Climate risk and commercial real estate: Lessons and challenges to strengthen financial stability

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Climate change poses growing risks to commercial real estate and, by extension, to financial stability. In Sweden, where roughly half of bank lending to non-financial corporations is directed to the commercial real estate sector, physical risks such as flooding, rising sea levels and ecosystem degradation can erode collateral values and amplify systemic vulnerabilities. A joint workshop organised by the Sustainable Finance Lab and Sveriges Riksbank in November 2025 explored how climate-related risks transmit through commercial real estate markets to the financial system. This article summarises the workshop's insights on how to strengthen climate resilience in the financial system through improved data quality, better governance coordination, and policy responses including stress testing, regulatory disclosure and preventive investment.

1 Introduction: Climate risk and the financial system's core vulnerability

Commercial real estate (CRE) plays an important role in many economies and has an important impact both on economic and financial stability. The sector influences business activity, employment, credit markets, and wider macroeconomic trends. Financial instability has often been linked to developments in real estate markets.[1] About 51 per cent of Swedish bank lending to non-financial corporations is to CRE firms, and roughly half of this is secured by physical property. This ties a large share of banks' balance sheets directly to real estate values and their market stability. While a high rate of collateralization offers some protection, the scale of this concentration

* The opinions expressed in this article are the sole responsibility of the authors and should not be interpreted as reflecting the views of Sveriges Riksbank.

[1] See, for example, Sun et al. (2015) and Campiglio et al. (2023).

creates a potential “single point of failure”, where a downturn in property markets could threaten broader financial stability.

These links are increasingly shaped by evolving climate-related risks. More frequent and severe weather events – such as the 2011 floods in Copenhagen and Hurricane Sandy in New York in 2012 – show how physical climate shocks can translate into financial losses. As the costs of such disasters continue to rise, approaches to managing climate-related and financial commercial real estate risks need to adjust.

In this context, the Sustainable Finance Lab and Sveriges Riksbank organized a workshop on “Climate Risk and Commercial Real Estate” in November 2025. The event aimed to deepen understanding of climate-related financial, physical and transition risks in CRE and to promote cooperation among banks, insurance companies, public institutions, and academia. The goal was to identify ways to strengthen stability in the CRE sector and financial stability more broadly.

This article summarizes the workshop’s main discussions. It first considers the role of CRE in financial stability, then examines key challenges in managing climate risks, particularly related to data, governance, and coordination among private actors and public institutions. It concludes with a discussion of policies that could enhance resilience. While focused on CRE, many insights are relevant for the broader financial system.

2 Commercial real estate and financial exposures

Sveriges Riksbank’s mandate includes promoting the stability and efficiency of the financial system. Because climate risks can affect both financial institutions and the real economy, they are an increasingly important consideration (see Sveriges Riksbank 2019). In particular, the strong exposure of banks to commercial real estate calls for close policy attention (Sveriges Riksbank 2022).

The growing influence of climate-related risks compounds this exposure. Physical risks—such as rising sea levels and extreme weather – and transition risks – such as tighter carbon and energy efficiency standards – can both reduce asset values and create stranded assets. Similar patterns exist across Europe, where corporate lending is largely directed to sectors that contribute significantly to climate change. Since much of this lending is tied to real estate, European banks face both physical and transition risks, creating pressures on collateral and credit quality (see Ceglar et al. 2025).

Research presented at the workshop highlighted both direct and indirect climate-related channels of risk. Even with full insurance coverage, Norwegian households affected by flooding have experienced persistent declines in housing wealth due to falling property prices – peaking at about USD 13,000 two years after a flooding event (Espegren et al. 2025). This repricing of risk lowers collateral values and illustrates how insurance alone cannot eliminate direct financial stability risks transmitted via the real estate sector. The authors also document a decrease in household

consumption that, in aggregate, can have significant consequences for both economic growth and financial stability.

Environmental degradation can affect property values without causing direct physical damage (Piseddu 2025). In particular, increases in water temperature during the summer in Sweden have led to harmful algae blooming, which were found to reduce housing investment returns by roughly 5.5 per cent. In Sweden, where mortgage loans make up 83 per cent of household credit, such declines in collateral value can have noticeable effects on bank balance sheets and profitability.

These vulnerabilities highlight the need for better data and measurement approaches to climate risks in the financial sector. They also point to a need for combining risk assessment methods developed for natural sciences with those of finance.

