Integrating Climate Risks in Credit and Risk Management

The how-to guide to ensure efficient and compliant implementation of climate risks in the credit and risk management process

April 2025

Envira
SUSTAINABILITY ANALYTICS

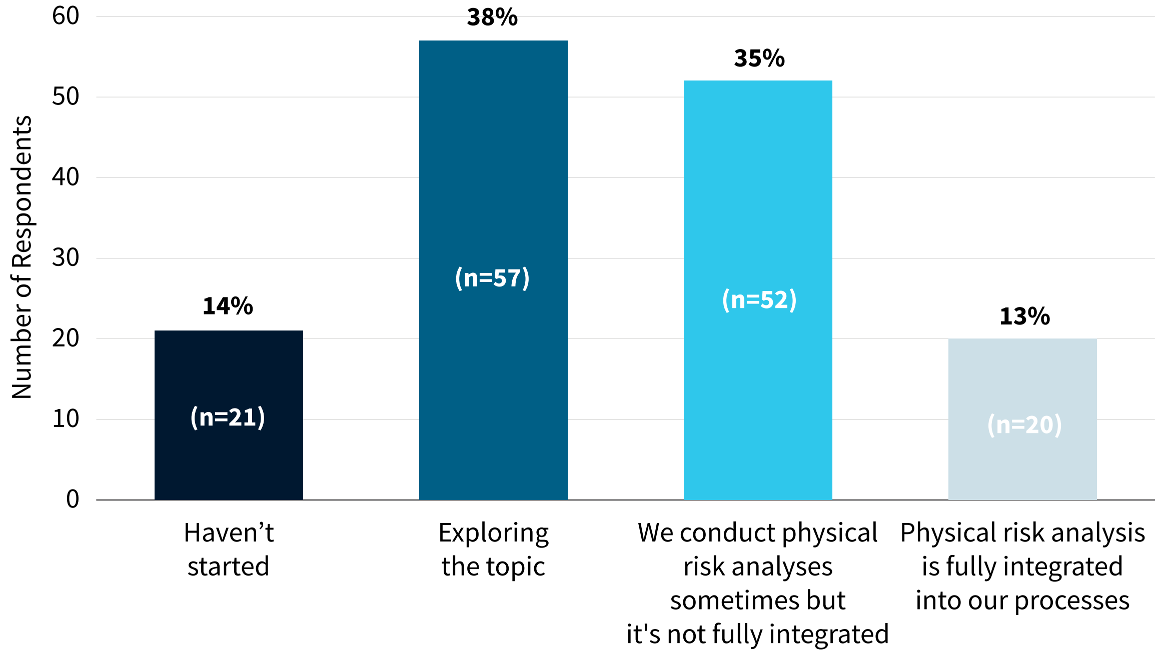
Introduction

Climate Change – From CSR to Real Risk Management

Traditionally, climate change and sustainability in the financial sector have been treated as part of Corporate Social Responsibility (CSR) – an area often seen as separate from core financial risk management. Historically, banks and other financial institutions have engaged in voluntary sustainability initiatives, often focusing on reputational benefits and stakeholder expectations rather than integrating climate risks into their fundamental risk assessment and decision-making processes. However, the regulatory landscape is undergoing a fundamental shift, with climate-related risks now being recognized as financial risks that must be systematically assessed and managed within prudential frameworks.

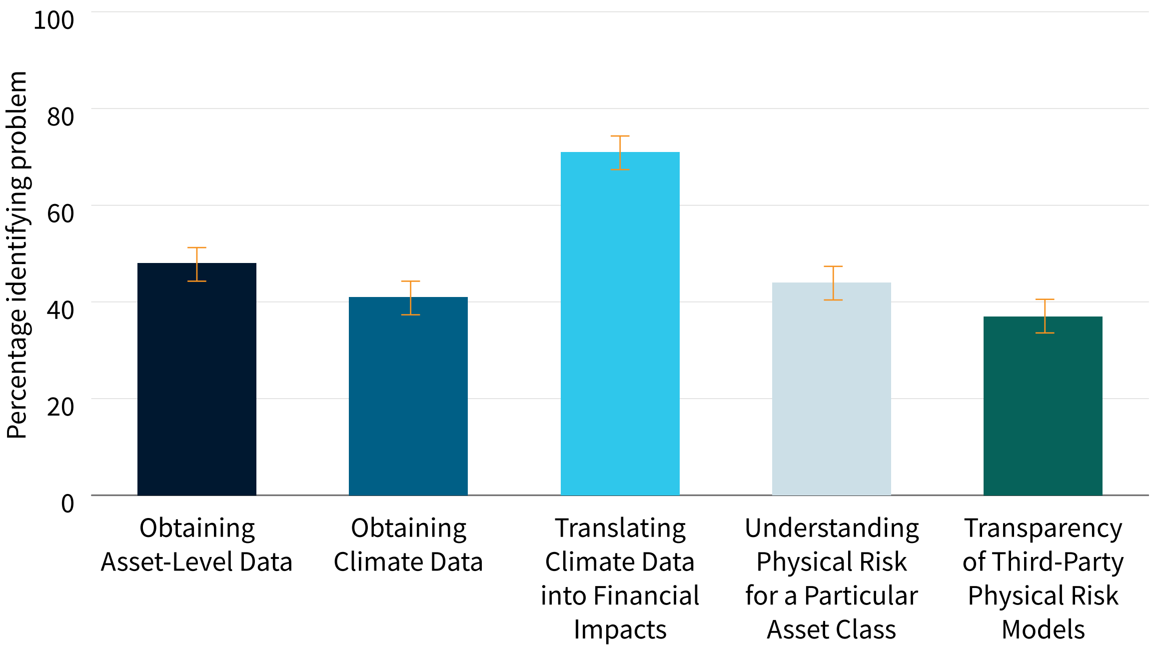
While most banks internationally have some experience working with physical climate-related risk, it is still a new field for many. As can be seen in figure 1, the majority of finance professionals responding to a recent Bloomberg survey answer that their institution is in the process of

