IMPAX Asset Management

Physical Climate Risk and the S&P 500

A report on our engagement with companies about the physical risks posed by climate change

by Julie Gorte, Ph.D., Senior Vice President for Sustainable Investing

Two-thirds of large companies around the world have at least one asset at high risk because of the physical hazards created by a warming climate.[1] In finance, this kind of information often gets subsumed by the avalanche of real-time information and the eternal pressure to show superior returns in the short run. The myopia of financial markets is well known and has been widely criticized, and nowhere is it more essential to avoid than in planning for the physical risks of climate change. This report describes our engagement with listed US companies in the S&P 500 Index about these risks and their responsibility to understand and mitigate them. It includes a snapshot of how many companies responded and from which sectors, what companies say they are doing about physical climate risk and how executive suites are thinking about it.

KEY TAKEAWAYS

- Two-thirds of large companies around the world have at least one asset at high risk because of the physical hazards created by a warming climate.
- To price risks appropriately, investors and asset managers must understand a company's exposure to physical climate risks and how a company plans to adapt to, mitigate or manage those risks.
- Our engagement with companies in the S&P 500 suggests businesses are not ready for the effects of climate change.

Why physical climate risk is so important

The recent report from the Intergovernmental Panel on Climate Change (IPCC) reinforces the need for urgency in solving the problem of climate change, noting that the current rate of warming is faster than anything that's happened during the last two millennia, and the warming is attributable to human activity. The report goes into some detail on the physical changes that are occurring, noting, for example, that it is "virtually certain that hot extremes (including heatwaves) have become more frequent and more intense across most land regions since the 1950s," and the "frequency and intensity of heavy precipitation events have increased since the 1950s over most land area."[2] The report notes that the surface temperature of Earth will continue to warm until at least mid-century under all the scenarios it examines, which means that preparation for physical risk will be essential to deal with for the next 30 years. Even with successful efforts to reduce emissions, however, many of the effects of climate change are "irreversible for centuries to millennia." In short, we have two choices: anticipate physical risks and adapt to them — or not.

Physical climate risk is a poster child for the kind of problem humanity has often proven to be especially incompetent at solving: mobilizing today's resources to help future generations. Avoiding the worst outcomes of climate change means making significant investments now that will pay off for decades. We do have time to avoid the worst impacts of climate change, but only if we make changes in the next few years. For long-term investors, the benefits of assessing physical risk are easy to see. Catastrophic events take an enormous toll, and if they are unforeseen and unplanned for, the toll is routinely higher. Even short-term investors have a stake in better understanding how exposed their portfolios are to physical climate risk. Events such as floods, storms, fires, droughts and heat domes are already occurring in many places, and until we are successful at eliminating anthropogenic greenhouse gas (GHG) emissions, they will continue to happen with increasing frequency and severity. In short, physical risk isn't just a long-term risk.

> "Physical risk isn't just a long-term risk."

Until recently, it was difficult to attribute specific events to climate change, but the science has evolved considerably during the last decade. It is now possible to say how likely a current or future event is made by climate change and to assign probabilities on a regional basis geographically. Under a high-emissions scenario — which, it should be noted, the world is currently on — week-long heat extremes that are three or more standard deviations greater than the mean are two-to-seven times more likely between now and 2050, and three-to-21 times more likely in 2051 and 2080.[3] As this report was written, we had an object lesson in one of the events the new IPCC report predicts — rapid intensification of tropical cyclones, demonstrated during Hurricane Ida. The report noted "There is high confidence that average peak TC (tropical cyclone) wind speeds and the proportion of Category 4–5 TCs will increase with warming and … peak winds of the most intense TCs will increase."

[1] S&P Global, "Physical Risks," www.spglobal.com/esg/education/essential-sustainability/climate/physical-risks?gclid=CjwKCAjwr56IBhAvEiwA1fuqGiu-wj6EseQ3n-k4VGkGyNA2oyLUmhEROMk3eZJge1jyD1gCKrtnXBoCs8cQAvD_BwE. Accessed Sept. 15, 2021.
[2] Intergovernmental Panel on Climate Change, "Climate Change 2021: The Physical Science Basis, Summary for Policymakers," Aug. 7, 2021.
[3] E.M. Fischer, S. Sippel and R. Knutti, "Increasing Probability of Record-shattering Climate Extremes," Nature Climate Change 11, July 26, 2021.

How investors can approach physical climate risk

The first job for investors and asset managers, therefore, should be to understand those risks and work to price them. The best risk-pricing combines a specific company's exposure to physical risk hazards — floods, fires, droughts, severe precipitation, tropical storms, heat, sea level rise, and increasing ranges of pests and diseases — with companies' policies and plans to adapt to, mitigate or manage those risks. That starts with knowing where companies' assets are located geographically, and with some precision. Unlike transition risk, which is linked with GHG emissions, physical risk doesn't have strong links to sector and industry; any company can be safer or more vulnerable depending upon where it operates, where its significant assets are, the geographic distribution of the key parts of its value chain, and its dependence on specific parts of physical infrastructure, such as ports or internet cables. Yet reporting on the locations of these elements with more precision than one often finds in company annual reporting, which often gets no more specific than a country, is inadequate to the task of understanding physical risk exposure for investors.