3 Addressing data deficiencies and measurement uncertainty

Robust climate risk assessment requires high-quality, accessible, and standardized data. However, the data required for risk assessment is often deficient. Key challenges arise from uncertainty in framing the problem itself – such as defining the scope of the system under analysis and deciding which data sources, metrics, and processes to include or exclude. This ambiguity complicates efforts to measure exposures accurately and consistently across institutions.

3.1 The nature of data uncertainty

Climate risk assessment relies on observational data, which are subject to multiple sources of uncertainty. Workshop discussions identified five main types.

At-station point measurement uncertainty arises from errors at the primary sensor level. High-quality instruments can still produce systematic or random errors – for example, wind turbulence often causes rain gauges to underestimate precipitation. Sensor degradation, improper calibration, or disturbances like animal activity can further distort readings. Regular maintenance, calibration, and traceability help address these issues.

Derived data uncertainty occurs when target variables must be estimated from proxy measures. River discharge, for instance, is typically calculated from water level data using stage–discharge relationships, that is, how the water level is linked to water flow rates. These relationships are often non-linear and influenced by factors such as soil moisture, leading to uncertainty ranges of 10–40 per cent in the estimates. Inaccurate modelling of these derivations can bias hydrological predictions.

Interpolation uncertainty emerges when values at unmeasured locations are estimated from observation stations that are spread out. This estimation process assumes that nearby points are strongly correlated, but this is often not the case due to spatial error patterns. Uncertainty increases with the distance to the nearest

station and depends on the density of the sensor network and the interpolation method employed.

Scaling uncertainty results when data collected at one scale are applied to another scale. Soil moisture, for example, varies sharply over short distances due to differences in soil type, vegetation, and evaporation. Using a single point measurement to represent a larger area – or downscaling satellite data – introduces errors that require advanced statistical adjustments.

Finally, *data management uncertainty* stems from errors in the data lifecycle, such as manual entry mistakes or procedural lapses. One documented case involved rain gauge checks being skipped on weekends, creating artificial gaps in records. Inconsistent formatting, poor documentation of coordinates, or changes in collection protocols over time can also undermine long-term datasets.

3.2 Bridging the data gap: standardization and accessibility

In Sweden, public data from authorities such as SMHI (Swedish Meteorological and Hydrological Institute) and the Swedish Civil Defense and Resilience Agency (previously MSB) cover high-risk areas but remain highly fragmented. Professionals often face data that lack sufficient detail for neighbourhood-level analysis or are delivered in formats requiring specialized skills. Legal restrictions, acquisition costs, and large file sizes further limit scalability for financial and insurance risk models. Coverage gaps also persist, with only parts of the country adequately mapped, complicating model validation.

Denmark offers a contrasting example. Building on initiatives from 2017–2021, authorities have developed centralized platforms like klimatilpasning.dk, providing free, high-resolution tools for address-level flood risk assessment from sea levels, groundwater, and cloudbursts.

To address these issues in Sweden, efforts could target three areas. First, standardize data through a uniform framework and consistent coverage across regions. Second, improve interpretability with simplified explanations and visualizations for non-experts. Third, issue clear guidelines on data use, including appropriate applications and limitations.

3.3 Technological solutions and cost barriers

Advances in downscaling methods now enable researchers to derive local climate information from coarse global models. These techniques produce more realistic representations of regional patterns, which serve as inputs for impact models in urban planning and hydrology.

High-resolution data at a very granular level are essential for assessing local threats such as extreme precipitation and heat stress. Producing such projections, however, requires substantial technical expertise and financial resources.

Artificial intelligence (AI) offers one possible solution. AI methods can improve data accessibility, refine downscaling, and enhance hydrological modelling. In several applications, these approaches have reduced biases in historical data and matched or exceeded the accuracy of conventional simulations.

New observational technologies complement these efforts. Image-based flow monitoring – using drones, smartphones, and satellites – measures flood severity directly via surface velocity. Unlike traditional derived estimates, which rely on proxy variables, these tools reduce associated uncertainties.

For commercial real estate and financial applications, high-resolution data must be packaged into accessible formats with assured long-term availability. Building this infrastructure may require collaborative frameworks, such as Nordic partnerships, to share development costs.

4 Existing collaborations could be improved

Given the potential effects of climate risks on the financial system, a key takeaway from the workshop is the need for closer collaboration between policymakers and the financial industry to strengthen risk management, transparency, and regulatory tools.