Figure 1: Physical Risk Analysis Adoption by Finance Professionals (Bloomberg Survey)



Source: Own calculations based on data from Bloomberg, Feb 19, 2025.

Figure 2: Main Challenges of Integrating Climate Risks into Risk Governance Systems



Source: Own calculations based on data from Bloomberg, Feb 19, 2025.

integrating physical climate risks in the risk management frameworks. However, the vast majority reply that physical risks are not fully integrated; rather analyses are "sometimes" carried out, or they are simply exploring the topic (the largest group). While not a representative survey, this conforms very well with our experiences within the climate risk sphere. This is understandable. As we will discuss, the need for a comprehensive approach to climate risk management *is* a rather novel phenomenon, and one that requires a set of novel analytic approaches. This white paper aims to ease the way into no-fuss, compliant physical climate risk management.

When looking at the key challenges in integrating physical risks into credit and risk management processes, it becomes clear that there are substantial challenges for institutions. Even with the expansion of available data, obtaining relevant and granular asset-level data can be challenging for many types of clients. However, the biggest challenge lies in translating climate and physical risk data into financial risk metrics that are usable for banks (see Figure 2).

Moving from an IPCC stylized climate-change trajectory and some asset-level risk scores towards a financial climate risk assessment is not straightforward.

Whereas a few years ago, just accessing some kind of physical risk data was difficult, the focus is now moving to the integration of climate risk data with financial modelling.

This white paper provides a framework for integrating these data sources into a decision-useful financial risk assessment that can be applied to various sectors within credit and risk management.

With the introduction of the *Capital Requirements Regulation* (CRR III) and *Capital Requirements Directive* (CRD VI) from 2025, banks are now required to incorporate Environmental, Social, and Governance (ESG) risks into their core risk management frameworks, governance structures, and strategic decision-making. With the new rules, banks are required to integrate ESG risks into their risk appetite frameworks, internal controls, and supervisory reporting processes. This marks a departure from treating sustainability as an advertising, compliance or reporting obligation and instead embedding it into fundamental credit risk assessment and portfolio management.

Climate risks are particularly emphasized within the new regulations, as both physical risks (e.g., extreme weather events, rising sea levels) and transition risks (e.g., regulatory changes, shifts in market preferences, and technological disruptions) have the potential to significantly impact banks materially. These risks can be potential drivers of all traditional categories of financial risks, including credit, market, operational, reputational, liquidity, business model, and concentration risks. Financial institutions must now quantify these risks and integrate them into their Internal Ratings-Based (IRB) models, stress testing frameworks, and overall risk governance.

Scope and Focus

This white paper serves as a practical guide to ensuring an efficient and compliant implementation of the new CRR III/CRD VI requirements, with a particular focus on integrating climate risks into the credit process and ongoing risk management. While broader aspects of risk management, including other risk categories, in banking are beyond the scope of this document, it will focus on clear methodologies for identifying, assessing, and incorporating ESG risks into credit assessments, portfolio analysis, and scenario modeling.

Based on the new regulation and supervisory guidance, the paper will lay out a step-by-step approach to conceptualizing, ordering, and quantifying the multiple climate-related risks associated with lending activities for banks. It will also provide examples of how to conduct such analyses in selected high-risk sectors.

This paper aims to serve as an operational guide for bank executives and risk management teams as they navigate the transition towards a more resilient and ESG-integrated financial system.

The Regulatory Framework for ESG Risk Integration

The integration of Environmental, Social, and Governance (ESG) risks into the European banking regulatory framework has evolved significantly over the past decade, reflecting a shift from voluntary sustainability efforts to mandatory risk management requirements. This transformation recognizes that ESG risks—particularly climate-related risks—are financial risks that can directly impact credit institutions' stability, capital adequacy, and long-term resilience.

Broadly speaking, there are three stages in the regulatory development of the area. After the 2008-09 financial crisis, the Capital Requirements Directive IV (CRD IV) and Capital Requirements Regulation (CRR) were developed to strengthen banks' capital positions and enhance risk management practices. However, these regulations primarily addressed traditional financial risks without explicit references to ESG factors.

Table 1: The Evolution of Regulation of ESG Risks in CRR/CRD

	Before 2019	2019-2024	2025 onwards
Financial Reporting	No	Partly	Yes
Risk Management	No	Partly	Yes
Governance	No	No	Yes
Stress test and transition planning	No	No	Yes

A significant change occurred in 2019 with the adoption of CRD V and CRR II, which introduced some non-financial disclosure requirements but stopped short of mandating full ESG risk integration into risk-management and governance structures. This regulatory framework built on the adoption of the EU Action Plan on Sustainable Finance, which emphasized the need to redirect capital flows toward sustainable investments and enhance financial stability by managing climate-related risks, but also reflected the fact that climate risk was still an evolving issue.

