainfall falls below a defined threshold, or a business loan in a cyclone-prone region could lower interest rates temporarily if wind speeds exceed a set level. Such mechanisms reduce default risk, accelerate recovery, and strengthen client relationships.

Scaling up such instruments requires public–private partnerships. Governments can subsidize insurance premiums, while banks handle distribution and customer service. Development banks may act as anchor investors in CAT Bond issuances. Commercial banks can bundle climate-responsive lending products with insurance for microfinance institutions and smallholder farmers. Reinsurers and modeling firms can contribute hazard indices to improve trigger accuracy and reduce basis risk.

Global and regional initiatives, such as the Global Risk Financing Facility (GRiF) and regional risk pools like the Caribbean Catastrophe Risk Insurance Facility in the Caribbean and African Risk Capacity in Africa (already discussed in Section 5.2), demonstrate how international cooperation can expand access to these mechanisms. GRiF, launched in 2018 by the World Bank together with Germany and the UK, provides technical assistance and premium financing to help low- and middle-income countries adopt disaster risk transfer tools. By subsidizing insurance premiums, strengthening risk models, and integrating risk transfer into national fiscal strategies, GRiF lowers entry barriers for vulnerable countries. Commercial banks can then complement these efforts by distributing GRiF-supported products, such as parametric insurance or sovereign risk transfer schemes, to local clients, embedding them in lending products and extending their reach.

Nevertheless, banks face important challenges in pursuing these multiple roles. Transaction and structuring costs remain high, especially for smaller issuances. Investor demand is uneven. Well-modeled

disaster risks like US hurricanes attract investors, while floods and droughts in developing countries face data gaps and higher pricing. Regulatory requirements, such as capital adequacy rules under Basel III, can also limit banks' ability to hold or sponsor these instruments. Addressing these constraints will be essential if banks are to mainstream climate risk transfer. Finally, standardization and transparency are critical. Advances in climate modeling, satellite data, blockchain, and smart contracts are improving trigger design and lowering costs. Clearer regulatory treatment for both banks and insurers will further accelerate adoption.

As climate-related physical risks become increasingly systemic, embedding risk transfer tools into banking frameworks is no longer optional: it is a financial necessity. Banks that innovate and adopt such tools early will be better prepared to withstand climate shocks, safeguard financial stability, and channel investment into long-term resilience. This sets the stage for the broader financing frameworks explored in Section 6.

6. Leveraging Insurance Sector Approaches for Bank-Level Risk Management

Building on Section 5's focus on parametric insurance and catastrophe bonds as risk-transfer instruments, this section turns to how insurance-sector approaches can be adapted to bank-level risk management. As climate risks increasingly affect the real economy and financial portfolios, banks can benefit from adopting concepts, tools, and risk frameworks developed by the insurance sector. Insurance companies have long operated under rigorous risk-based capital regimes and have developed advanced practices to evaluate exposure to disasters due to natural hazards, extreme events, and chronic climate stressors. This section focuses on how those practices can inform banks' identification, measurement, and management of physical risks.

6.1 Defining Risk Appetite and Translating Insurance Logic

In the insurance industry, a well-calibrated risk appetite framework forms the foundation of prudent risk management. It delineates which risks are to be retained, transferred, or mitigated, based on frequency, severity, and systemic importance. When applied to the banking sector, this approach means that banks

can develop climate-specific risk appetite frameworks, i.e., structured sets of criteria that define the types and levels of climate-related risk they are prepared to take on. These frameworks should account for the specific vulnerabilities of each sector, the hazard profiles of the regions where their clients operate, and the resilience measures adopted by individual borrowers.

Risk thresholds, such as aggregate exposure to flood-prone mortgages or drought-affected agribusiness, can trigger internal actions such as tighter credit terms, enhanced collateral requirements, or mandatory adaptation measures. These thresholds should be reviewed periodically, in light of evolving climate science, scenario modeling, and hazard data. Integrating such logic supports cross-functional coordination between credit, risk, and sustainability units and enhances disclosure alignment with regulatory expectations such as those developed by ISSB disclosure standards or NGFS guidelines.