4.1 Enhancing risk management frameworks

The guidelines of the European Banking Authority (EBA) on climate and ESG (Environmental, Social, and Governance) risks provide a structured approach for integrating these risks into banks' strategies, governance, and risk management. They explicitly require banks to consider real estate and collateral when assessing climate risk. Yet implementation remains incomplete, and many institutions still do not systematically incorporate physical risks such as flooding or rising sea levels into collateral valuation and financial risk assessment.

An important supervisory objective is to improve transparency. Disclosure obligations for banks are intended to create a common information base and allow markets and authorities to price risk more accurately. Under Pillar 3, banks must publish information on their real estate exposures and relevant energy performance indicators, such as EPC (Energy Performance Certificate) labels, and classify them by transition and physical risk dimensions.

4.2 Stress testing and scenario analysis

Policy can encourage the wider use of climate stress testing and scenario analysis. Stress tests help assess short-term impacts of acute events on capital and liquidity, while scenario analysis provides a long-term view of how portfolios and business models perform under different transition pathways.

Frameworks such as the CSRD (Corporate Sustainability Reporting Directive) of the EU and the EU Taxonomy require firms to describe how they manage climate risks and use scenario analysis, and they provide a common reference for defining

environmentally sustainable activities. Although the EU Taxonomy is still evolving, it helps identify activities that support mitigation and adaptation, including non-life insurance products that incentivize loss prevention.

If climate risks rise and banks' resilience does not keep pace, regulators may need to consider more stringent measures. Possible options include higher capital requirements or risk weights for exposures in high-risk geographical areas and targeted macroprudential tools such as stricter loan-to-value limits for properties exposed to floods or landslides.

4.3 Incentives and the treatment of "green" assets

Ongoing policy debates examine how regulatory treatment can support investments in sustainable assets. One line of discussion concerns whether, and under what conditions, preferential capital treatment for certain "green" exposures could be justified. The broader objective is to align financial incentives with preventive investments, so that financial capital increasingly supports measures that reduce future losses rather than only financing reconstruction after damage has occurred.

4.4 The governance and coordination gap

Despite clear evidence on the need for adaptation, implementation of risk-reducing measures remains uneven. This action gap is closely linked to governance arrangements and funding constraints, and addressing it requires clearer mandates and better coordination across actors. There is a clear need to better coordinate natural science-based risk assessments and financial risk assessments. A key challenge is that these forms of assessment have historically been conducted by separate actors and are grounded in different analytical traditions. Natural science and financial risk assessments rest on distinct epistemological and ontological foundations, relying on different types of data, methods, and modelling approaches. As a result, risks may be assessed in parallel but not in an integrated manner. This points to the need for governance arrangements that enable effective coordination between natural science risk assessment bodies, such as SMHI, and financial risk assessment institutions, such as the Riksbank.

4.4.1 Limits of municipal authority

Municipalities such as Stockholm are central to adaptation because they are responsible for critical services and own substantial public property. At the same time, primary responsibility for adapting buildings lies with individual property owners. Municipalities can typically intervene on private land only when a project can be justified as serving a general public interest.

This setting raises questions about when it is appropriate to use public funds to reduce risks to private commercial assets. It also creates coordination challenges: neighbourhood-scale measures often require agreement among many private owners, which can make negotiations long and complex. Free-rider problems are common, as measures such as flood walls or nature-based solutions provide benefits to a wider area, including actors who do not contribute financially.

4.4.2 Formal responsibilities and national guidelines

To accelerate local adaptation, especially in urban areas, governance frameworks may need to be adjusted so that municipalities have clearer responsibilities and effective tools. These include rights of disposition in defined areas, predictable financing models, and enforcement mechanisms that reduce dependence on purely voluntary cooperation from private stakeholders.

National guidelines can also improve consistency and reduce administrative burdens. When each municipality must develop its own assumptions about climate scenarios and methods, efforts are duplicated and risks may be assessed unevenly. Standardized scenarios and guidance would allow local authorities to focus more on concrete solutions.

Large-scale infrastructure projects, such as coastal protection or sluice gates, generally exceed the financial capacity of a single municipality. Treating these investments as matters of national interest would facilitate broader funding arrangements. Progress to date has been relatively slow: only a minority of Swedish municipalities have completed systematic analyses of how climate change may affect them, compared with a substantially higher share in Norway. Clarifying mandates and elevating coastal defence to a national priority would strengthen the protection of high-value commercial real estate and, in turn, support financial stability.