Recognizing the growing materiality of ESG risks, the new CRD VI and CRR III establish mandatory ESG risk integration into risk management, governance, and capital assessment frameworks. The rules are phased in from 2025-2027 and explicitly require banks to:

- Integrate ESG risks into risk appetite frameworks, stress testing, and credit risk models.
- Conduct mandatory ESG materiality assessments, including sectoral risk exposure analysis.
- Implement climate-related stress testing and scenario analysis to gauge the impact of climate risks on financial positions.
- Enhance Pillar 3 disclosures, requiring transparency on ESG risk exposure and mitigation strategies.

The European Banking Authority (EBA) plays a central role in translating regulatory mandates into supervisory expectations. The EBA's Final Guidelines on ESG Risk Management provide a structured approach for banks to implement CRD VI/ CRR III requirements.

The EBA highlights data challenges as a key obstacle for ESG risk integration and encourages banks to improve data collection processes, leverage external ESG metrics, and utilize proxies when necessary. To ensure coherence with other pieces of EU legislation, CRD-based plans and disclosures should be aligned with other disclosure requirements such as the Corporate Sustainability Reporting Directive (CSRD).

EBA Guideline Requiremens:

1. Comprehensive ESG risk identification: Banks must assess both physical risks (e.g., extreme weather events) and transition risks (e.g., regulatory shifts, market changes).
2. Integration into governance: Boards and senior management must possess expertise in ESG risk oversight and incorporate it into strategic decision-making.
3. Long-term and scenario-based risk analysis: Institutions should have a robust and sound approach to managing and mitigating ESG risks over the short, medium and long term, including a time horizon of at least 10 years. They should also apply climate scenario modeling and portfolio alignment tools.

The shift toward mandatory ESG risk integration reflects a recognition that climate and sustainability risks are systemic financial risks. As climate-related disruptions intensify, financial institutions must proactively manage these risks to ensure long-term stability and regulatory compliance. CRD VI and CRR III, alongside the EBA guidelines, aim to embed ESG risk management into the core financial system, ensuring that banks are resilient to environmental and social challenges.

This regulatory evolution underscores a fundamental transformation in risk management—one that moves beyond compliance-driven sustainability efforts to a strategic, risk-based approach that will have a profound impact on the future of banking in the EU.

A Methodology for Conducting Compliant ESG Risk Assessments

The EBA guidelines make clear that institutions should ensure that they are able to properly identify and measure ESG risks through sound data processes and a combination of methodologies, including exposure-, portfolio- and sector-based, portfolio alignment and scenario-based methodologies.

Fundamentally, factors emanating from climate change are no different than any other factor which may influence the business decisions of a financial institution in relation to a client or other stakeholder. This means that although a number of novel climate-specific considerations must be taken into account, readying a financial institution for incorporating climate-based risks does not entail a paradigmatic shift in the way that risks are analyzed, modelled, or mitigated.

The basic task of the credit function with respect to climate risk is thus to model how the various, non-financial climate-derived risk factors can be turned into financial risk with specific expected losses and loss-ranges that are identified in time and among particular clients or client groups.

In the following, we will present a simple, conceptual framework for sufficiently handling climate-related physical risks in the portfolio of a financial institution. We present a pragmatic and manageable model that ensures an adequate anticipation of risk without unnecessarily burdening the organization with administration. As highlighted already, physical risks stemming from climate change are not inherently different than risks stemming from other sources. The only major difference is that climate change-related risks are likely to change (mostly as increases) over time.

Figure 3 shows the major steps involved in this process. It consists of moving from understanding the physical risks associated with climate change for a specific industry to integrating climate change scenarios in risk modelling and finally understanding how specific damage functions translate physical damage into financial damage and thus tie the climate-models back into the internal risk management framework of the institution.

Figure 3: The Four Steps of Physical Climate Risk Integration

Step 1: Key risk drivers of each industry are identified. This enables a top-level view of key risks for large exposures on the loan book.

Step 2: The bank applies a hazard model to estimate the impact of climate change on the identified risk drivers.

Step 3: Physical climate risks are converted to financial risk via empirical damage functions.

Step 4: The bank integrates the outcomes into its Enterprise Risk Management framework using existing risk categories, such as credit risk.

Step 1 Identifying Major Drivers of Climate Risk

The first step consists in identifying the major drivers of climate risk. These drivers are qualitative statements about the issue at hand. Proper identification of drivers serves to ensure that all major sources of risk are covered, and that modelling can take local conditions into account. The impacts of some drivers are virtually universal across all geographical areas, while those of others vary considerably. When using third-party data and software providers for climate risk assessments, it is important to verify whether they actually map the contributions of major drivers for each industry that the data or models are used for, or whether they rely on broad proxies.

