

Uncovering the Complexity of Physical Climate Risk: Insights from the Insurance Sector

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Overview

The increased occurrence of extreme weather-related events requires organizations to enhance their risk management systems related to physical climate risk. A June 2023 survey of Chief Risk Officers found that risk managers are primarily focused on transition risks, including macroeconomic indicators, pricing and supply disruptions, and regulatory changes, often without explicitly considering the impact of climate-related physical risk.¹ While companies rally to invest in resources to understand physical climate-related risks – the first time for many – insurers have been managing and measuring these risks for decades. By drawing on our expertise as a global property and casualty insurer, this paper aims to equip and empower risk managers and organizations with the knowledge needed to mitigate and manage physical climate risks.

The Challenges in Managing Physical Risk: *Evaluating Climate Risk Models*

Managing physical risk is undeniably complex and our understanding of the risk continues to evolve. Furthermore, the science linking climate change to perils, including its components (see Box 2 on following page), is still developing, revealing that the frequency and losses of past events are not always reflective of future trends.

Shifting weather patterns also make it harder to rely on past trends to accurately predict or manage weather events. While many organizations are turning to traditional climate models known as general circulation models (GCMs) for guidance, these tools often fall short when it comes to managing acute

physical climate risks such as wildfire or hurricanes. Though valuable for predicting long-term chronic physical risk trends such as temperature change and sea level rise, GCMs are not designed to directly simulate extreme events or translate those events into impacts and losses.²

Property insurers use catastrophe models to measure and manage physical risk. These models are statistically based tools that have been used by the insurance industry for over three decades to assess rare, extreme events like hurricanes. As we navigate these challenges together, it is important to understand the types of models available to help measure and manage physical risk, along with the limitations of each. We encourage you to explore [more](#) about these models on our website where you'll find [resources](#) to help us collectively build a stronger, more resilient community.



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Box 1:

Defining Physical Climate Risk

To effectively manage physical climate risk across an organization, establishing a common language and understanding equips teams with the necessary knowledge to help identify and mitigate these risks.

Through a shared language, teams can work together more effectively to make informed decisions and strengthen the organization's overall resilience in the face of uncertainty.

We recommend the definition developed by the Taskforce on Climate-Related Financial Disclosures (TCFD) Recommendations, which defines physical risk as the potential adverse impacts that arise from the physical effects of climate change on both the natural and built environments. The TCFD categorizes physical risk into acute (i.e., extreme weather events, such as flood and wildfires) and chronic (i.e., temperature change, sea level rise).³ But it is all connected - chronic changes can influence the frequency and severity of acute events, like how rising sea levels can worsen storm surges.

Box 2:

Examples of climate-affected acute perils, and components of those perils that may change with climate change

Perils	Components that may be changing
Hurricane	<ul style="list-style-type: none"> • Storm surge • Hurricane rainfall • High severity wind
Flood	<ul style="list-style-type: none"> • Flash flooding • River flooding • Coastal flood
Wildfire	<ul style="list-style-type: none"> • Temperature and drought • Ecosystem change • Wind-driven fire

Getting Started: A Simplified Physical Climate Risk Management Framework

Identifying and prioritizing which perils drive physical climate risk to businesses or portfolios is difficult. To get started we recommend considering three key dimensions (see Figure 1: Dimensions of Physical Climate Risk) that inform physical risk exposure in an organization. By working together to apply these dimensions, teams can better understand where the greatest threats and opportunities lie, ensuring efforts to manage and mitigate physical risks are focused where they matter the most.

Dimension 1: Exposure

The first dimension to explore when assessing physical risk is understanding the business or assets in a book of business. In insurance, we refer to this as 'exposure'. Unlike transition risk, which is commonly managed at broader scales like countries or regional economies, physical risk demands a finer level

