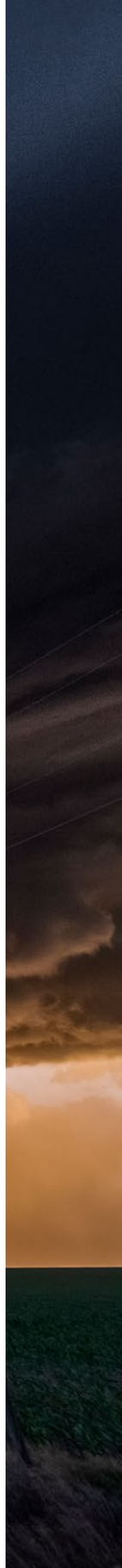

TERRA CARTA
Sustainable Markets Initiative
Investing in an Era of Extreme Weather
How asset owners and managers can build more resilient portfolios
IMPAX Asset Management
MARSH

Sustainable Markets Initiative

IMPAX Asset Management

MARSH

Contents



Executive summary

Extreme weather events have the potential to erode company value, disrupt supply chains and drive losses in portfolios. Studies have estimated that companies around the world face US$1.3 trillion in near-term losses driven by direct damages and operational disruption.[1] These effects are already observable: firms exposed to hurricane-affected regions exhibit negative excess returns and lenders with concentrated regional portfolios report impaired loan values following extreme events.[2]

Despite these signals, there is a growing recognition among asset owners that physical risks remain systematically underpriced.[3,4] Investors face incomplete asset-level data and information on adaptive actions taken, as well as large discrepancies across physical risk vendor outputs.[5] Existing climate models often lack the spatial granularity required for investment decisions, and uncertainty around tail events and tipping points can lead to paralysis in decision making over investment time horizons.

In Autumn 2025, the SMI's Asset Manager Asset Owner Hub, led by Impax Asset Management and with input from Marsh, convened two roundtables to examine how investors can more effectively understand and manage the financial impacts of extreme weather. Both sessions brought together asset owners, asset managers and insurance industry representatives, underscoring the value of cross industry collaboration in strengthening investment.[6] This report reflects a summary of those closed-door discussions, distilling insights on actions being taken, challenges to effective risk management and practical steps to make investment strategies more resilient.

The report sets out five key recommendations that emerged from these roundtable discussions.

1. **Act now to enhance investment processes** and consider extreme weather risk – waiting for perfect tools or foresight will only delay effective decision-making.

There is growing acknowledgement that short-term physical climate risks are frequently underestimated, raising the likelihood that assets exposed to these risks may currently be mispriced and therefore vulnerable to abrupt repricing as markets incorporate new information.[7] Preparing portfolios for a higher likelihood of asset revaluations is now viewed as a necessary step in protecting long-term, risk-adjusted returns. While data gaps remain, investors are focusing on minimising areas of informational uncertainty by developing decision-making frameworks that explicitly account for imperfect information.

2. **Access or develop appropriate tools and useful datasets,** acknowledging that traditional modelling and financial loss estimates can fail to show the materiality of risks.

Data limitations and the inherent uncertainty of future risks remain the most cited barriers to better risk management. Despite the growth of data providers in this space, investors note that modelled financial loss metrics have often proven difficult to use in practice. Some investors are opting instead for simple hazard exposure analysis to spot vulnerabilities and guide deeper discussion, while others are developing proprietary tools that deliver an additional signal for asset selection and trading.

All investors should start by improving asset-level location data and mapping locations against expected hazard patterns to identify concentration risk and geographic hotspots. To support investment decisions, teams should use data to prompt discussion and stress-test assumptions, rather than treat it as a precise estimate of impact. Transparency on underlying assumptions and outputs that feed into existing investment analysis are essential for building trust. Translating insights into action will also require triangulating modelled data with real-world evidence, including insurance market behaviour and the indirect impacts from past events.

1 MSCI Institute, 2025: Transition Finance Tracker Q3 2025
2 MSCI, November 2025: MSCI in Practice
3 MSCI, 2024: What the Market Thinks: A Climate Risk Survey
4 EDHEC Climate Institute, 2024: Physical climate risk survey
5 Climate Financial Risk Forum, October 2025: A Risk Professional's Guide to Physical Risk Assessments
6 Institutions represented had cumulative assets under management or advisement of over US$20tn
7 Morgan Stanley Institute for Sustainable Investing, 2025: Sustainable Signals

3. **Make decisions that prioritise resilience, diversification and flexibility** in strategic asset allocation and investment mandates, adapting climate scenarios and acknowledging unavoidable uncertainty.

Extreme weather risks impact both the return and risk sides of the asset allocation process. For instance, long-term regional return assumptions may be structurally lower, with higher volatility, as extreme weather reduces productivity, slows economic growth, and raises operational downtime. Volatility may rise as tail-risk events become more common and diversification benefits may weaken where climate impacts affect multiple asset classes simultaneously.

Climate-aware asset allocation is being adopted by a growing number of investors, with scenario analysis used to test model portfolio resilience and assess performance across multiple future states of the world. As uncertainty grows over longer horizons, decision-making will need to evolve – seeking diversification to minimise regret across plausible futures rather than maximise expected returns. Ignoring these risks altogether is equivalent to the strong assumption that extreme weather will have minimal long-term economic impact – a view that is increasingly untenable across asset owners and managers.

4. **Leverage engagement to assess vulnerability,** recognising that preparedness and the ability to respond to events will be the key differentiator as extreme weather becomes increasingly frequent and widespread.

Proactive engagement offers the clearest path to bridging data gaps, reducing uncertainty and strengthening the resilience of capital allocation. Investors are increasingly using engagement to obtain more granular insights. Vulnerability questionnaires are being incorporated into due diligence for real assets, and qualitative insights from dialogues are influencing portfolio construction decisions, including in systematic strategies.

Investors' approaches will depend on where they have material exposure to risks and whether it makes strategic sense to focus engagement on specific sectors, asset classes, or material holdings. Key topics for dialogue will almost always include the expected evolution of risks; the adaptive measures taken to reduce vulnerability; key nodes in the supply chain which could be disrupted; and the implications of changing insurance cost or availability.