In Table 2 below, examples of major drivers of climate-related physical risk are provided. In this list, primary and secondary causes are separated, so that direct climate change effects on weather systems can be separated from the effects that these, in turn, have on various economic activities. This is meant to make it clearer what types of data products or services the bank will need to access to be able to integrate

Table 2: Some Major Drivers of Climate-Related Physical Risks

Primary Physical Drivers	Examples of Secondary / Derived Impacts (Effect)	Examples of Industries Affected and Key Financial Loss Drivers
Temperature Variability (e.g., heatwaves, cold spells)	• Increased wildfire risk • Heat stress on crops, livestock, and labor; • Higher cooling/heating costs	**Agriculture:** Reduced yields, increased input costs; **Construction & Real Estate:** Project delays, higher operating costs;
Precipitation Variability (e.g., intense rainfall, droughts)	• Flooding and waterlogging; • Water scarcity • Crop failure • Increased wildfire risk	**Agriculture:** Flood damage to fields, irrigation challenges, lower productivity; **Industry:** Supply chain disruptions, water shortages;
Sea-Level Rise (e.g., gradual rise, storm surges)	• Coastal erosion • Saltwater intrusion into groundwater • Structural damage to buildings	**Construction & Real Estate:** Property devaluation, damage to coastal buildings, costly mitigatory retrofits; **Industry:** Increased operational risks for coastal facilities;
Extreme Weather Events (e.g. severe storms, hurricanes)	• Structural damage to buildings and infrastructure • Disruptions to supply chains • Supply chain disruptions	**Construction & Real Estate:** Structural damage, project delays; **Industry:** Disruptions in production, equipment damage; **Shipping:** Port and vessel damage, interrupted operations

physical risk model of the phenomenon in question.

Covering these four major drivers, banks can account for most types of impact on the risk profiles of their portfolios. While there is some overlap between primary causes on some secondary effects – like wildfires, which often start under conditions of both high heat and low precipitation – most common risk factors can be satisfactorily accounted for by integrating data on the above issues.

In Northern Europe, excess rainfall leading to both rain (pluvial) and river (fluvial) flooding is likely going to be the single most important issue, with widespread effects across agriculture, all types of real estate and construction, and industry. Not only is the change towards higher (but also more variable) levels of rain in Northern Europe one of the most certain climate change effects documented in the scientific literature, it also comes on top of already high levels of precipitation.

Step 2 Quantify Hazards

Introduction

In step 2, the qualitative drivers identified in step 1 are quantified. This is achieved through adopting specific risk models appropriate for the specific driver. Note that while simple in theory, this rules out simply applying averages or general assumptions and may prove demanding in terms of data and modeling requirements.

Adopting a specific risk model typically involves integrating a third-party data product as few banks will find it feasible to rely solely on internally generated data and modeling. A purely internal approach is typically only relevant for very particular niche markets and then only if the bank is able to develop and maintain data products that are clearly superior to third-party options.

In order to critically compare different third-party options, it is necessary to gain insight into what empirical and modelling input goes into the climate data product. This enables the bank to assess the efficiency, accuracy and scope of the solution and whether it delivers on any market- or geo-specific needs of the bank.

What is *not* sufficient is to assume that third-party vendors have satisfactorily modelled risks or have access to the relevant data.

Typical Issues with ESG Data Providers:

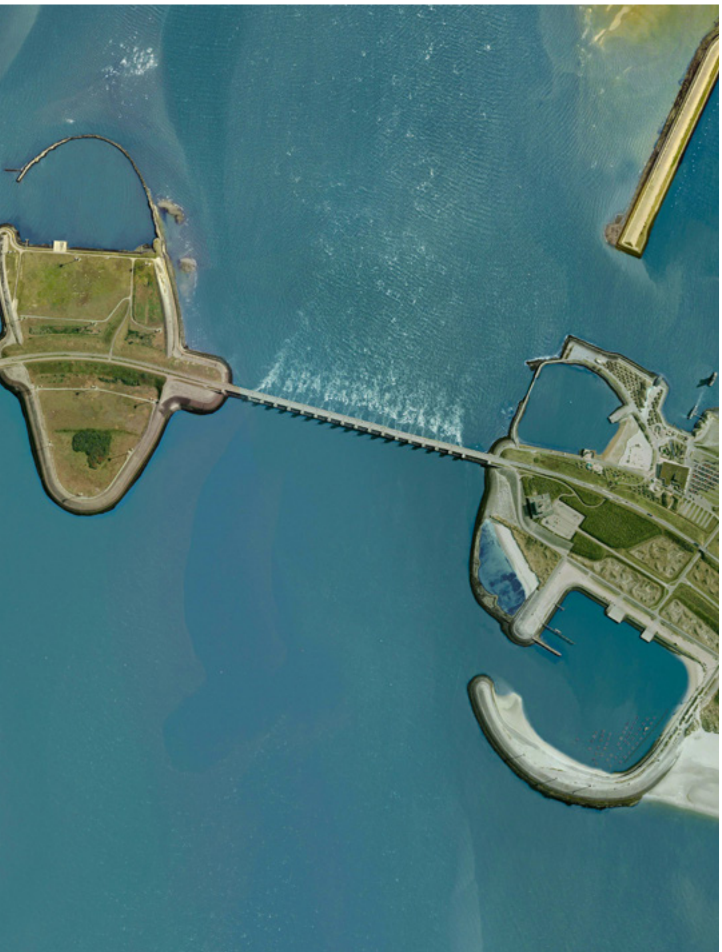
1) They confuse risk metrics with sustainability impact. An example is equating CO_2 emissions with financial risks. CO_2 emissions only become risks if they are taxed or regulated.
2) They use non-primary data or models, i.e. they simply aggregate labels, certificates, surveys, etc. instead of using input data on the specific (typically physical) climate risk at hand.