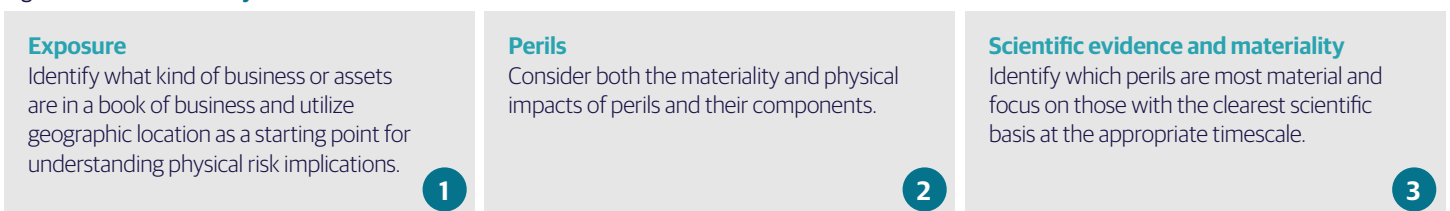
of detail and granularity. This means getting down to the basic characteristics about the properties in the business or portfolio. For insurers, location, building value, type of building, construction quality and design, age of building and number of stories are considered the minimum set of factors needed to generate meaningful results from physical risk models.

For some organizations, this level of detail may not always be readily available. In such cases, geographic location can provide a solid starting point for understanding physical risk implications for an organization or asset. Recognizing these geographical differences is a crucial first step toward identifying potential physical risks and perils, helping teams develop targeted strategies to mitigate impacts.

Dimension 2: Perils that drive losses

It is difficult for companies to know which perils to prioritize to manage and mitigate physical climate risk. While it is tempting to manage all perils, it is more effective to identify and focus

Figure 1: Dimensions of Physical Climate Risk



on those perils that drive losses. Focusing on components of the perils (see box 2 on previous page) that correlate with higher impacts or loss potential (i.e., wind-driven fire, high-category hurricanes) allows us to prioritize climate actions by the biggest impact to the bottom line.

For example, there is a strong link between increasing temperature with climate change and increased burn area in wildfires, but a company may not be impacted by large fires that burn in remote forests. On the other hand, wind-driven fires produce a majority of the catastrophic property losses, so a company interested in managing its wildfire risk should dig in on understanding this particular subset of fires. Importantly, those high-impact components will differ between different types of businesses – a forestry management company will probably care more about which fires are burning large areas of remote forests. Determining if potential changes will translate into losses requires a sophisticated understanding not just of the climate, but also of the needs of the business.

It should be kept in mind that as physical climate risk continues to change and evolve, it is also critical to consider potential future material perils. For example, a region may not experience drought currently, but increasing global temperatures also increases the probability of drought.

Dimension 3: Scientific evidence and materiality of perils

The third dimension to evaluate physical climate risk is the scientific evidence or understanding of the link between climate change and peril. This means identifying what types of hazards are most material to the organization and focusing on those which have the clearest scientific basis at the appropriate timescale. It requires organizations to focus on perils where there are clear climate impacts in the near term on their book such as hurricanes, floods and wildfires.

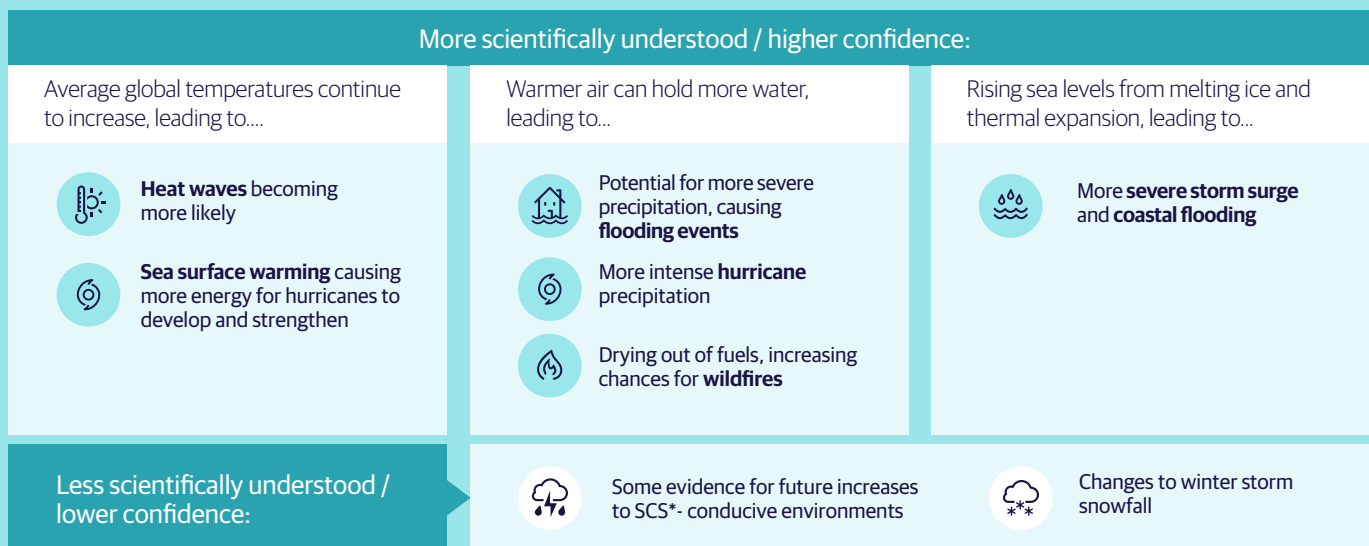
Lots of different hazards are changing with climate change (see box 3 below). For companies planning in the near term (<25 years), changing acute hazards are likely dominated by hurricane, flood and wildfire, with lower scientific confidence for other perils like tornadoes. The geographic distribution of a business, collected in dimension 1 (exposure), can further narrow the list - a company centered in Europe probably doesn't need to spend as much time on hurricanes, while an Australian company may want to push wildfire up the list.

