



Physical Climate Risk

FSS International Conference

2 September 2026

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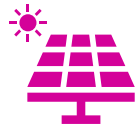
Two climate risks – Transition vs. Physical

Transition risk

- Financial and non-financial impact from the **process of transition towards a low-carbon economy**:



Policy & legal



Technology



Market sentiment



Investor/customer preference

Physical risk

- Financial and non-financial impact from the **physical effects of environmental factors**:

Acute

Event-driven, increase of frequency or severity due to climate change



Wildfires



Storms & hurricanes



Drought

Chronic

Long-term shifts in climate patterns



Sea level rise



Temperature change



Water scarcity

Extreme heat is becoming a macro-financial risk

0.3-0.5%

GDP impact

Labour productivity losses during Europe's most severe heat years

>1%

Impact in highly exposed regions

Output losses are substantially higher in vulnerable locations

0.3%

Immediate economic loss

Estimated European output loss from heatwaves, droughts and floods in summer 2025

0.8%

Cumulative impact

Potential accumulated economic damage by 2029

+0.4-0.9pp

Inflationary pressure

Potential increase in food inflation from heatwaves and drought

Heatwaves have economy-wide impacts

- **Productivity:** Heat stress reduces labour productivity and disrupts labour-intensive activities
- **Essential systems:** Health services, energy infrastructure, transport and tourism face higher disruption and operating costs
- **Asset resilience:** Buildings and infrastructure designed for historical climate conditions may be increasingly vulnerable
- **Financial transmission:** Lower revenues, higher costs and operational disruptions can weaken borrowers' credit profiles and ultimately affect bank portfolios

**Physical risk is no longer only an environmental issue.
It is increasingly a growth, inflation and credit risk issue.**

Physical climate risk affects every major bank risk type

Credit risk

Physical hazards can affect borrower revenues, costs, margins and credit quality through operational disruption

Collateral risk

Floods, heatwaves, wildfires and changing insurance availability can affect asset values and recovery rates

Operational risk

Bank operations, including branches, data centres, employees, third-party providers and business continuity arrangements, may be disrupted

Concentration risk

Geographic concentrations, sector exposures and shared infrastructure can amplify correlated losses