Generally, such models are not worth much outside of branding and communication purposes and they do come at the potential cost of confusing external positioning needs with internal information needs.

When applying the actual product as input for the internal risk models of the bank, it becomes clear why climate-related risks are empirically distinct from other risk areas. Climate-risk based models rely on input from both global climate models and more localized models of specific phenomena such as precipitation, flooding, or drought that are not traditionally part of financial or commercial analysis.

Climate Change trajectories

When considering the empirical input models, it is important to understand how climate change trajectories are generally modelled in stylized fashion to enable a common language. The International Panel on Climate Change (IPCC) uses a concept called representative concentration pathways (RCPs). They are a set of deterministic, scenario-based greenhouse gas concentration trajectories used in climate modeling. Fundamentally, each RCP (labelled RCP2.6, RCP4.5, RCP6, and RCP8.5) represents a different level of changes to the energy transferred to Earth's surface and hence describes a possible future pathway for the climate. This allows for a relatively simple way of 'packaging' a series of estimated outcomes in terms of temperatures and climate systems effects based on fixed assumptions about atmospheric CO_2 levels and certain thresholds. They are helpful to get an overview of likely mean differences between futures where CO_2 emissions are lowered versus those where they are not. While not necessarily the most realistic scenarios of climate change, their relative simplicity and their widespread acceptance make them helpful as inputs for applied risk models.



Climate Risk Data Solutions

Table 3 below summarizes two types of data products within the physical risk estimation sphere: Climate risk analytics platforms and hazard mapping tools. Climate risk analytics tools are often presented as one-stop tools and bundled into larger ESG packages. They are convenient due to the range of issues covered, and because they often combine steps 3 and 4 covered here, resulting in direct estimates of financial risk. This comes at the cost of often being overly broad and often not offering specialist knowledge, data and modelling on any one industry. Worse still, some products – typically broad ESG suites or platforms – offer mostly synthetic and derived data which are often 'sustainability' measures based on non-physical data such as certificates, ratings, and surveys rather than input from sensors, satellites and land surveys.

Further, collapsing steps 3 and 4 into one single operation means that both changes to the assets exposed to risk as well as mitigating factors become harder to account for. Still, they can be a convenient starting

Table 3: Climate Risk Data Product Types

Data Product Type	Description	Pros	Cons
Climate Risk Analytics Platforms	Platforms that aggregate historical and projected climate data with financial risk models, offering dashboards and risk maps for portfolio analysis.	• Provides an integrated, high-level overview of exposure • Supports strategic decision-making	• Often broad, but shallow • May require customization • Often significant licensing fees.
Hazard Mapping and Forecasting Tools	Tools that merge remote sensing and weather forecast data to produce geospatial risk maps and early-warning alerts for localized events.	• Delivers localized risk information • Enhances short-term risk management with clear geographic risk indicators	• Accuracy may vary by region • Translating geospatial data into financial impact requires additional analysis • Technically demanding

point if requirements for data resolution and origins are met. While they may not offer data detailed enough to manage the risk of individual clients, they typically are informative about areas and sectors. Often these platforms are offered by consultancies and general software providers.

Hazard mapping tools are often more specialized tools that focus squarely on physical risks. They are typically (though not always) sector-specific and rarely include direct financial forecasting. This specialization means that they are more likely to be tailored to the specific industry they are created to solve for, often delivering more accurate data and better predictive models for the phenomenon in question. They are also more likely to come with the data resolution required to go from risk management of entire sectors or areas to individual clients. Usually, these advantages come at the cost of the individual product being substantially narrower in focus than the first group of products. This means that more, diverse products must be combined as inputs for different types of climate risk, which again means that in-house maintenance and data governance requirements are likely to grow higher. Larger organizations that can handle higher levels of complexities are likely to benefit from establishing such 'data ecosystems'. However, even smaller organizations are likely to benefit from having access to a few products to "sanity check" input from generalized platforms in the most key sectors.

Empirical Example: Hazard-modelling

Here, we will show how a hazard-map type model can be applied to form estimates of how future risks may change along with the climate.

The following example is based on highly detailed hazard-mapping of 103,935 discrete buildings in Vancouver, Canada carried out by Darlington et al. (2024). It combines all three sources of flooding considered in physical risk modeling: Rain (pluvial), river (fluvial), and coastal. It applies a 5-meter resolution, far more detailed than the standard 30-, 50- and 90-meter resolutions often applied in many datasets. Employing a similar dataset in a commercial setting would, in most cases, allow for a client-by-client evaluation of risk.