For perils where scientific understanding is clearest, scenario exercises can be used to manage and mitigate risks. Conversely, we may need other risk management strategies, such as sensitivity tests and stress testing, to mitigate the perils that are less understood by the scientific community. These tools are discussed in more detail in the following section.

Box 3:

Scientific Confidence of Different Perils

The graphic below charts our understanding of the relationship between climate change and chronic and acute weather events. The level of confidence is based on: i) the understanding of how the physical processes that drive an extreme event will be affected by climate change, also known as climate understanding; and ii) the ability to assign a likelihood of climate impacts to any events, also known as climate attribution.



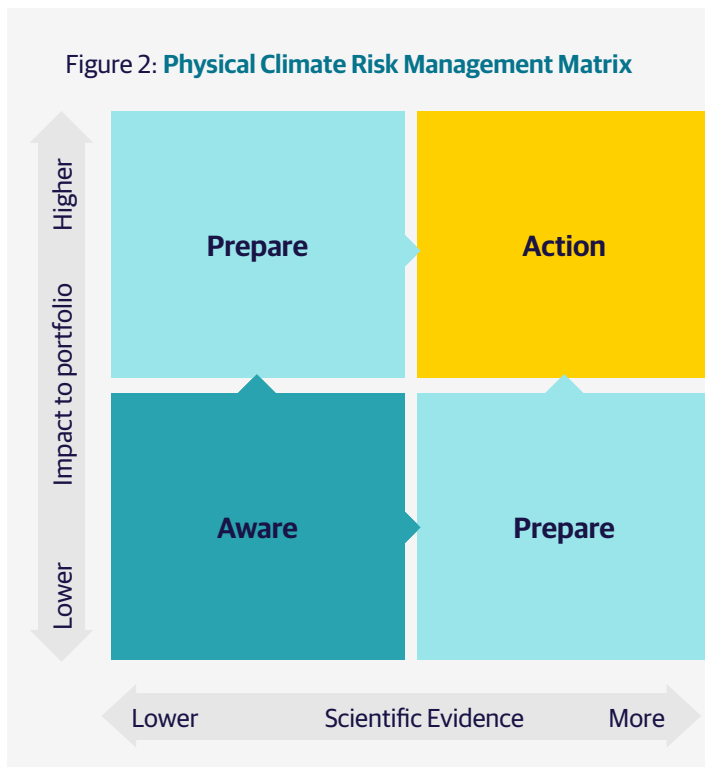
*Severe convective storms (SCS)



Prioritizing Physical Risk: *The Physical Climate Risk Management Matrix*

Given the high likelihood of organizations being exposed to multiple physical perils it is necessary to prioritize managing each and using the right tools in order to efficiently allocate resources and mitigate risk.

At Liberty we implement a matrix such as the one below (Figure 2), which can serve as a guide for how to prioritize



and respond to acute and chronic perils that might impact a portfolio.