4.4.3 The role of the insurance sector

Insurers can support adaptation by moving beyond loss compensation toward risk reduction. Through risk-based pricing, differentiated deductibles, and conditional coverage requirements, insurance policies can incentivize households, firms, and municipalities to invest in preventative measures such as flood-proofing, resilient building materials, and urban nature-based solutions. Insurers have access to forward-looking risk assessment data that can inform spatial planning, infrastructure design, and capital allocation decisions. Data sharing and engagement with municipalities and other stakeholders can enhance risk management.

However, some insurers argue that the scalability of such contributions is constrained by regulatory and institutional barriers. Fragmented regulatory regimes inhibit standardized data use and cross-border risk pooling. Insurers have the technical capacity and market leverage to support adaptation at scale, but insurers are often constrained by governance gaps and policy failure rather than actuarial or financial innovation constraints.

5 Conclusions: lessons for policymakers

Climate risks to commercial real estate could pose important challenges for financial stability. Recent disasters in Europe and beyond illustrate the rising costs of inaction, requiring Sweden to move beyond traditional approaches. The workshop identified several potential opportunities that can help strengthen the CRE sector’s resilience to climate-related risks.

Regulators should continue to promote a shift from post-disaster repairs to preventive investments. Technical measures and regulatory pressure alone cannot close the action gap, which stems from governance and funding constraints.

Robust climate risk integration into financial decision-making depends on standardized, high-resolution, and accessible data. Current fragmentation, methodological inconsistencies, and multiple layers of uncertainty weaken assessment, stress testing, and portfolio analysis. Without coordinated national data frameworks and clearer guidance on use and interpretation, financial institutions cannot price risk consistently. Strengthening data governance is critical to strengthening financial resilience. National guidelines on data use and risk scenarios would reduce duplication, ensure consistent assessments, and address free-rider issues, where actors benefit from others' investments without contributing. Regulators should integrate physical risks into collateral valuations through stress testing and scenario analysis. Transparency requirements – such as Pillar 3 disclosures, CSRD, and the EU Taxonomy – provide a foundation for identifying exposures across sectors.

The workshop highlighted these key challenges, but a necessary effort is ongoing dialogue among banks, insurers, municipalities, authorities, and researchers. Continued collaboration can help mitigate climate risks to CRE and support broader financial stability.

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APPENDIX – Workshop program

Welcome address: Aino Bunge, First Deputy Governor, Sveriges Riksbank

Session I: Research presentations

Chair: Ulf Söderström (Sveriges Riksbank)

Emilia Garcia-Appendini (University of St. Gallen)
"Weathering the storm: The effects of natural disasters on households under universal insurance"
Discussant: Christian Thomann (KTH Royal Institute of Technology)

Tommaso Piseddu (Stockholm Environment Institute)
"Blooming algae and falling returns on investments. The Swedish housing market in the face of biodiversity risk"
Discussant: Kent Eriksson (KTH Royal Institute of Technology and Sustainable Finance Lab)

Giuliano Di Baldassarre (Uppsala University)
"The challenge of unprecedented floods and droughts in risk management"
Discussant: Øyvind Paasche (NORCE)

Session II: Panel discussions

Panel 1 – Data and measurement

Deep dive into the challenges related to the measurement, interpretation, and application of climate data for assessing financial risk

Chair: Valentin Schubert (Sveriges Riksbank)
Ralf Doescher (SMHI – The Swedish Meteorological and Hydrological Institute)
Laura Ni (If P&C Insurance)
Ida Westerberg (IVL Swedish Environmental Research Institute)

Panel 2 – Policy implications

Focus on current private and public policy responses to commercial real estate's exposure to climate risk

Chair: Cristina Cella (Sveriges Riksbank)
Niklas Frykström (Sveriges Riksbank)
Rolf Marquardt (Swedbank)
Philip Thörn (If P&C Insurance)

Panel 3 – Ways forward

Where do the key governance and coordination gaps lie in addressing climate risks in commercial real estate, and what policy or institutional actions are needed to close them?

Chair: Mark Sanctuary (KTH Royal Institute of Technology and Sustainable Finance Lab)
Per Bolund (Stockholm University)
Karin Dhakal (Stockholms stad)
Fedra Vanhuyse (Stockholm Environment Institute)

Wrap-up

Kent Eriksson (KTH Royal Institute of Technology and Sustainable Finance Lab)

Organising committee

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