Banks can emulate the insurance industry's tripartite strategy: risk acceptance, adaptation, and transfer (Munich Re & UNEP FI 2024):

- **Accepting risk:** Where potential losses are of low probability or are well diversified across different sectors and geographies, banks may decide to retain the exposure rather than avoid or transfer it. Such a decision should not be based on intuition alone but supported by robust scenario analysis—for example, using climate change projections under multiple Representative Concentration Pathways and Shared Socioeconomic Pathways. Representative Concentration Pathways describe possible future greenhouse gas concentration trajectories, while Shared Socioeconomic Pathways outline different global socioeconomic development patterns and their implications for emissions and adaptation capacity. Both were developed within the framework of the IPCC and are widely used in climate science and risk analysis to project changes in hazard frequency and severity over the coming decades. In parallel, geospatial mapping tools can pinpoint vulnerable assets. Tools like Four Twenty Seven's Climate Risk Scores quantify acute (e.g., hurricanes & typhoons, flooding, extreme heat, wildfires) and chronic (e.g., sea-level rise, water stress) risks at the facility level, while Munich Re's NatCatSERVICE provides decades of historical loss data from catastrophes due to natural hazards, enabling calibration of loss probabilities

and severity. Climate Risk Scores measure the exposure of physical assets, companies, and countries to climate hazards by assigning a score (from zero to 100). NatCatSERVICE provides database of natural catastrophe events (such as earthquakes, storms, floods, droughts, wildfires, extreme temperatures) worldwide since 1974. By integrating these datasets into portfolio models, banks can determine whether the residual risk level aligns with their risk appetite and capital allocation strategies.

- **Adapting assets and clients:** Banks can strengthen the climate resilience of their loan portfolios by linking lending conditions to a borrower's commitment to adaptation measures. This means that before approving or disbursing a loan, the bank may require the borrower to invest in protective upgrades to their assets. Examples include flood-proofing (installing barriers, drainage improvements, or elevating equipment to prevent water damage). Such requirements serve two purposes: (a) Risk mitigation—reducing the likelihood and severity of climate- or disaster-related losses, which benefits both the borrower and the lender; and (b) Asset preservation—maintaining the long-term value and functionality of the property, which protects the bank's collateral and the borrower's investment. By embedding these adaptation requirements into loan agreements, banks actively encourage climate-resilient practices among clients, thereby aligning financial stability with broader climate adaptation goals.
- **Transferring risk:** Banks can reduce their exposure to high-impact, low-frequency risks, such as major hurricanes or other catastrophic events, by using risk transfer instruments. This means shifting part of the potential financial loss to other parties, typically through the insurance or capital markets (ILS or CAT Bonds), as mentioned in Section 5. These tools should be placed in the broader context of a bank's institutional risk management strategy, showing how the logic of the insurance industry—spreading and transferring risk—can be integrated into day-to-day banking operations. By doing so, banks can safeguard capital, maintain lending capacity, and stabilize earnings even in the face of rare but severe disasters.

Beyond pure risk management, these instruments can also serve as strategic tools for advancing sustainable finance goals.

Moreover, integrating climate-themed ILS and CAT Bonds into green finance portfolios offers reputational and regulatory benefits. Such bonds appeal to impact-oriented investors and help fulfill ESG commitments, particularly under the “E” (environment) and “S” (social) pillars. Banks can act not only as investors or structuring agents but also as co-developers, enabling local adaptation through co-financing. While many CAT Bond transactions have been executed at the sovereign level, they provide important design lessons for financial institutions seeking to structure similar risk-transfer mechanisms for their own clients.