5. **Work to tackle both portfolio and systemic risks, to maximise long-term value for clients and beneficiaries.** Collaboration will be key to successfully addressing gaps in information and analytical tools, and in advocating for market structures that recognise the benefits of investment in adaptation.

Going forward, investors should improve access to decision-useful information and tools to better manage physical climate risks in their portfolio. This requires strengthening asset level disclosure on hazards and resilience measures, as well as dialogue with data providers to enhance the transparency and comparability of commercial risk products. Sustained risk reduction, however, will depend on aligning economy wide incentives for adaptation. Investors have a critical role to play by engaging insurers to recognise adaptation actions in pricing and expand resilience-linked products. In parallel, investors urgently need to advocate for policy that mandates disclosures, strengthens construction standards, and creates financial incentives for resilience, alongside the removal of current policies that prevent risk-reflective insurance markets. Ultimately, without better information and aligned pricing signals, capital will continue to be allocated towards risk rather than resilience - undermining long-term value for portfolios and beneficiaries.

Introduction

Extreme weather events are rising in frequency and severity, with company-level impacts already evident. Between 2022 and 2023, economic losses rose 19% above the annual average for 2014 to 2020.[8] Although 2025 had relatively few multi-billion-dollar weather events, the Los Angeles wildfires of 2025 were the costliest on record.[9] The effects on corporate performance are evident. For example, Hurricane Helene's landfall in the southeastern US in 2024 forced a medical technology company, Baxter International, to temporarily close a critical facility, resulting in US$110mn in pre-tax costs.[10] Even after activity resumed, disruption in Baxter's intravenous solutions had led healthcare providers to adopt conservation protocols, softening medium-term demand for its products.

Despite these clear signals, weather-related risks remain systematically mispriced.[11] Rapid real estate development continues in many regions with very high exposure to climate-related hazards, such as the Florida coast, underscoring the disconnect between physical risk and capital allocation.

Asset owners and managers are increasingly recognising the implications of extreme weather on near term portfolio performance. Over 75% of surveyed asset owners expect material impacts on asset prices within five years, and over one-third anticipate that these effects will be widespread.[12] While integration varies across asset classes, over half surveyed now consider climate resilience as a core component of their risk return assessment when evaluating infrastructure and real estate opportunities.

Current responses are insufficient due to data gaps and a lack of tools to credibly estimate asset-level impacts. Persistent data gaps and the limitations of existing climate risk tools hinder investors' ability to price risks with confidence. A recent study by the Climate Financial Risk Forum (CFRF) and the Global Association of Risk Professionals (GARP) shows wide variability of outputs across 13 physical risk data vendors, including a fundamental lack of consensus on what is a 'high risk' asset.[13]

Cross-industry collaboration between investors and insurers is essential, with opportunities to learn from the insurance industry's experience in pricing extreme weather risks. With insurance costs increasingly being scrutinised by the investor community, there remains an opportunity for asset managers to better communicate their risk management strategy, including climate adaptation plans, to insurers, enabling greater consideration of resilience within insurance programmes.

In Autumn 2025, the SMI's Asset Manager Asset Owner Hub, led by Impax Asset Management's Sustainability Centre, convened two roundtables to examine how investors can more effectively understand and manage the financial impacts of extreme weather. The first roundtable explored how to integrate extreme weather considerations into strategic asset allocation – an area where many asset owners are still developing approaches. The second focused on best practices for incorporating extreme weather risks and resilience measures into portfolio management. Both sessions brought together asset owners, asset managers and insurance industry representatives.

This report seeks to distil the key findings and conclusions arising from these conversations, with the aim of making investment strategies more resilient and stimulating innovation in the development of adaptation-focused products by asset owners and managers.

8 Oxera, 2024: The economic cost of extreme weather events
9 Munich Re, January 2026: Climate change presses on: Devastating wildfires and intense thunderstorms exacerbate losses for insurers
10 Baxter International, February 2025: Form 10-K
11 First Street Foundation, 2023: The 9th National Risk Assessment
12 Morgan Stanley Institute for Sustainable Investing, 2025: Sustainable Signals
13 Climate Financial Risk Forum, October 2025: A Risk Professional's Guide to Physical Risk Assessments

Financial materiality and data

Act now to enhance investment processes and consider extreme weather risk – waiting for perfect tools or foresight will only delay effective decision making.

Why data is a critical barrier to action

A growing body of real-world evidence shows how climate-related events are already eroding company value, disrupting supply chains and impairing asset performance.[14] Recent MSCI analysis indicates that the world's listed companies could face US$1.3tn in losses over the next year from extreme weather, due to both direct asset damage and lost revenue opportunities.[15] These impacts are not theoretical. Effects on performance have been found to be statistically significant: hurricane-impacted companies experienced negative excess returns (in excess of other market drivers) correlated with the concentration of their asset or revenue exposure to hurricane-affected areas.[16]

However, data limitations and the inherent uncertainty of future risks remain the most cited barriers to better risk management. These limitations are complex and stem from a combination of factors, which can be broken down into:[17]

1. **Model constraints**, which limit their utility within the investment decision-making process.
   - **a. Spatial granularity mismatch**. Extreme weather risks – flood depth, wildfire spread, and storm surge, for example – manifests at far finer scales than standard Global Climate Models (GCM) model outputs.
   - **b. Tail risk uncertainty**. Models are far less precise in estimating low-probability, high-impact outcomes, particularly where risks arise from compound or cascading events. This is increasingly relevant due to the rising probability of extreme outcomes. While average portfolio losses rise modestly (by around 2% by 2050) under a 3°C temperature rise scenario, the share of assets facing value losses of over 20% is estimated to increase five-fold.[18]
   - **c. Near-term relevance**. Climate models were historically designed for long-term responses (for example, 2050 and beyond). Over shorter investment horizons (three-to-ten years), internal variability often dominates, which can reduce forecast precision and applicability.
   - **d. Deep uncertainty around tipping points**. Non-linear Earth system components – including the Greenland Ice Sheet or Atlantic Meridional Overturning Circulation – introduce threshold risks that remain highly uncertain in timing and probability.
2. **Data limitations**, which reduce the accuracy of exposure and vulnerability assessments.
   - **a. Inadequate asset-level geolocation data**. Many companies do not disclose where critical assets are located, even when their exposure to extreme weather is material.
   - **b. Limited information on asset characteristics**. Key determinants of vulnerability – such as building type, condition or adaptation measures – are often missing.
   - **c. Complex operational footprints**. Multi-tier, global supply chains make indirect exposure difficult to map beyond Tier 1 suppliers.