Market & liquidity risk

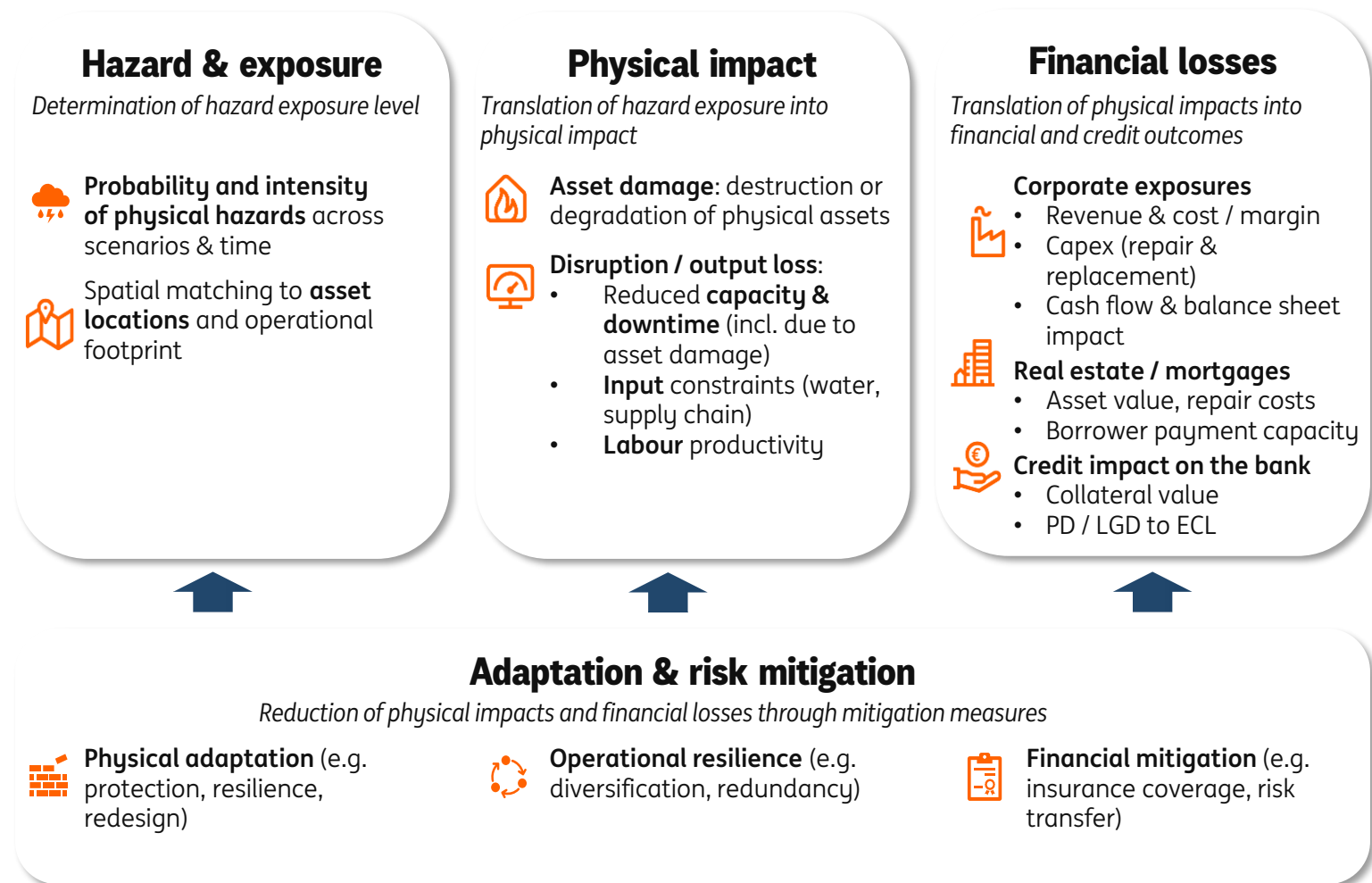
Asset repricing, declining collateral values and shifting funding-market sentiment can transmit and amplify shocks

Strategic risk

Banks that fail to address physical climate risk may lose client relevance, business opportunities and long-term growth potential

From location-specific hazard exposure to financial and credit impact

Translating hazard exposure into physical impacts, financial losses and credit risk to inform risk appetite, lending and portfolio management



Use Cases

Risk Appetite Setting (RAS)

- Assess portfolio exposure to location-specific hazards and associated financial impacts
- Inform limits, concentration management, and mitigation requirements

Lending decisions

- Assess physical risk at asset, site, or firm level for new and existing exposures
- Identify material risks and required mitigants (e.g. adaptation, insurance)

Stress-testing and scenario analysis

- Evaluate potential impacts under adverse climate scenarios
- Quantify sensitivity to hazard intensification and disruption risks

Credit risk and capital impact

- Translate physical impacts into borrower financials and credit risk
- Inform probability of default (PD), loss given default (LGD) and expected credit loss (ECL)

Dealing with uncertainty in risk management – options & limitations

Physical climate risks pose challenges for banks' decision-making frameworks. Unlike conventional financial risks, physical risk losses are characterized by **uncertainty**: it is often impossible to assign precise probabilities or reliable historical benchmarks, since climate change introduces non-linear dynamics

Risk Assessment

Materiality

Use **longer-term scenario horizons** and stress severe outcomes (e.g. 1-in-200-year events) **prior to mitigation** such as insurance to understand inherent risk

Assess credit quality & income deterioration

Stress testing

Embrace scenario analysis **considering multiple “worst-case” stress tests**. As physical risk compounds over time short term solvency impact will be limited today.