A compelling example of such risk transfer design is the Philippines’ sovereign CAT Bond program implemented under the IBRD Capital-at-Risk Notes platform, as pointed out in Section 5. This structure illustrates how public-private partnerships can enhance transaction viability. The World Bank provided legal, operational, and credit infrastructure; Swiss Re, Munich Re, and Guy Carpenter contributed catastrophe modeling, pricing expertise, and investor distribution; and the Philippine government integrated the instrument into its national disaster risk financing strategy. For banks, the design offers transferable lessons: the use of a credible intermediary to reassure investors, the alignment of payout triggers with pre-defined policy frameworks, and the blending of sovereign and private-sector capacities to achieve both fiscal resilience and market appeal.

6.2 Practical Applications of Insurance-Inspired Lending

Several banks are increasingly developing lending products that integrate physical risk considerations inspired by core principles of the insurance sector. These products often incorporate features drawn from parametric insurance, such as objective event triggers, rapid disbursement or repayment relief mechanisms, and incentive-based pricing, into loan structures that both support borrower adaptation and mitigate lender risk. Parametric logic is also embedded in loan contracts for microfinance and agricultural lending, triggering repayment grace periods or interest rate adjustments when climate thresholds are breached. These parametric-triggered loans reduce default risk and strengthen trust between borrowers and lenders. Moreover, resilience-linked loans can be provided, for example, to farmers, SMEs, local governments, and utility companies with terms linked to disaster resilience outcomes. These loan schemes lower interest rates if the borrower adopts climate adaptation measures (see [Shirai 2025] for details with regard to adaptation finance).

The following examples illustrate diverse approaches, with emphasis on verified practices:

Rabobank (Netherlands) has been a pioneer in combining agricultural credit with weather index insurance to shield smallholder farmers from climate-related shocks such as prolonged droughts, erratic rainfall, and floods. Through its Rabo Partnerships platform, the bank has partnered with specialist providers like Pula to embed yield-based crop insurance directly into loan products. Under this arrangement, insurance payouts are triggered when independently measured yield losses occur, allowing farmers to maintain repayment capacity even in adverse seasons. By applying principles similar to parametric insurance—linking payouts to objective indicators such as weather patterns and yield data—Rabobank helps to reduce credit default risk while strengthening farmer resilience. These bundled products not only protect farmers’ livelihoods but also help unlock local bank lending to smallholder segments that are often underserved due to high perceived risks. Moreover, the integration of environmental and agricultural data into credit design enables Rabobank to monitor portfolio quality more effectively, align with ESG commitments, and support rural economic development. Taken together, these innovations illustrate how climate-smart finance can simultaneously improve loan performance, extend financial inclusion, and contribute to long-term adaptation strategies in vulnerable farming communities (Rabobank 2023, 2024). This is an example of parametric-triggered loans.

BNP Paribas (France) has incorporated physical risk considerations into its lending portfolio and risk management frameworks, using climate scenario analysis and sectoral stress tests to evaluate exposure to floods, droughts, and other extreme weather events. Building on this foundation, the bank is exploring sustainability-linked loan structures that reward adaptation efforts by tying financial incentives to measurable resilience outcomes. BNP Paribas also actively collaborates with multilateral institutions—most notably the European Investment Bank—to mobilize concessional finance and technical assistance for resilience-enhancing investments. Such initiatives encompass areas like upgrading drainage and transport infrastructure, adopting certified drought-resistant crops, and flood-proofing industrial facilities. These mechanisms are often structured through syndicated and blended finance platforms, allowing BNP Paribas to scale risk-sharing across sectors and geographies. Within the broader umbrella of ESG and sustainable finance strategies, these frameworks are reinforced by performance monitoring

covenants, linking credit terms directly to verified adaptation milestones and strengthening accountability to investors and regulators. (BNP Paribas 2024, 2025). This is an example of resilience-linked loans.

Mitsubishi UFJ Financial Group (MUFG, Japan) demonstrates how large banks can align lending operations with national policy frameworks. Under the Bank of Japan's *Climate Response Financing Operations*, MUFG can access low-cost funding when it extends loans to climate-related projects, including disaster-resilient infrastructure such as flood defenses, seismic retrofitting, and supply-chain reinforcement. This program reduces MUFG's own funding costs, enabling it to expand concessional or preferential lending terms for eligible borrowers. Project assessments often draw on municipal-level hazard maps and local government collaboration to allocate capital to high-risk areas (MUFG 2024).