14 MSCI Institute, October 2025: What the market thinks
15 MSCI Institute, 2025: Transition Finance Tracker Q3 2025
16 MSCI, September 2025: Is Physical Risk Financially Material?
17 Goldklang, M., October 2025: Decoding Climate Uncertainty
18 MSCI, December 2025: Sustainability and Climate in Focus: Trends to Watch for 2026

3. **Transmission complexity**, which makes it inherently challenging to model the complex impacts of climate change on assets and portfolios.
   a. **Indirect and cascading impacts**. Supply chain disruption, lost productivity or business interruption are often more material than direct physical damage, but are harder to accurately estimate. Business interruption losses from Hurricanes Sandy and Harvey were 800% to 900% higher than property damages.[19]
   b. **Market-level distortions.** Models rarely factor in changes in perceived risk, insurance availability and regulation, which can alter asset liquidity ahead of changes in realised physical impacts.
4. **Uncertainty over the future scenario and emissions pathway,** which makes it challenging for investors to accurately price climate-related risks.

   Differences in human choices have limited near-term impacts on extreme weather projections, however, due to inertia in climate systems. This implies that investors need to prepare for near-term impacts regardless of scenario choice.

How are investors using data today

While data gaps remain, investors are refocusing on minimising areas of informational uncertainty and exploring how to work with imperfect data. There is growing acknowledgement that near term physical climate risks are frequently underestimated, increasing the potential for sudden market repricing. Preparing portfolios for a higher likelihood of asset revaluations is now viewed as a necessary step in protecting long term, risk adjusted returns. Though investors highlight that perfect tools are not available, they also increasingly acknowledge the false precision embedded in existing approaches.

Increasingly, investors are forgoing the use of simplified financial loss metrics. Asset owners note that third party vendor metrics – such as Climate Value at Risk (CVaR) – have proven difficult to use in practice due to concerns over robustness, limited portfolio coverage and 'black box' methodologies. Investment teams across listed equities and private markets often find these metrics insufficiently specific to the assets or companies they analyse. At a systematic level, these tools also risk embedding unintended biases, particularly where risk scores correlate closely with industry allocations – penalising asset-intensive sectors regardless of resilience measures.

Instead, investors are focusing on hazard exposure analysis across different time horizons and scenarios. While far from being comprehensive, the simplicity of hazard exposure data and geographic heatmaps have made them a constructive input into investment decisions. Several asset owners note that visibility into how exposure intensifies over longer horizons has played a decisive role in choosing not to invest in certain private assets.

Data is also being used as a catalyst for deeper dialogue, rather than as an estimate of probable impact. By highlighting asset and fund-level vulnerabilities, investors can prioritise where to probe further and open discussions with investment teams on tolerable levels of physical climate risk. Asset owners are increasingly using data as a triage mechanism – to identify portfolio concentrations, assess geographical clustering and evaluate exposure to regions facing multiple, compounding hazards.

In some cases, asset owners are going further to build internal teams and analytical tools to generate more decision-useful insights. For example, some investors are applying historical attribution analysis to understand how company balance sheets and key economic variables would respond under specific extreme weather events. By combining this with forward looking scenarios, they are developing views on which companies are most exposed and how these insights should inform trading decisions. Others are creating proprietary indicators to evaluate the financial preparedness and underlying resilience of companies, drawing on non-traditional quality factors.

19 Dormady, N.C., 2022: The cost-effectiveness of economic resilience. *International Journal of Production Economics*

How the insurance market impacts asset values

Insurance affordability and availability need to be incorporated into investment decisions far more explicitly given its financial materiality. As shown in Figure 1 (on page 10), insurance is one of the channels for extreme weather to increase operating costs, reduce asset value or impair financing costs, effects that can be more sudden than many investors account for today due to climate change.

Insurance capacity and coverage is narrowing in the face of rising threats posed by more volatile and extreme weather. Climate change is affecting the factors that determine ongoing, cost-effective insurability: expected loss levels, the distribution of extreme outcomes (fat tail risks or higher-frequency 'nuisance' losses), and confidence that these factors will remain stable within predicted bounds. As extreme weather events become increasingly common, traditional insurance underwriting models become less reliable, and the longer-term availability of insurance becomes less predictable. Insurers are responding through raising premiums, narrowing coverage or exiting markets altogether, although this behaviour is currently mostly limited to residential markets.