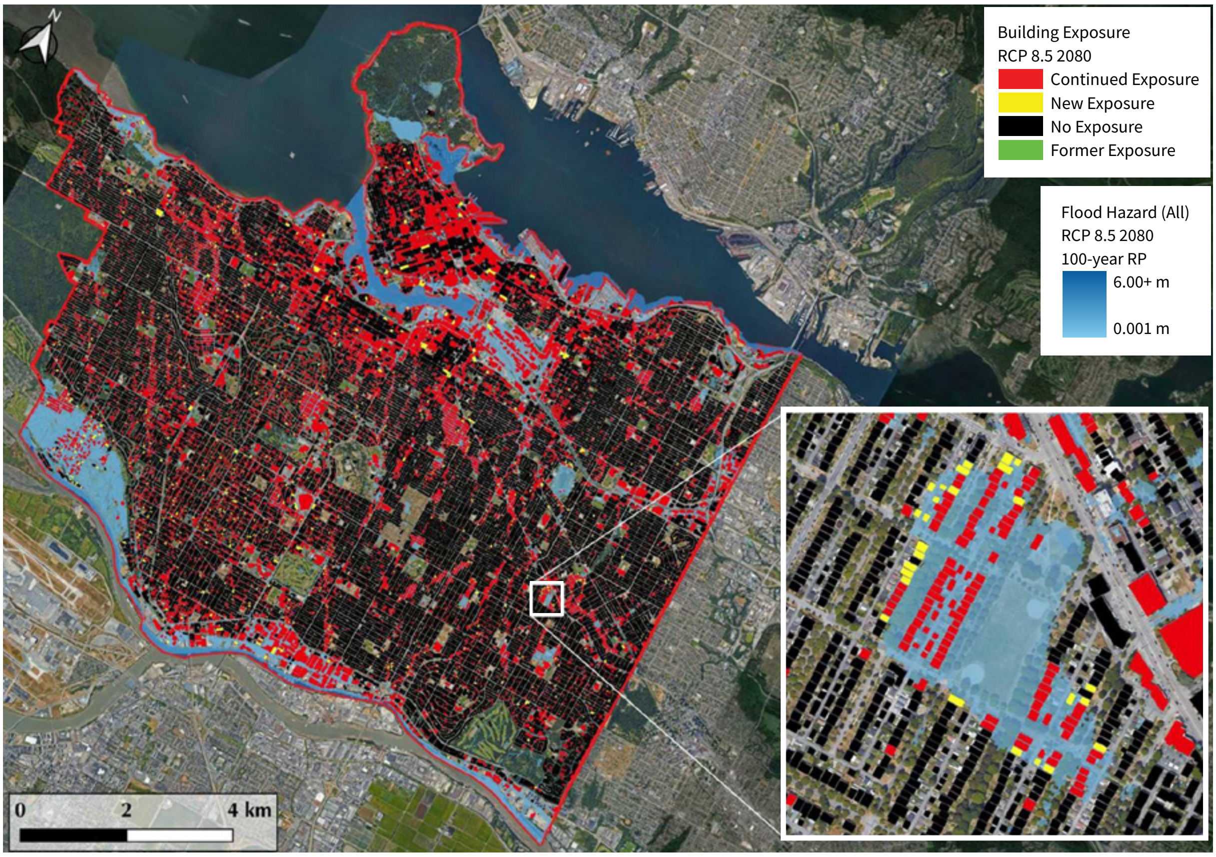
We can see from the map below how individual buildings would be expected to be exposed to flooding in through 2080 applying the assumptions of RCP 8.5. Notice how the yellow buildings in the magnified map part show buildings affected under RCP 8.5 but not under a no climate change scenario. This provides a good basis for assessing loan terms, including insurance offsets and potential individual mitigating factors.

To understand the contribution of the above view, consider two contrasting scenarios: One in which climate change is not accounted for, and one in which climate change is accounted for, but the resolution is lower than 5 meters, or an area or industry proxy is applied.

In the first of these alternate scenarios, the risk is not properly accounted for in the case of all the yellow buildings. They seem safe from flooding under current conditions, but are actually likely to be significantly at risk when climate change is taken into account. Thus, depending on insurance coverage, the lender risks having their mortgaged assets at risk.

In the second of these scenarios, the creditor would not properly understand the risks of *individual debtors*. Even if average risk estimates were accurate (which is unlikely), this would lead to higher risk premium charged on relatively low-risk clients, and conversely, too low risk premiums charged on high-risk clients. A better-equipped competitor would be able to leverage this gap and offer better prices for low-risk clients, leaving the under-analyzed creditor with only poorly understood high-risk clients.

Figure 4: Comparing Climate-Adjusted Building Flood Exposure to an NCC Scenario



Finally, of course, there is the very likely possibility that the institution has access to neither high-resolution analysis tools nor climate-based modelling, leading to the even more dangerous (and non-compliant) "third scenario", where physical climate risks are both inappropriately averaged across areas or industries and generally underappreciated.

Such projections must be embedded into a financial institution's stress-testing frameworks, ensuring resilience under future climate conditions. A robust approach to sector-specific risk modelling requires banks to contextualize risk estimates within broader economic and regional patterns. The same climate event can have drastically different financial consequences depending on local mitigation measures, insurance structures, and economic resilience.

With physical risk models in place, the next step is to apply damage functions that quantify the financial impact of different climate hazards in a structured and actionable manner.

Step 3 Apply Damage Functions

In this step, we translate the physical risks identified in Step 2 into financial risk metrics by applying damage functions. These functions estimate the expected economic losses associated with extreme weather events—such as 100-year rain and flood events—by quantifying how physical damages affect asset values, business operations, and credit risk exposure. These functions, derived from empirical loss data, experimental models and engineering assessments, form the basis for transforming climate science into financial risk metrics.

Damage functions thus model the relationship between hazard intensity (e.g., rainfall or flood depth), asset vulnerability and the corresponding economic loss. These losses can be expressed as a percentage of asset value, revenue reduction, or increased operating costs.