YES Bank (India) has focused on community-level climate resilience in water-stressed and disaster-prone regions. The bank offers concessional loans to cooperatives and self-help groups for adaptive infrastructure, such as solar-powered irrigation, drip irrigation systems, and moisture-conserving agricultural practices, sometimes paired with flexible repayment schedules aligned with seasonal incomes. Working with local governments, nongovernment organizations, and technical consultants, YES Bank delivers financial literacy, on-site monitoring, and capacity-building, ensuring that adaptation measures are both technically sound and socially embedded (YES Bank 2023).

Bank Negara Indonesia (BNI, Indonesia) has introduced climate-resilient financing products aimed at agricultural and coastal sectors, integrating adaptation requirements into eligibility criteria. For example, borrowers may need to adopt water-saving irrigation or mangrove restoration practices to qualify for subsidized interest rates. The bank coordinates with Indonesia's Meteorological Agency to incorporate seasonal forecasts into loan scheduling and repayment grace periods. In flood-prone regions, loans may be bundled with government-backed index insurance schemes to provide repayment relief when hazard thresholds are met (BNI 2024; Infobank News 2024). This is also an example of resilience-linked loans.

Banco do Brasil (Brazil) is a major participant in Brazil's national low-carbon agriculture program, known as ABC+ (now RenovAgro). The program provides credit lines that support farmers adopting sustainable and climate-resilient practices such as no-till farming, agroforestry, and pasture recovery. As Brazil's largest

agricultural lender, the bank channels significant financing through RenovAgro and reports billions of reais annually in concessional-style loans to producers engaged in low-carbon agriculture initiatives (Banco do Brasil 2024). Research indicates that Brazil's ABC/ABC+ credit program has played an important role in promoting pasture recovery and reducing greenhouse gas emissions, with discussions also highlighting the use of satellite monitoring, geospatial tools, and proposals to pair concessional credit with parametric insurance instruments to protect farmers' repayment capacity under climate stress (Climate Policy Initiative 2023).

Across these diverse models, common design elements emerge: integration of objective climate or hazard data into credit decisions, conditional incentives tied to verified adaptation measures, and the strategic use of risk-transfer mechanisms, whether via insurance products, reinsurance partnerships, or public guarantee schemes. By adopting such operational and contractual features, banks can strengthen financial stability, safeguard portfolio quality, and accelerate investment in climate-resilient assets.

6.3 Overcoming Barriers to Operationalizing Physical Risk Management

Operationalizing physical risk management in the banking sector requires more than internal governance and product innovation. To achieve systemic impact, banks must coordinate with financial regulators and national governments to establish an enabling policy environment. This includes integrating climate risk disclosure into supervisory and prudential frameworks, and developing clear classification systems for adaptation and resilience investments, often referred to as taxonomies. Ideally, such taxonomies should be developed or endorsed by governments or regulatory bodies, ensuring legal authority, consistency across sectors, and credibility in the eyes of investors. Publicly led taxonomies also help prevent "greenwashing" or "adaptation-washing" by providing standardized criteria. Harmonized standards across jurisdictions are particularly crucial for globally active financial institutions, enabling comparability, reducing compliance complexity, and fostering cross-border capital flows into climate-resilient projects.

Furthermore, capacity building remains essential, particularly in developing countries where banks often lack the technical tools, data infrastructure, and risk analytics needed to assess and manage physical risks effectively. International development institutions,

central banks, and transnational knowledge platforms such as the NGFS, UNEP FI, and the Climate Financial Risk Forum can play a vital role in disseminating methodologies, data platforms, and implementation toolkits adapted to local contexts. The Climate Financial Risk Forum is an industry forum set by financial regulators in the UK to develop practical tools together with the financial sector for managing climate-related financial risks and opportunities. Technical cooperation, regulatory dialogues, and peer learning platforms are key vehicles for scaling such efforts.