IFRS9

Emphasizes **“reasonable and supportable” forward-looking scenarios over a relatively short horizon** (typically up to 5–10 years, reflecting exposure lifetimes and forecast limits), focusing on **likely outcomes**

Risk Appetite & Monitoring

Risk Appetite

Exposure boundaries to climate-vulnerable segments used not to restrict lending but to diversify and set trigger for re-evaluation of mitigants.

- Properties in high flood-risk zones to X% of the mortgage portfolio
- limit the share of corporate lending to “high physical risk” sectors based on credit quality impact

Use **inherent risk only taking into account adaptation & resilience**

Monitoring

Climate early-warning indicators (e.g., a spike in uninsurable properties, rising insurance claims, local climate policy changes), proper loss tagging

Underwriting & Loan Origination

Counterparty risk assessment

- Sensitivity check including financial impacts from physical risks (damage, income loss, ...)
- Consideration of adaptation costs



Adaptation & Resilience



Physical adaptation (e.g. protection, resilience, redesign)



Operational resilience (e.g. diversification, redundancy)



Risk Transfer (e.g. insurance coverage, risk transfer)



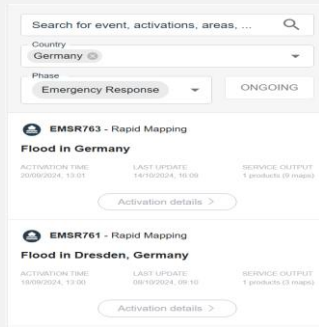
Risk Adjustments (e.g. collateral valuation, exclusion)

Approaches for better attribution of physical risk impacts

Identification of impacted collaterals based on event mapping

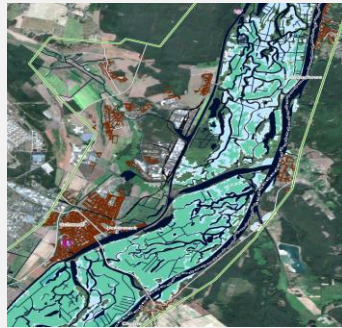
Event Identification

Copernicus satellites recognize extreme weather events like **Flood, Wildfire, Earthquake, Storm & Volcanic eruptions** and activates an event



Event evaluation

After the event Copernicus provides the area of interest and maps out which type of areas were affected – **if residential areas were affected, we proceed**



Asset mapping

If residential build ups were affected, we **check whether the houses which back our mortgages are within the area of interest** on two accuracy levels rooftop or postal code



Engagement

For those houses where we know the **exact location (geocoordinates)** we can determine whether they are in the area of interest

For those where we don't have the exact location due to data issues, we can use **postal codes as a proxy**

Results are then sent to the taskforce for further processing and tagging

Identification of physical risk connection of existing losses

Default identification

Defaults were linked to **global hazard events** (earthquakes, floods, droughts, wildfires) using **geographical and time (0-15 months) overlap**. Resulted in 770 hazard events that were matched to at least 1 default

Identify casual link

Potential matches were narrowed to **medium/high severity hazards only**. This resulted in 38 events. Focused on most **vulnerable sectors** and conducted **qualitative analysis** confirm causal links

Tagging logic (exemplary)

Argentina's economic downturn, high inflation, and tightening credit conditions in 2019 heavily restricted companies' ability to refinance debt.

While multiple factors were present a prolonged drought acted as an important driver

Adaptation finance: From risk mitigation to investment opportunity

US\$1.8 trillion

In global adaptation investments

Investment across five adaptation areas globally from 2020 to 2030: early warning systems, climate-resilient infrastructure, improved dryland agriculture, mangrove protection and resilient water resources.