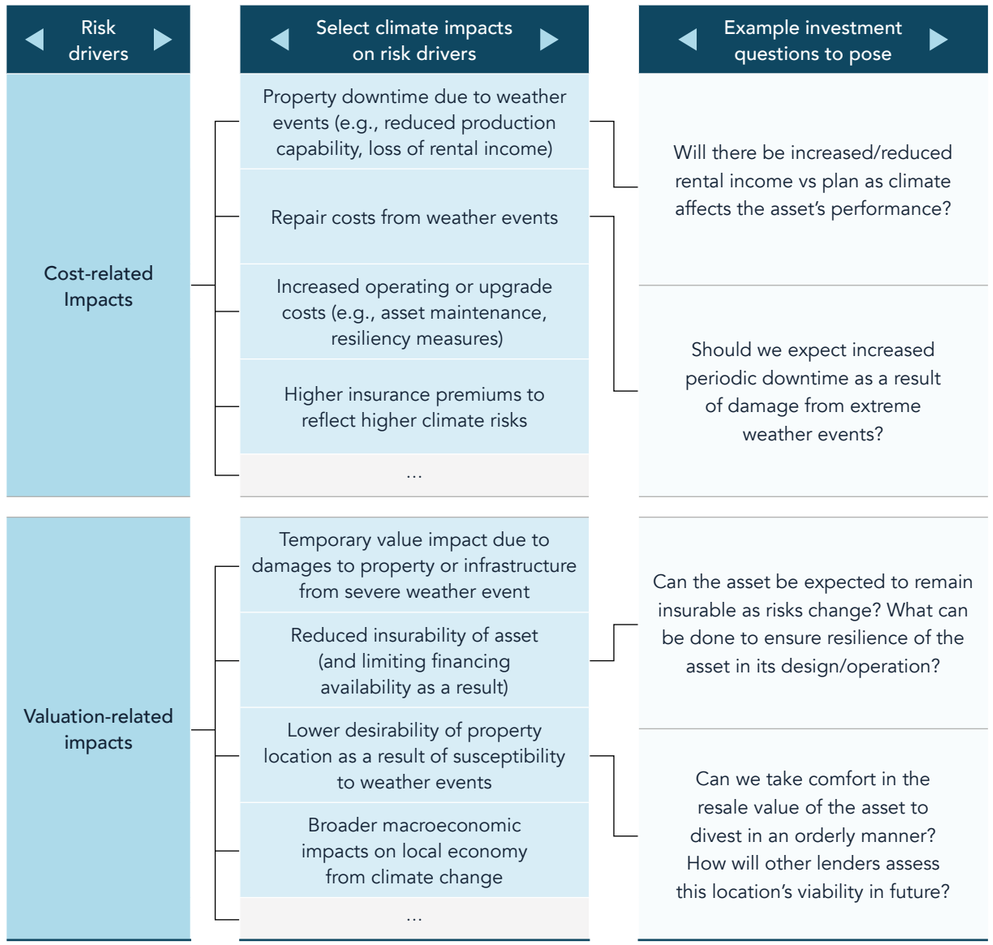
Insurance market signals are not always predictable, increasing the risk of sudden repricing events and liquidity shocks. Insurers typically adjust underwriting and pricing individually in response to improved modelling and new data, but they can react en masse to large loss events. These shifts can trigger abrupt tightening of underwriting appetite and capacity across multiple carriers simultaneously. Such periods of market 'hardening' can persist for several years as capital returns slowly and uncertainty around loss distributions remains elevated. As one example of the magnitude of these shocks, in Hong Kong, one leading asset owner saw its insurance premiums jump by 117% in the aftermath of Super Typhoon Mangkhut in 2018.[20]

Insurance market distortions can amplify portfolio risk in ways that are not always visible through headline premiums or continued market participation. Carriers may alter coverage by raising deductibles, increasing attachment points, reducing policy limits, narrowing wording or excluding specific perils from multi-peril contracts. These changes compress effective coverage while giving the appearance that insurance remains available.

Government interventions can further complicate price signals and, over time, can result in greater risk ultimately being retained by asset owners. Perceived public backstops may encourage underinsurance, while schemes designed to stabilise markets can obscure underlying risk pricing. State-level efforts in the US to preserve insurability amid insurer exits, such as in California, have practical financial limits. They can also distort market signals and reduce incentives for investment in resilience. These interventions increase the likelihood of abrupt valuation adjustments when risks are eventually repriced.

20 Link REIT, 2025: Sustainability-Linked Insurance: Rewarding Climate Risk Adaptation

Figure 1: Insurance is one of several climatic drivers that can influence investment decisions across real asset investments



Source: Marsh Analysis

Steps to use data more effectively

Access or develop appropriate tools and useful datasets, acknowledging that traditional modelling and financial loss estimates can fail to show the materiality of risks.

Investors need to move beyond simplistic – and often misleading – risk estimates towards more nuanced, layered analyses. Data should be treated as a catalyst for informed discussion, offering a directional perspective that can be challenged, triangulated and refined through deeper dialogue. Transparency around underlying assumptions and limitations is critical for building confidence in outputs and ensuring that data meaningfully informs investment decisions. In practice, this means using climate data to stress-test cash flow models when data limitations exist, rather than substituting it for core financial projections. It also will mean building processes that guide how to interpret divergent modelling outcomes (Section 2) and prioritise engagement with companies to close information gaps (Section 3).

A priority should be improving visibility into asset-level location data. Understanding where assets are situated, how critical they are to operations, and what characteristics shape their vulnerability can significantly strengthen risk assessment. This will typically require a combination of engagement with portfolio assets or purchase of external data, due to limited public reporting. Mapping locations against expected hazard patterns provides a clearer picture of portfolio concentrations and potential hotspots in geographical exposure to physical risks.

To ensure insights translate into action, outputs and analytical tools must be designed in ways that integrate easily into existing investment team workflows and financial models. Usability – and relevance to established decision processes – should be front of mind when selecting datasets or developing new internal analytics.

Investors should complement climate model outputs with real-world evidence, including insurance market behaviour and historical experience during past extreme weather events. Many risks – such as tipping points, supply chain failures or insurance repricing – are not yet fully captured in models. Drawing on observed outcomes can help reveal the full extent of potential losses and strengthen the case for financial materiality.

Allocation strategies: responses at a portfolio level

Make decisions that prioritise resilience, diversification and flexibility in strategic asset allocation and investment mandates, adapting climate scenarios and acknowledging unavoidable uncertainty.

Why weather risks matter for capital market assumptions

Asset owners direct trillions of dollars of capital through their strategic asset allocation process. Numerous studies show that the numerous studies show that investment policy, the allocation across asset classes, is the primary driver of portfolio outcomes over time, with a significantly larger impact on return variability than manager selection or individual security decisions.[21] To set these allocations, asset owners must consider future liabilities (such as pension obligations or insurance claims), spending requirements, risk tolerance and return objectives.

There are multiple approaches to determine strategic asset allocation, informed by capital market assumptions (CMAs) as well as institutional objectives. CMAs reflect long term expectations for inflation, volatility and financial returns, and highlight the trade-offs embedded in investment decision-making. They are a critical input across asset allocation methodologies, which seek to maximise the probability of meeting objectives given expected returns and risks.[22] Different methods for asset allocation have varying sensitivities to CMAs which play an explicit or implicit role in how asset owners allocate capital.