An emerging frontier is the securitization of climate-adaptive portfolios. Bundling resilience-linked or parametric-triggered loans, as illustrated above, into climate-themed asset-backed securities could offer opportunities for risk diversification, capital recycling, and broader investor participation. While market precedents are limited, examples such as the European Bank for Reconstruction and Development's Climate Resilience Bond and the World Bank's catastrophe bond programs illustrate potential structuring models. Establishing robust secondary markets for such instruments would require clear performance metrics, third-party verification standards, and supervisory clarity on their regulatory treatment. Some central banks and regulators are exploring differentiated capital requirements or risk-weightings for climate-resilient collateral, which, if implemented, could further stimulate development of this market.

Finally, financial inclusion must remain central to these efforts. Climate risk disproportionately affects micro, small, and vulnerable borrowers, many of whom operate in informal economies or climate-exposed sectors. Embedding resilience into inclusive finance through targeted concessional terms, digital delivery mechanisms such as mobile-based lending, and bundled risk-transfer instruments (e.g., index insurance) ensures that adaptation benefits extend beyond well-capitalized clients. However, the design of such mechanisms must account for basis risk and affordability constraints. By fostering partnerships with fintechs, community organizations, and local authorities, banks can help scale these solutions, ensuring that climate adaptation is a shared societal endeavor.

Learning from the insurance sector offers banks a powerful pathway to build more robust, adaptive, and transparent systems for managing physical risks. By integrating clear risk appetite frameworks, strategic risk transfer tools, and cross-sector partnerships, banks can not only protect their own stability but also catalyze climate resilience across economies.

7. Conclusion

This policy brief has examined the growing importance of physical risks in the banking sector and explored the evolving strategies, tools, and regulatory expectations that shape its management. As climate change intensifies, banks are increasingly exposed to both acute and chronic hazards—ranging from floods and storms to droughts and heatwaves—that can impair asset quality, erode collateral values, and disrupt client operations across sectors and geographies. The integration of physical risk into banking practices is no longer a conceptual ambition but a practical imperative for safeguarding financial stability and aligning with long-term sustainability objectives.

At the macro level, frameworks such as the NGFS Climate Scenarios, including short- and long-term scenarios, are equipping regulators and financial institutions with tools to assess the systemic impact of climate shocks. These scenarios provide forward-looking insights into how physical risks may unfold across economic, sectoral, and regional dimensions. Furthermore, the NGFS's work on adaptation finance, including its conceptual framework and target setting, has expanded the risk management lens to encompass resilience-building activities and offered guidance on how financial institutions can categorize, measure, and support such investments.

At the micro level, banks are beginning to embed physical risk assessment into portfolio management, guided by supervisory expectations, disclosure standards such as ISSB IFRS S2 Climate-related Disclosures, and peer benchmarking. Scenario analysis, hazard mapping, and borrower-level vulnerability assessments are being integrated into governance structures, lending processes, and product innovation. In both developed and developing countries, banks are experimenting with resilience-linked and parametric-triggered loan products—often in collaboration with insurers, governments, or development agencies—to close the insurance protection gap, while also addressing basis risk and affordability challenges.

Significant challenges remain, however. Technical capacity constraints, data limitations, fragmented taxonomies across jurisdictions, and underdeveloped adaptation finance markets, and the limited secondary market for resilience-linked ABS continue to hinder progress, particularly in low- and middle-income countries. Addressing these barriers will require coordinated action between public and private sectors, supported by global platforms such as the NGFS, the G20

Sustainable Finance Working Group, and international standard setters.

Ultimately, the convergence of banking and insurance approaches offers a powerful pathway to internalize physical risks into financial decision-making. Banks must move beyond risk avoidance and become active enablers of climate adaptation by leveraging their financial

architecture to allocate capital toward resilience. By embedding physical risk into governance, scenario planning, product design, and supervisory engagement, banks can help reshape financial systems for a more climate-resilient future. The transition from conceptual awareness to operational readiness is underway—and must accelerate in the face of rising climate volatility and societal expectations.