To leverage this matrix, an organization would need to first identify the physical risks or perils associated with its book of business as suggested above and then plot the different risks based on scientific understanding of the impact of climate change on the peril (X-axis) and financial impact to business (Y-axis).

There are three possible buckets or outcomes that perils fall into once the risks are plotted on the matrix.

Action: These are perils where there is high financial impact and high scientific evidence allowing the organization to take **Action** to prevent or mitigate the risk immediately.

Prepare: These are perils where there is high financial impact and low to moderate scientific evidence or low to moderate financial impact but high scientific evidence that allows the organization to assess and **Prepare** for the risk.

Aware: These are perils where there is low financial impact and low scientific evidence allowing the organization to de-prioritize these perils but periodically **monitor for any changes**.

Managing Physical Climate Risk: *Tools Based on Level of Scientific Evidence*

Once the perils have been identified and prioritized, our ability to manage the risk is driven by the level of scientific evidence and certainty associated with the peril. Below are tools or risk management strategies that we recommend using:

High scientific evidence

Where the direction and amount of change is relatively clear: Scenario analysis, based on emissions scenarios and future time steps. Example: Sea level rise impacts on storm surge

Medium scientific evidence

Where the direction is clear, but the amount is not: Sensitivity testing, varying one component of risk in a systematic way to explore impact potential. Example: Temperature impacts on wildfire

Lower scientific evidence

Where the direction and amount of change are unclear: Reverse stress tests, defining a risk tolerance and working backwards to assess which changes would threaten that tolerance. Example: Hurricane frequency

An insurance partner can help an organization better understand how to use these tools and leverage a company's existing data and resources.



Ensuring Business Resiliency: *Building a Physical Climate Risk Management Program*

Given the changing nature of physical risk, there are standard procedures that all organizations can implement, regardless of industry, geography and perceived risk, to ensure business resilience.

Periodic assessment of material perils: Given the changing nature of perils and escalating nature of physical risk, it is critical to set a cadence for reviewing what might be considered a material peril. This could be incorporated into an existing risk review process, or a new process specifically focused on climate risk could be put in place. Reporting this risk in the same terms used for other risk management measures ensures that climate risk assessment can be directly incorporated into the business.

Continuous monitoring of science: As climate-related science continues to evolve, it is important to monitor scientific

developments and refine processes for identifying and managing climate-related risks. This can include leveraging the latest credible and peer-reviewed sources, attending conferences, engaging in cross-sector dialogue – including with academic and research institutions, and hiring talent from across backgrounds and disciplines.

Incorporating physical risk lens into business strategy and planning: Companies should consider physical risk and the evolving nature of climate risk in any future planning, including M&A deals and business growth, considering how the time horizon of a project might shift the level of certainty.

Investments in resiliency measures and adaptive practices: While risk management is important for businesses, this must be introduced in parallel with the implementation of resiliency measures and practices. Given predicted changes to material perils, additional investment in enhancing resilience, informed by an organization's understanding of physical risk, may be needed.

Conclusion:

Physical risk is complicated and our understanding will continue to evolve. The insurance industry has a unique lens given its decades of experience monitoring and measuring physical risk. The framework outlined above should serve as a foundation for companies to map and manage physical risks – and insurers can serve as guides and partners. Given the ever-changing nature and increasing risk, now is the time for companies to both strengthen their own capabilities and to partner with experts from the insurance industry, while also being open to adapting structures and strategies as science advances.

What can companies do?

- Speak with your insurance partners about best practices for identifying and managing physical risk.
- Implement a physical risk management framework, taking into consideration exposure and material perils to better manage impacts from climate change.
- Evolve internal governance to ensure streamlined discussion, reporting and decision-making around physical risk.
- Introduce internal education and simulations to ensure that all business leaders understand the implications of physical risk stemming from climate-related impacts and understand how to leverage the physical risk framework.



Send questions or comments to
sustainability@libertymutual.com

¹World Economic Forum, [Chief Risk Officers Outlook: July 2023](#)

²Journal of Financial Transformation, [Understanding the Key Challenges and Opportunities in Creating Climate Transition Pathway](#)

³[Task Force on Climate-Related Financial Disclosures Recommendations Report](#)

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