Ignoring extreme weather risk in CMAs is equivalent to the very strong assumption that it has minimal long-term economic impact. Extreme weather risks impacts both the return and risk side of the asset allocation process, for instance:

1. **Long-term regional return assumptions may be structurally lower**, with higher volatility, as extreme weather reduces productivity, slows economic growth and raises operational downtime for assets.
2. **Volatility measures may need updating.** With a higher likelihood of tail-risk events, cascading system failures and highly localised impacts, traditional metrics may understate risk.
3. **Risks to asset classes will not be evenly distributed.** Real estate, infrastructure and emerging market assets – particularly those with limited adaptation measures – are structurally more exposed to extreme weather events.
4. **Finally, correlations between asset classes may shift as extreme weather events increasingly affect multiple assets simultaneously**, potentially weakening traditional diversification benefits.

What are investors doing about these risks today

Many asset owners now use scenario-based frameworks to navigate uncertainty around how extreme weather may shape future market conditions. Several investors are also testing more holistic strategic asset allocation approaches – shifting away from optimisation-heavy models toward hybrid frameworks that blend quantitative filtering with qualitative assessments of portfolio quality.

21 Ibbotson, R.G. & Kaplan, P.D., 2000: Does Asset Allocation Policy Explain 40, 90, or 100 Percent of *Performance? Financial Analysts Journal*
22 At one end of the spectrum, mean variance optimisation approaches optimise expected return for a given volatility using CMAs and asset liability models optimise assets relative to liabilities based on expected return from CMAs. They are, however, often used in combination with other approaches, including risk-based allocation which aims for each asset group to contribute a targeted amount of portfolio risks and where CMAs are a less explicit factor.

Where used effectively, scenarios are already influencing asset allocation. Scenario analysis is most commonly applied when reviewing model portfolios or conducting asset–liability studies, helping investment teams explore how to build resilience across a wide range of macroeconomic outcomes. In some cases, outputs are being incorporated directly into baseline capital market assumptions, although investors remain divided on whether CMAs should reflect any specific scenario.

However, many still struggle to translate scenario outputs into actionable decisions. While four-fifths of roundtable participants reported applying some form of scenario analysis to assess portfolio exposure, fewer than two-fifths use the analysis to inform decisions. The remainder report either experimenting with scenarios or are not planning to use them.

Those making most progress are developing bespoke approaches. Some asset owners use public sources – including the Network for Greening the Financial System (NGFS), the International Energy Agency (IEA) and Bloomberg NEF – to build sub-industry financial modules that investment teams can directly integrate into both top-down and bottom-up analysis. Others are designing short-term, narrative-driven scenarios that capture expert views on how climate-related developments may unfold across energy systems, geopolitics and the broader economy, helping to overcome the limitations of optimisation-based climate models.

How the insurance market cycle can inform asset allocation

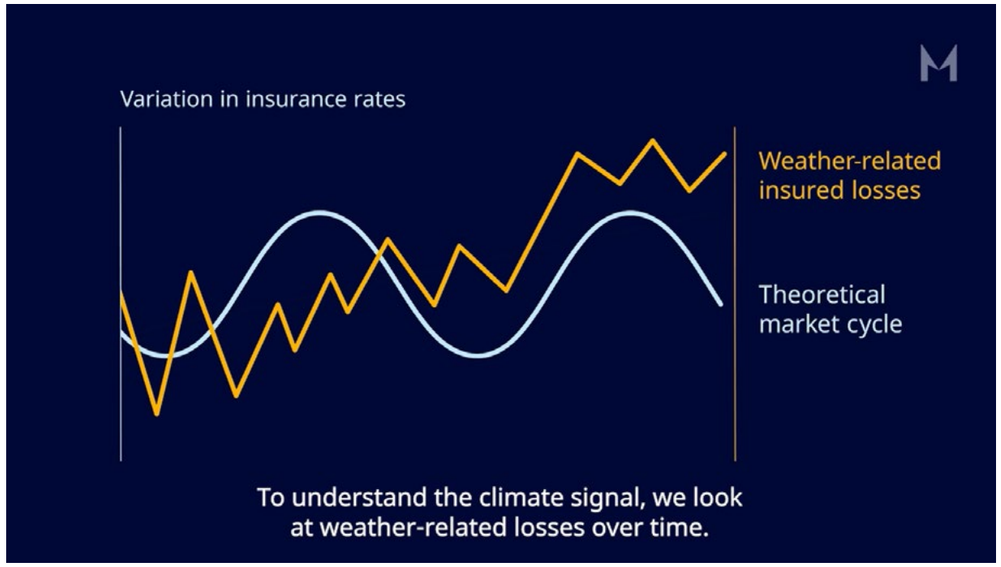
Insurance market cycles can mask the rising risk from extreme weather events. Insurance markets move through cycles typically lasting five-to-seven years, which materially influence pricing, capacity and underwriting norms. These dynamics shape when – and how clearly – the climate signal becomes visible.[23] In hard markets following periods of significant industry losses, underwriting tightens, capacity contracts and premiums rise. In soft markets, which we observe today, heightened competition and stronger balance sheets can broaden coverage and depress rates. This can temporarily suppress pricing signals even as underlying risks continue to rise.

Beneath cyclical dynamics, insured losses are rising sharply over the medium-to-long term. According to Guy Carpenter, when loss data is normalised for changing exposure and adjusted for inflation, climate change manifests as an incremental increase in annual global insured losses on the order of roughly 1% from a hazard-only perspective.[24] Despite this trend, Marsh's 2025 Adaptation Survey found that only about 5% of respondents cited access to insurance as a primary motivation for adaptation, suggesting that potential loss of insurability is still underappreciated as a strategic risk.[25]

Soft markets should present a strategic window to invest in resilience measures that minimise future costs. Falling premiums (as seen today) can create a false sense of security and delay necessary risk-mitigation actions.[26] However, experience shows that when markets harden, insurers rapidly become more selective and risk averse. This can amplify losses to owners of weather-exposed assets, which face sudden increases in operating costs or constraints on refinancing. To maximise risk-adjusted returns over a longer horizon spanning multiple insurance cycles, investors should use soft market headroom to ensure their portfolio of assets is investing in resilience measures, which could prove invaluable when negotiating with insurers in harder markets.