References

- African Risk Capacity (ARC). 2024. 2023 Annual Report: Celebrating a Decade of Impact. ARC Ltd. <https://www.arc.int/sites/default/files/2024-09/ARC%20Ltd%20Annual%20Report%202023.pdf>.
- Artemis.bm. (n.d.). Catastrophe Bonds & ILS issued and Outstanding by Year [Data dashboard]. Artemis. <https://www.artemis.bm/dashboard/catastrophe-bonds-ils-issued-and-outstanding-by-year/> (accessed 14 August 2025).
- Banco do Brazil. 2024. Banco do Brasil Sustainable Finance Framework – Second-Party Opinion. *Sustainalytics*. 8 March. https://api.mziq.com/mzfilemanager/v2/d/5760dff3-15e1-4962-9e81-322a0b3d0bbd/cd1b3730-c6a9-6d96-1b45-df390d0b4f86?origin=2&utm_source=chatgpt.com.
- Bank Negara Indonesia (BNI). 2024. *Moving Towards a Sustainable Future*. https://www.bni.co.id/Portals/1/BNI/Perusahaan/HubunganInvestor/Docs/SR-BNI-2023-ENG-final_highres.pdf.
- Basel Committee on Banking Supervision (BCBS). 2022. Principles for the Effective Management and Supervision of Climate-Related Financial Risks. 15 June. <https://www.bis.org/bcbs/publ/d532.htm>.
- . 2024. Core Principles for Effective Banking Supervision. 25 April. <https://www.bis.org/bcbs/publ/d573.htm>.
- . 2025. A Framework for the Voluntary Disclosure of Climate-Related Financial Risks. 13 June. <https://www.bis.org/bcbs/publ/d597.htm>.
- BNP Paribas. 2024. *Climate Report: Strategy, Risks & Opportunities, Net Zero Commitments*. May. https://cdn-group.bnpparibas.com/uploads/file/bnp_paribas_2023_climate_report.pdf?utm_source=chatgpt.com.
- . 2025. *ACTS White Paper: EMEA Edition*. 2025. January. <https://cib.bnpparibas/app/uploads/sites/2/2025/02/acts-white-paper-2025-published-bnp-paribas-cib-2.pdf>.
- Caribbean Catastrophe Risk Insurance Facility SPC (CCRIF). 2023. Annual Report 2022–2023. https://www.ccrif.org/publications/annual-report/ccrif-spc-annual-report-2022-2023?language_content_entity=en.
- Castoldi, A., G. Lucini, B. Micale, A. Benayad, and M. Coppola. 2024. How Banks Can Transform Physical Climate Risk into an Opportunity. White Paper, Boston Consulting Group. <https://media-publications.bcg.com/How-Banks-Can-Transform-Physical-Climate-Risk-into-an-Opportunity.pdf>.
- Climate Bonds Initiative (CBI). 2024. Climate Bonds Resilience Taxonomy Methodology. 24 March. https://www.climatebonds.net/files/documents/supporting-documents/Climate-Bonds_Resilience-Methodology_2024.pdf.
- Climate Policy Initiative. 2023. Landscape of Climate Finance for Land Use in Brazil. <https://www.climatepolicyinitiative.org/wp-content/uploads/2023/09/Landscape-of-Climate-Finance-for-Land-Use-in-Brazil.pdf>.
- European Commission. 2022. Commission Notice on the Interpretation of Certain Legal Provisions of the Disclosures Delegated Act under Article 8 of EU Taxonomy Regulation on the Reporting of Eligible Economic Activities and Assets. 6 October. [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52022XC1006\(01\)](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52022XC1006(01)).
- European Investment Bank. 2022. Joint Methodology for Tracking Climate Change Adaptation Finance, Joint Report on Multilateral Development Banks' Climate Finance. <https://thedocs.worldbank.org/en/doc/20cd787e947dbf44598741469538a4b-0020012022/original/20220242-mdbs-joint-methodology-climate-change-adaptation-finance-en.pdf>.
- Evans, S. 2024. African Risk Capacity Ltd. (ARC), Munich Re Back Parametric Cover Integrated into Disaster Adapted Loan. Artemis. 4 October. <https://www.artemis.bm/news/arc-munich-re-back-parametric-cover-integrated-into-disaster-adapted-loan>.