The relationship between hazard intensity and financial loss is typically non-linear. As the severity of climate events increase, financial losses tend to escalate disproportionately. A minor flood event, for instance, may result in only superficial damage to a property, such as basement flooding. However, as water levels rise, the extent of the damage expands considerably: at 1.5 meters, electrical systems and structural components become compromised, driving up repair costs. Beyond a certain threshold - typically around three meters in residential areas - properties may become permanently uninhabitable, leading to total asset loss.

Conducting damage function analysis across multiple climate scenarios is essential for capturing the full range of potential financial risks. Climate impacts are highly uncertain, and a single-scenario approach may lead to either over- or underestimation of risks, affecting credit risk assessments and capital planning.

For a moderate emissions scenario (RCP 4.5), policy action on climate mitigation is gradual, leading to a disorderly transition where regulations tighten unpredictably. In this scenario, both transition risks—such as regulatory shocks, carbon pricing, and shifts in market preferences—and physical risks, like increased flooding and extreme weather events, must be incorporated into risk models. Damage functions in this scenario would reflect gradual but intensifying financial impacts, particularly for industries with high carbon dependencies and real estate assets in increasingly vulnerable areas.

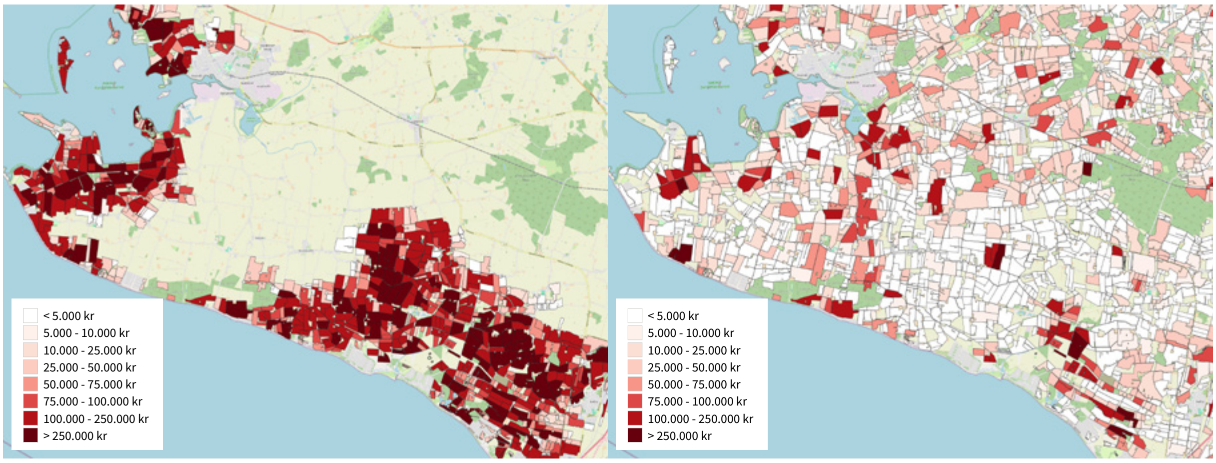
Under a high-emissions, worst-case scenario (RCP 8.5), global carbon output remains unchecked, leading to severe physical risks dominating financial losses. The frequency of 100-year floods accelerates, supply chains face persistent disruptions, and asset values in flood-prone and heat-sensitive regions could deteriorate rapidly. In this scenario, damage functions must be adjusted to account for higher expected losses, increased default probabilities, and declining recovery values on collateral.

Integrating damage function outputs into stress testing and credit risk models for both RCP 4.5 and RCP 8.5 ensures banks are prepared for both moderate disruptions and extreme climate-driven financial instability, aligning with regulatory expectations under CRD VI and CRR III.

Empirical Example: Damage Functions in Agriculture

Utilizing a model implemented by AgroRisk, we show how to deploy an empirical damage function model in agriculture. The AgroRisk Financial Risk Model applies damage functions to estimate economic losses from climate-related hazards such as extreme rainfall, flooding, and storm surges in agriculture. The model functions by translating physical impacts - such as water depth on farmland or flood duration – into financial damage metrics based on empirical data and predefined vulnerability curves.

Figure 5: Financial Cost of Stormflood (left) and Rainfall (right)



Source: AgroRisk

This empirical example illustrates the structured methodology already described, highlighting direct agricultural impacts. However, the model primarily captures direct impacts such as yield reductions due to waterlogging or physical damage to farm buildings and equipment. Indirect impacts, like loss of soil fertility, increased input costs, supply chain disruptions, and potential land value depreciation, are not included.

Figure 5 shows how two drivers (Step 1), coastal flood and pluvial flooding, respectively, are likely to affect specific plots of land (Step 2) with specific results (Step 3), resulting in quantified, economic losses to the business operation (Step 4). Here, major events likely to only occur once per 100 years under a no-climate-change (NCC) scenario are chosen. As can be seen from the damage maps, it is important to distinguish between different physical hazards to understand the distribution of financial risk and damages.

Even within a local area, neighboring fields may be very differently affected. Figure 5 shows the importance of geolocalized damage functions. Notice how – notice how deep red (severely flooded) fields are sometimes surrounded by white (unaffected) fields. This results from variations in factors such as topography and soil, which necessitates a granular, field-based approach to risk management.