23 Marsh, January 2026: The silent signal: How extreme weather can impact pricing in a soft market
24 Ibid
25 Marsh, 2025: Climate adaptation 2025 report
26 Marsh, 2025: Global Insurance Market Index Q4 2025

Figure 2: Weather-related losses can impact insurance market signals, watch the video here



Source: Marsh Analysis

Expectations about where insurers sit within the cycle should also inform strategic asset allocation discussions. Incorporating insurance cycle dynamics, such as how pricing and capacity may evolve in the medium term, into portfolio risk analysis, can help investors anticipate insurance-driven repricing events that traditional climate models struggle to capture. It can also strengthen the financial case for investing in resilience, including both asset that are actively reducing their risk exposure and adaptation solution providers. As insurer scrutiny on extreme weather risks increases, resilience will increasingly differentiate medium-term financial performance and portfolio stability.

Steps to build 'climate-aware' asset allocation

Uncertainty should not prevent progress towards more resilient portfolios and investment strategies. Capital market assumptions inevitably involve imperfect information. Instead of paralysing action, uncertainties can be minimised when decision-making frameworks are built to understand and prepare for possible-but-uncertain outcomes. Leading investors have noted that early steps – supported by open dialogue – have already strengthened their ability to manage extreme weather risks.

In the near-term, modelling uncertainty can be mitigated through portfolio construction approaches that build resilience across a wide range of scenarios. Variations in modelling assumptions and knowledge gaps mean that no single model provides a reliable basis for decision making. Instead, investors should use an ensemble of scenarios to identify common themes, understand potential tail risks and the full distribution of outcomes. Averages – such as a 2% GDP decline in a 3°C warming scenario – can mask the risk of rare, but market-shifting events.

Where uncertainty grows over longer horizons, decision-making frameworks must adapt. Uncertainty stems from how societies, economies and physical systems will evolve. Efforts to 'optimise' for any single scenario are counterproductive. Instead, portfolios should be tested for robustness across a broad set of plausible futures, seeking to minimise regret rather than maximise expected outcomes.[27]

Amid deep uncertainty, narratives and signposts become essential tools for investors. Conversations about the different pathways that a system may follow – and their associated physical and financial implications – can help investment teams identify early indicators of change and adjust course as the future unfolds.[27]

27 Goldklang, M., October 2025: Decoding Climate Uncertainty

Engagement: responses at the asset level

Leverage engagement to assess vulnerability, recognising that preparedness and the ability to respond to events will be the key differentiator as extreme weather becomes increasingly frequent and widespread.

Why engagement is essential to assess asset vulnerability

Extreme weather risks are inherently idiosyncratic, creating a wide dispersion of potential outcomes even within the same asset class. Two assets located only a short distance apart may experience materially different levels of risk depending on factors such as elevation, drainage and surrounding land use. Likewise, vulnerability can differ sharply between seemingly similar assets due to variations in building quality, age and the presence – or absence – of adaptation measures.

Despite growing data, investors increasingly recognise that quantitative metrics alone cannot reliably capture asset level vulnerability. One of the most critical blind spots is the lack of accurate, well reported asset location data for companies – particularly multinational companies. Although data providers are developing proprietary databases, inconsistencies often lead to materially different assessments of asset exposure. The recent CFRF and GARP benchmarking study underscored the variability across physical risk data vendors – showing the large spread of hazard (such as flood depth) and damage estimates for the same property.[28]

These limitations underscore the importance of engagement. Direct dialogue with companies allows investors to obtain the granular insights that models often miss, such as detailed asset-level location information, an understanding of which facilities or components are operationally critical, the condition and resilience of buildings, and the adaptation measures already implemented. Proactive engagement should ultimately therefore strengthen the resilience of capital allocation decisions.

How are investors engaging with assets today

Investors across asset classes are increasingly turning to direct engagement to understand how well assets and companies are prepared for escalating extreme weather risks.

One growing practice is the use of vulnerability questionnaires in due diligence for real estate and infrastructure. These tools provide a qualitative view of an asset's preparedness that helps investors identify operational pinch points and areas requiring further scrutiny. In private markets, these preparedness scores are already feeding into investment discussions and shaping engagement with asset managers.

Engagement insights are beginning to influence systematic investment strategies. Some investors prefer to incorporate qualitative findings from company interactions – rather than rely solely on third party quantitative datasets – when adjusting portfolio tilts. This approach reflects an increasing preference for decision-relevant, context-specific information over generic exposure metrics.

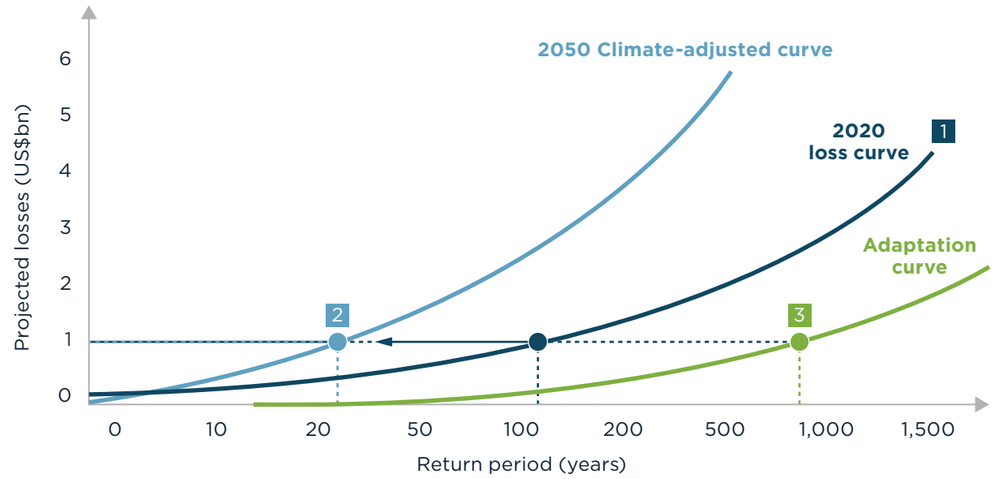
Collaboration is strengthening the effectiveness of engagement. Since 2022, investor groups involving Impax Asset Management, New York State Common Retirement Fund and PIMCO have undertaken a series of sector-focused collaborative engagements, including with utilities and semiconductor firms. Investors found that corporate awareness of risk exposure has improved significantly over the past five years. A persistent gap remains, however, between what investors need to know and what companies currently disclose about their extreme weather risk. One striking insight emerged: the companies most prepared for future climate shocks tend to be those that have already experienced one.