- Green Finance Institute. 2024. Framework to Develop a UK Green Taxonomy for Adaptation and Resilience Developed by the Land, Nature and Adapted Systems (LNAS) Advisory Group. <https://www.greenfinanceinstitute.com/wp-content/uploads/2024/12/LNAS-Framework-to-develop-a-UK-Green-Taxonomy-for-adaptation-and-resilience.pdf>.
- Infobank News. 2024. BNI Salurkan Kredit Hijau Rp188 Triliun di Kuartal III 2024, 25 October. <https://infobanknews.com/bni-salurkan-kredit-hijau-rp188-triliun-di-kuartal-iii-2024/>.
- Intergovernmental Panel on Climate Change (IPCC). 2022a. Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Edited by H.-O. Pörtner, D.C. Roberts, M. Tignor, et al. Cambridge, UK and New York: Cambridge University Press. <https://www.ipcc.ch/report/ar6/wg2/>.
- . 2022b. Annex II: Glossary. In Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York: Cambridge University Press. pp. 2897–2930. <https://www.ipcc.ch/report/ar6/wg2/chapter/annex-ii/>.
- International Sustainability Standards Board (ISSB). 2023. IFRS S2 Climate-Related Disclosures. IFRS Foundation. 26 June. <https://www.ifrs.org/issued-standards/ifrs-sustainability-standards-navigator/ifrs-s2-climate-related-disclosures/>.
- . 2024. ISSB Delivers Further Harmonisation of the Sustainability Disclosure Landscape as It Embarks on New Work Plan. 24 June. https://www.ifrs.org/news-and-events/news/2024/06/issb-delivers-further-harmonisation-of-the-sustainability-disclosure-landscape-new-work-plan/?utm_source=chatgpt.com.
- . 2025. IFRS Foundation Publishes Guidance on Disclosures about Transition Plans. 23 June. https://www.ifrs.org/news-and-events/news/2025/06/ifrs-publishes-guidance-disclosures-transition-plans/?utm_source=chatgpt.com.
- Ministry of Agriculture, Livestock and Food Supply (MAPA). 2023. Low Carbon Agriculture: The ABC Plan in Brazil. Brasília: Government of Brazil. 1 December. https://assets.fsfnforum.fao.org/public/contributions/2024/Publication_Low%20Carbon%20Agriculture_ABC%20Plan_2023_Brazil_0_0.pdf.
- Mitsubishi UFJ Financial Group (MUFG). 2024. *Climate Report 2024*. https://www.mufig.jp/dam/csr/report/progress/climate2024_summary_en.pdf.
- Munich Re & United Nations Environmental Programme Financial Initiative (UNEP FI). 2024. Managing Physical Climate-Related Risks in Loan Portfolios: Technical Supplement to the 2024 Climate Risk Landscape Report. United Nations Environment Programme Finance Initiative. <https://www.unepfi.org/themes/climate-change/managing-physical-climate-related-risks-in-loan-portfolios/>.
- Network for Greening the Financial System (NGFS). 2024. NGFS Conceptual Note on Adaptation. Technical document. 13 November. https://www.ngfs.net/system/files/import/ngfs/medias/documents/ngfs_conceptual_note_on_adaptation.pdf.
- . 2025a. NGFS Short-Term Scenarios for Central Banks and Supervisors, Workstream on Scenario Design and Analysis 7 May. <https://www.ngfs.net/en/publications-and-statistics/publications/ngfs-short-term-climate-scenarios-central-banks-and-supervisors>.
- . 2025b. Technical Note Target Setting and Transition Plans. 16 July. <https://www.ngfs.net/en/publications-and-statistics/publications/ngfs-notes-relating-transition-plans-climate-target-setting-and-climate-scenario-analysis%3F>.
- . 2025c. NGFS Input Paper on Integrating Adaptation and Resilience into Transition Plans. 22 July 2025. <https://www.ngfs.net/en/publications-and-statistics/publications/ngfs-input-paper-integrating-adaptation-and-resilience-transition-plans>.
- Organisation for Economic Co-operation and Development (OECD). 2024a. Fostering Catastrophe Bond Markets in Asia and the Pacific, 14 February. https://www.oecd.org/en/publications/fostering-catastrophe-bond-markets-in-asia-and-the-pacific_ab1e49ef-en.html?utm_source=chatgpt.com.
- . 2024b. Development Finance Statistics: Resources for Reporting. 30 October. <https://www.oecd.org/en/data/insights/data-explainers/2024/10/resources-for-reporting-development-finance-statistics.html>.
- Rabobank. 2023. A Quick Look at How Rabobank Acts on Climate. 19 December. <https://www.rabobank.com/about-us/impact/article/011405879/a-quick-look-at-how-rabobank-acts-on-climat>.
- . 2024. Crop Insurance: The Collaborative Journey of Rabo Partnerships & Pula. Rabobank, 22 January. <https://www.rabobank.com/about-us/rabo-partnerships/stories/011408532/crop-insurance-the-collaborative-journey-of-rabo-partnerships-pula>.
- Risk & Insurance. 2024. ILS Market Capacity Hit \$100 Billion in 2023. 18 March. <https://riskandinsurance.com/ils-market-capacity-hit-100-billion-in-2023>.
- Shirai, S. 2025. Evolving Frameworks for Adaptation, Resilience, and Disaster Risk Finance: Basic concepts, Financing Gaps, Disclosure, and Taxonomies. ADBI Policy Brief No. 202513. Asian Development Bank Institute. <https://www.adb.org/publications/evolving-frameworks-for-adaptation-resilience-and-disaster-risk-finance-basic-concepts-financing-gaps-disclosure-and-taxonomies>.
- United Nations Environmental Programme Financial Initiative (UNEP FI). 2023. Climate Adaptation Target Setting, Principles for Responsible Banking: Guidance for Banks. <https://www.unepfi.org/wordpress/wp-content/uploads/2023/11/PRB-Adaptation-Target-Setting-Guidance.pdf>.