Up to US\$3.6-18 trillion

Potential returns from adaptation investments

Adaptation investments can generate benefit-cost ratios ranging from approximately 2:1 to 10:1 through avoided losses, enhanced resilience and wider economic benefits

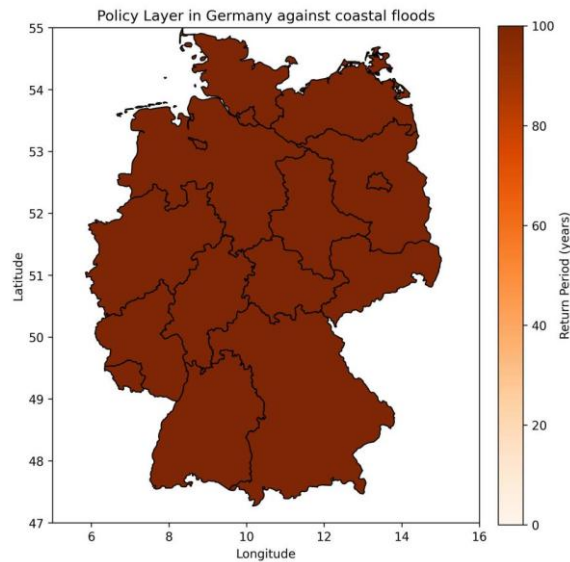
Why adaptation finance matters

- **Protects asset values and collateral quality** through resilient infrastructure, retrofits and climate-proofing measures, and other systems against physical climate hazards
- **Reduces borrower vulnerability** to physical disruptions such as floods, heatwaves, droughts and storms
- **Creates investable financing opportunities** across water, agriculture, resilient buildings, coastal protection and nature-based solutions
- **Supports portfolio resilience** by reducing long-term credit losses and climate-related financial impacts

Prioritize mitigation that improve resilience under any future

Policy Layer

Relative to normative standards of protection, which is the rule-based data that **reflects the regulations standards** or **governmental directives** against the flood. **These are not evidence-based defenses**



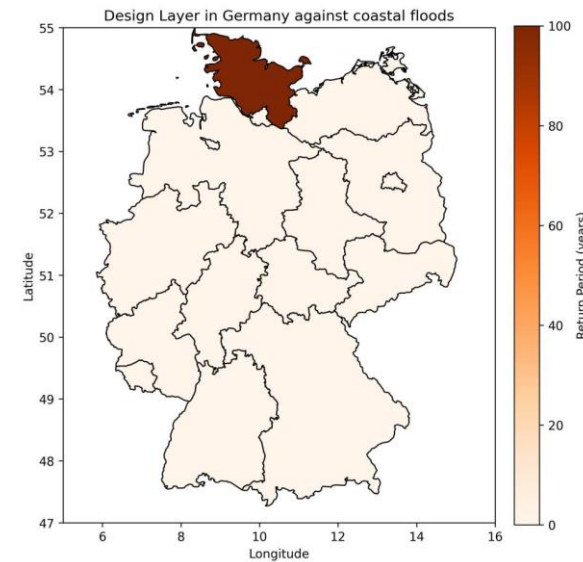
Insurance layer

Private **insurance** and **public insurance schemes** that insure against natural hazards differ per jurisdiction, have their own terms and conditions and are not always guaranteed



Macro Design Layer

Provides information on construction standard of existing protection measures, which is the evidence-based data that **shows actual protections against the flood.**



Counterparty Adaptation

Collects information from corporates and asset level protection against natural hazards such as **flood protection, water management plans**

Incentivize early adaptation measures and proactive risk reduction such as:



Physical and technical modifications - to protect infrastructure and assets (relocation, flood barriers)



Process adaptation - e.g. Water management strategies, alternative raw materials



Supply Chain & Logistics Continuity - e.g. Supply Chain Diversification, stock piling, alternate multi-modal transport routes



Nature based solution - e.g. Restoring wetlands, Mangrove re-forestation for coastal flood protection

A practical action agenda for banks

Translating physical climate risk insights into resilient outcomes

1



Map exposure

Build an exposure baseline across asset, collateral, client location and supply-chains

2



Quantify impact

Apply scenario analysis and stress testing to assess losses beyond historical experience

3



Integrate decisions

Integrate physical climate risk into underwriting, pricing, limits, collateral valuation and capital allocation

4



Engage clients

Discuss resilience plans, adaptation investment, insurance coverage and business continuity strategies

5



Finance resilience

Structure loans, bonds and advisory solutions that support resilient assets, systems and infrastructure

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