28 Climate Financial Risk Forum, October 2025: A Risk Professional's Guide to Physical Risk Assessments

How adaptation can shape insurance pricing and coverage

Investment in adaptation can help to reduce direct climate-related damages and insurance premiums. There are numerous adaptation solutions that are widely available and cost effective to implement today, such as site hardening or fortified roofing, that can help reduce the impact of climate-related events on assets. The benefits of adaptation can be understood through the loss curve for an asset (line 1 in Figure 3), which reflects its anticipated losses by a given event, such as a 1-in-100-year storm or flood, in the present day and under a future world impacted by climate change (2). Adaptation measures to reduce expected damage from events can push the loss curve down (3), potentially unlocking improved insurance outcomes.

Figure 3: Adaptation measures can reduce expected losses from climate change



Source: Marsh Analysis

The tangible benefits of adaptation are illustrated by mounting evidence, including:

- Houses built to the 'Fortified Roof' standard had a loss ratio reduction of 55% to 72%.[29,30] If all households in a sample study had roofs built to this standard, damages during Hurricane Sally in 2020 could have been reduced by 66%.[31, 32]
- A study focused on a Californian town shows that aggregate expected wildfire loss could fall by up to 53% if all homeowners carried out actions – such as hardening structures and managing buffer zones – recommended under the Insurance Institute for Business & Home Safety's (IBHS) Wildfire Prepared Home Program.[33]
- Link REIT in Asia, working with Marsh and Axa, secured an 11.7% reduction in property insurance premiums in 2025 due to its quantification of climate risk and targeted resilience investments. Notably, they also negotiated a 7.5% premium reduction tied to its loss ratio, creating a clear financial incentive to continue investing in long-term climate preparedness.[34]

29 Alabama Department of Insurance, 2025: Fortified Performance in Hurricane Sally
30 The loss ratio measures the proportion of insurance claims relative to premiums earned.
31 The Epicenter, 9 July 2025: FORTIFIED Roofs and Homes Are Saving Alabama Homeowners and Insurers Thousands
32 Guy Carpenter, 2021: Quantifying Insurance Benefits of a Nature-Based Approach to Reducing Risks: Wildfire Risk Reduction Buffers
33 Milliman and Corelogic, 2023: Town of Paradise California Resilience Challenge Task 1 to Task 4
34 Link REIT, 2025: Sustainability-Linked Insurance: Rewarding Climate Risk Adaptation

Innovation in insurance mechanisms is strengthening the financial case for adaptation, by linking financial returns to proactive resilience action. The North Carolina Insurance Underwriting Association issued a US$600mn three-year catastrophe bond – the first to include an explicit resilience feature.[35] A small annual spread (0.35%) is set aside in a dedicated resilience account and returned to the issuer with interest if losses remain below a predefined threshold. These funds can be used to finance local adaptation measures, directly reducing expected losses. By blending indemnity-based catastrophe bond protection with a resilience payback, it serves as a practical model for future insurance-linked security (ILS) resilience transactions.

Investment in resilience is the most durable way to lower portfolio risks but requires proactive engagement with both insurers and underlying assets. While solutions exist to lower the costs of extreme weather events, and thereby reduce insurance premiums, these are not always captured by insurers in their pricing models or considered by corporates or infrastructure project developers. Investors play a critical role in accelerating conversations on adaptation across these players, uncovering hidden price incentives that lower risks for all stakeholders.

Steps to engage on extreme weather risks

To begin, investors should prioritise engagements by identifying their portfolios' most material exposures to extreme weather risk. Diversified investors may find that focusing on private infrastructure and real estate assets is particularly valuable, given their long-duration nature and the inherent exposure of fixed physical assets to climate-related hazards. For portfolios with a greater weighting in listed equities, prioritisation may be informed by sectoral or regional exposure, as well as the asset intensity of business models. However, asset intensity alone should not be treated as a full proxy for risk: sectors such as banking and insurance, which provide lending or coverage to asset-heavy industries, may also face significant indirect exposure to underlying physical risks.

When engaging with companies, key areas for dialogue could include:

- **Forward-looking preparedness:** How companies identify and plan for unprecedented extreme weather events, including the use of scenario analysis and the governance structures overseeing physical climate risks.
- **Impact pathways:** The expected evolution of risk over time – both direct damages and indirect operational disruptions that could arise if an event were to occur.
- **Value chain exposure:** Key nodes in supply chains that may be vulnerable to material interruptions from extreme weather and how interdependencies are managed.
- **Insurance market implications:** Shifts in premium affordability, coverage availability and broader insurability trends that may affect operational or financial resilience.
- **Adaptation measures:** Actions already undertaken or planned, and their anticipated effectiveness in reducing vulnerability at the asset or enterprise level.

Finally, investors should draw on the growing body of external resources available to support effective engagement on extreme weather risk. Several organisations – including global investor groups and specialist climate risk consultancies – have developed guidance and frameworks that can help structure dialogue and enhance the usefulness of engagement outcomes. These include:

- Institutional Investors Group on Climate Change (IIGCC), Climate Resilience Investment Framework[36]
- Cadlas, Investor Stewardship for Climate Resilience Sourcebook[37]
- Ceres, Guidance on Engaging on Climate Risk Governance[38]

35 Artemis, May 2025: NCIUA's recent catastrophe bond included integrated disaster-resilience feature
36 Institutional Investors Group on Climate Change, June 2025: Climate Resilience Investment Framework
37 Cadlas, 2025: The Cadlas Sourcebook on Investor Stewardship for Climate Resilience
38 Ceres, 2025: Guidance for Investor Engagements with Directors on Climate Risk Governance

Future work: what to prioritise

Work to tackle both portfolio and systemic risks, to maximise long-term value for clients and beneficiaries. Collaboration will be key to successfully addressing gaps in information and analytical tools, and in advocating for market structures that recognise the benefits of investment in adaptation.