- . 2024. Climate Risk Landscape Report. Geneva. <https://www.unepfi.org/wordpress/wp-content/uploads/2024/04/Climate-Risk-Landscape-2024.pdf>.
- World Bank. 2012. FONDEN: Mexico's Natural Disaster Fund – A Review. Washington, DC: World Bank. <https://hdl.handle.net/10986/26881>.
- . 2022. The Philippines: Transferring the Cost of Severe Natural Disasters to Capital Markets. Case Study. https://thedocs.worldbank.org/en/doc/58d421407f57c5eb8d0f35ad843ae474-0340012022/original/case-study-Philippines-CAT-bond.pdf?utm_source=chatgpt.com.
- . 2024. World Bank Returns to the Cat Bond Market Providing Financial Protection to Jamaica. International Bank for Reconstruction and Development. April 25. <https://www.worldbank.org/en/news/press-release/2024/04/25/world-bank-returns-to-the-cat-bond-market-providing-financial-protection-to-jamaica>.
- . 2025. World Bank Catastrophe Bond Renews \$150 Million Hurricane Coverage for Jamaica. 27 February. <https://thedocs.worldbank.org/en/doc/401877c87631461af8ad227793affc5f-0340012025/original/Case-Study-Jamaica-2024-Cat-Bond.pdf>.
- YES Bank Limited. 2023. CDP Climate Change Questionnaire 2023, July. https://www.yesbank.in/content/published/api/v1.1/assets/CONT8736D17AC62E4C9F8822E01F9669074F/native/ybl_cdp_climate_change_questionnaire_2023.pdf?download=false&channelToken=21f7ccfa2fc3401091938f541a6f8f2a.

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