With the calculations of expected losses conducted at field level, it is possible for banks to estimate total financial losses from an extreme weather event. The analysis can be applied to individual farmers and integrated with existing credit risk assessments, or it can be applied to a region or portfolio of farmers to gain insight into aggregate risks for multiple farmers for purposes such as understanding the overall exposure of the bank to the sector, or comparing agricultural clients across different geographical locations.

As with the housing example in Step 3, both figures make it clear that applying undifferentiated, low-resolution and non-climate change informed models expose the bank to unnecessary and uncontrolled-for risk.

After mapping the hazards and quantifying losses, the financial loss estimates are integrated directly into the bank's internal models by informing Expected Loss (EL) and Loss Given Default (LGD) calculations within the overall credit risk management framework. Direct losses, including immediate impacts like crop yield reductions, infrastructure damage, or machinery loss, are explicitly modeled. By applying this structured approach, banks can systematically assess and integrate climate-driven financial risks into their overall credit risk management, aligning with CRR III/CRD VI regulatory expectations.

Implications

Climate change is projected to significantly exacerbate the frequency and severity of physical hazards over the coming decades, thereby elevating financial risks for exposed assets. Rising temperatures and shifting weather patterns can intensify storm surges and extreme precipitation, causing more extensive coastal flooding as well as increasingly damaging pluvial floods. From a risk perspective, these trends translate into greater disruption and damage to infrastructure, crops, and property, making once-in-a-century floods and other major events more probable within a shorter timeframe. Consequently, institutions cannot rely on historical averages alone when forecasting losses; they must integrate forward-looking climate data—both at local and regional levels—to accurately estimate present and future exposures.

This structured approach to financial risk modelling, integrating probabilistic hazard projections with empirically grounded damage functions, ensures that financial institutions move beyond broad, theoretical discussions of climate risk and instead establish actionable strategies that reflect both forecasted climate realities and the financial constraints of risk management. It thus enables financial institutions, insurers, and policymakers to make informed decisions about risk mitigation, insurance pricing, and adaptation strategies.

Conclusion

Climate-related physical risks have emerged as material considerations for financial institutions, transitioning from optional elements within CSR initiatives to integral components of core financial risk management frameworks. This report has outlined a structured methodology for systematically translating physical climate hazards into actionable financial risk assessments, through a comprehensive four-step approach: identifying major climate risk drivers, quantifying hazards with granular, sector-specific data, applying empirically derived damage functions, and integrating financial losses into internal risk models and stress-testing frameworks.

The approach presented emphasizes the importance of granular analyses that provide robust, empirical bases for estimating the direct economic impacts of events such as coastal storm floods and extreme rainfall. By applying sector-specific damage functions within this structured framework, banks can reliably translate projected physical hazards into concrete financial outcomes, significantly enhancing their capacity for informed decision-making.

In practice, however, the effectiveness of this approach depends heavily on the choice and quality of data products and services utilized. As outlined in this paper, selecting appropriate data products—ranging from broad-based climate risk analytics platforms to specialized hazard mapping tools—is a critical step.

The methodology directly supports improved financial risk management practices in several ways:

1. **Loan Book Impact**
   Estimating potential financial losses enables banks to clearly understand the credit risk implications for individual borrowers and the broader loan book. By quantifying asset devaluations and projected revenue losses, banks gain insights necessary for informed lending decisions, provisioning, and collateral management.
2. **Sectoral Stress Testing**
   Integrating physical risk estimates and their associated financial damages into existing stress testing frameworks allows banks to perform sophisticated scenario analyses. To evaluate how different sectors and geographic portfolios respond under varying climate scenarios.
3. **Capital Adequacy Considerations**
   The quantified financial losses inform adjustments to risk-weighted assets. Such integration ensures regulatory compliance and accurate reflection of risk exposures in capital adequacy calculations.

Ultimately, incorporating empirically grounded damage functions into financial modeling not only aligns institutions with evolving regulatory expectations under CRD VI and CRR III but also strengthens overall resilience in the face of increasingly frequent and severe climate impacts. This comprehensive approach ensures financial institutions move beyond theoretical acknowledgment of climate risks, facilitating strategic, risk-informed decision-making and regulatory compliance. Finance professionals thus remain central to this process, guiding the strategic integration of climate risks effectively within existing risk management frameworks.

About us

Envira ApS is a Copenhagen-based consultancy operating at the intersection of sustainability, finance, and regulation. We help financial institutions translate complex ESG and climate-related requirements into actionable strategies. With a strong foundation in EU sustainable finance legislation and deep expertise in risk management, Envira enables clients to integrate environmental and social considerations into their core financial and governance frameworks.

Dr. Ask Foldspang Neve
is an independent consultant specializing in advanced analytics and AI-driven insights. He holds a doctorate in statistical sociology from the University of Oxford and previously established the AI consulting unit at the Danish Agency for Public Finance and Management.

Theodor Christensen
is the CEO of Envira ApS. With a background in both financial regulation and sustainable finance, he has held senior roles at Danske Bank and the Danish Financial Supervisory Authority, and brings over a decade of experience in integrating ESG and climate risk into strategy, compliance, and risk management frameworks.

Envira
SUSTAINABILITY ANALYTICS

ENVIRA APS

Applebys Plads 7
1411 København
Denmark

+45 23 66 44 42
www.envira.dk
info@envira.dk

CVR number:
44186217