1. Improve portfolio risk management through better information and analytical tools

a. **Engage with companies, issuers and real asset operators to disclose the material extreme weather risks they face** at the asset and supply-chain level, alongside the adaptation measures implemented to manage those risks. Differences between sources on the number of companies reporting context-specific adaptation plans (35%, according to S&P), versus the larger proportion surveyed that are implementing some form of adaptation planning, suggest a reporting gap that may obfuscate action that is already underway.[39] Investor pressure can help to ensure this financially material information is more widely accessible.[40]

b. **Facilitate peer-to-peer dialogue among investors on practical approaches to incorporating physical climate risk** into strategic asset allocation, security selection and engagement priorities, particularly in contexts where risks are characterised by deep uncertainty and limited historical data.

c. **Work with climate risk modellers and data providers to ensure analytical tools are relevant and useful for investor decision-making**, enabling:

- Co-creation of investor-relevant scenarios – a recent example of this 'is the narrative-based No Time to Lose scenarios developed by the University of Exeter and Universities Superannuation Scheme pension fund.[41]
- Greater transparency around model assumptions, damage functions and uncertainty ranges, enabling investors to interpret results appropriately.
- Development of approaches to compare outputs across commercial climate risk models, improving consistency in how risks are incorporated into investment analysis.

2. Minimise systemic risks through stronger system-wide incentives for resilience

a. **Encourage greater recognition of resilience measures in insurer underwriting and premium pricing, alongside the development of resilience-linked products.** These products can reward risk-reducing investments through lower premiums, improved coverage terms or multi-year pricing stability. Some US insurers already provide premium discounts for homes certified under the 'Fortified Roof' standard, but there remains significant scope to broaden the range of resilience measures recognised in pricing.[42] For example, a first-of-its-kind insurance policy that considers nature-based efforts to mitigate wildfire risk has enabled coverage in an area of the Sierra Nevada where other insurers are declining to write or renew policies, with pricing set 39% lower than it would otherwise have been.[43]

39 MSCI Institute, October 2025: What the market thinks
40 World Economic Forum, September 2025: Mind the adaptation gap: Despite rising climate costs, few companies have adaptation plans
41 Accounting for Sustainability, 2024: Q&A: A narrative approach to climate scenario at USS
42 The Epicenter, 9 July 2025: FORTIFIED Roofs and Homes Are Saving Alabama Homeowners and Insurers Thousands
43 UC Berkeley Law, 2025: First Ever Wildfire Resilience Insurance Policy Written and Placed

b. Advocate for policy that creates risk-reducing incentive structures is critical, via frameworks that:

- Mandate disclosure of corporate resilience plans and the location of assets and supply-chain nodes exposed to material extreme weather risks, improving market transparency.
- Strengthen incentives for adaptation investment by tightening building standards in high-risk areas and providing targeted financial support. Effective examples of this include property tax abatements linked to resilience upgrades or grant programmes partially funded by local insurers.[44] Evidence from FEMA's nationwide study found that building codes adopted in 2000 saved US$1.6bn each year, highlighting the economic savings from upfront investments.[45]
- Reduce distortions in insurance markets by enabling risk-reflective pricing and linking discounts explicitly to risk-reducing investments, rather than broadly subsidising coverage in high-risk areas. Insurance markets play a critical role in revealing and pricing physical climate risk, yet regulatory constraints and opposition to insurance rate hikes often limit insurers' ability to fully reflect risk in premiums.[46] Policies that suppress price signals and create an insurer-of-last-resort may be politically appealing in the short term, but evidence suggests they enable an increase in risk exposure and will come under increasing strain as extreme weather events intensify.[47,48,49]

44 S&P Global, 2023: Ala. storm mitigation program offers template for La. insurance market
45 Federal Emergency Management Agency, 2020: Landmark Nationwide Losses Avoided Study Finds That Building Codes Save
46 First Street Foundation, 2023: The 9th National Risk Assessment
47 Federal Reserve Bank of Dallas, 2025: Last Resort Insurance: Wildfires and the Regulation of a Crashing Market
48 Climate & Community Institute, October 2025: Insurers of Last Resort: Why Today's FAIR Plans Need a Redesign to Address the Home Insurance Crisis
49 Kreisman Initiative for Housing Law & Policy, 2024: Do we need an insurer of last resort?

Contributors

Sustainable Markets Initiative - Founded by His Majesty King Charles III (then Prince of Wales) in 2020, the Sustainable Markets Initiative has become the world's 'go-to' private sector organisation on transition. Launched in 2021, the Terra Carta serves as the Sustainable Markets Initiative's mandate with a focus on accelerating positive results for Nature, People and Planet through real economy action. Read more: www.sustainable-markets.org.

Impax - Founded in 1998 and with approximately 100 investment professionals within listed equities, fixed income and private markets, Impax is one of the largest specialist investors focused on the transition to a more sustainable economy.

Impax believes that strong investment returns can be generated by investors who better understand the opportunities and risks associated with forces shaping the future, including resource constraints, policy and regulation, technological innovation, and evolving social trends. Impax believes that these trends are reshaping capital markets: driving growth for well-positioned companies and creating risks for those unable or unwilling to adapt. Its investment approach seeks out high-quality companies and issuers with enduring business models and sound risk management, aiming to deliver strong outcomes for our clients over the medium to long term.

Marsh Risk - Marsh Risk is a business of US-listed Marsh, a global leader in risk, reinsurance and capital, people and investments, and management consulting, advising clients in 130 countries. With annual revenue of US$27bn and more than 95,000 colleagues, Marsh helps build the confidence to thrive through the power of perspective. For more information about Marsh Risk, visit Marsh Risk | Global Leader in Insurance Broking and Risk Management.

Authors

Shahbano Soomro, Sustainable Investment Research & Strategy, Impax
Callum Ellis, Head of Climate Resilience, Marsh
Blaize Siggers, Senior Climate Consultant, Marsh

For further information please visit
www.sustainable-markets.org/taskforces/asset-manager-and-asset-owner-taskforce

---