What companies need to disclose

Physical risk assessment that is meaningful for investors should factor in not only exposure to physical hazards but the company's own knowledge of its exposure and its plans to mitigate those risks or adapt to physical hazards. To some degree, investors can assess exposure solely on the basis of where the company's key assets and value chain dependencies are located, but a full risk profile also includes company preparedness, and that information cannot be gleaned from anything other than companies' own disclosures. This kind of information is not often available, but when companies do disclose it, it usually comes in the form of a TCFD (Task Force on Climate-Related Financial Disclosures) or CDP (Carbon Disclosure Project) report, or a company sustainability report. There is not yet complete comparability in these sources, but as climate risks increase, so too will the pressure for standards in reporting climate risks.

Most companies don't disclose much about physical risk now, except for the occasional boilerplate sentence in a financial report to the effect that natural disasters may cause unspecified harm in the future. But the tools of climate analysis are developing rapidly, and it is now possible to assign specific hazard probabilities to many geographies, including most locations on land, using the existing suite of climate science models.[4] With that information, and the locations of companies' assets and key parts of their value chains, investors can develop risk profiles that describe changes in the likelihood that a particular hazard might affect company performance. To do that well, we must understand where and what those assets are at a greater level of specificity than just a continent, country, state or region. For some assets, even specifying a city is not a sufficient level of detail; sea level rise, particularly, may have a profound impact on some parts of cities and a negligible impact on other addresses in the same cities.

[4] Reuters staff, "Natural Disasters Cost Insurance Industry $76 Billion in 2020 – Swiss Re," Reuters, Dec. 15, 2020.

OUR S&P 500 ENGAGEMENT:
WHAT WE ASKED AND HOW COMPANIES RESPONDED

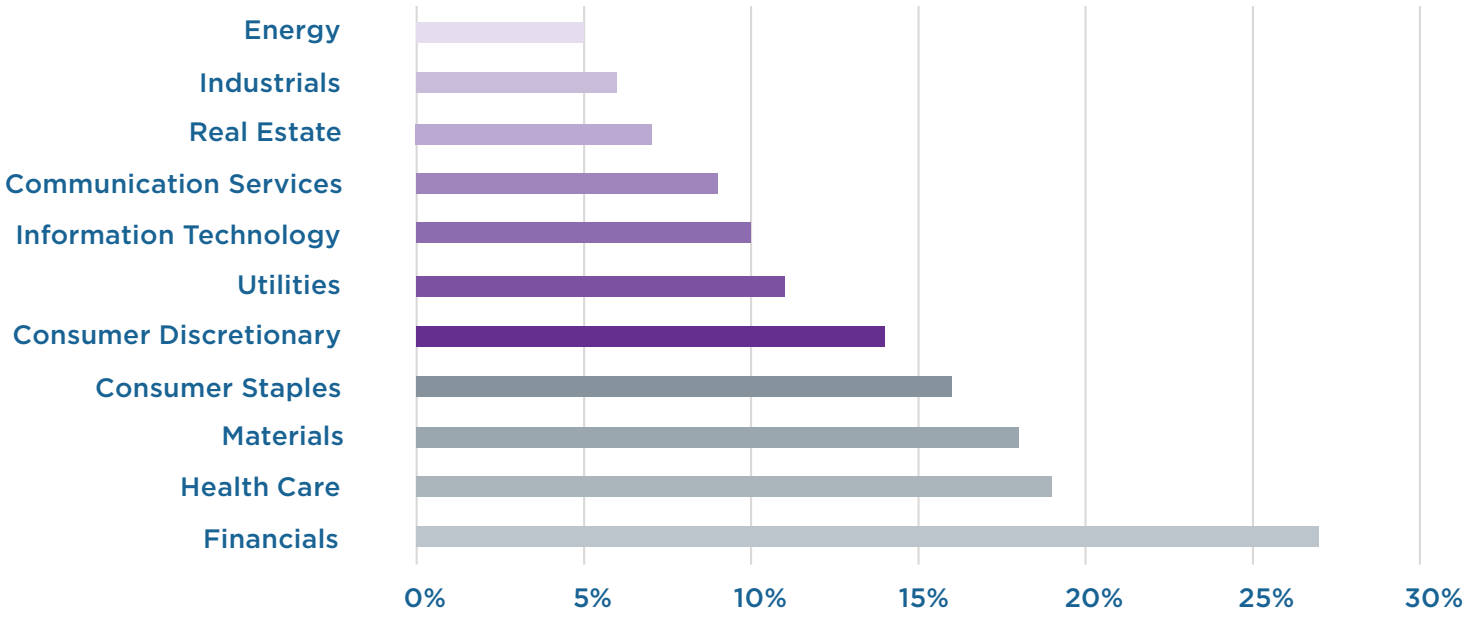
In October 2020, we sent a letter to the companies in the S&P 500 Index asking them to provide precise geographic coordinates — street address and/or longitude/latitude data — of any assets whose loss or impairment would have a material impact.

We learned quite a bit from our initial outreach.

Who responded?

Just over 13% of the S&P 500 companies responded to our initial letter. Response rates by sector varied considerably (Table 1)

TABLE 1: Response Rate of the S&P 500 To Physical Risk Letter, by Sector



Financials

The financial sector was more responsive to our enquiry than others, and this is not surprising. Financial companies, whether banks, investment banks, insurance companies, or capital markets participants, are exposed to physical risk in any industry or sector, through holdings or portfolios or lending or underwriting. Just over half the financial sector companies that responded were insurance companies, which is logical, considering their vulnerability to losses from events such as severe storms. So-called "natural disasters" — a category that increasingly is made up of climate events with anthropogenic influence — cost the insurance industry $76 billion in 2020, according to one reinsurance company,[5] and 2021 is already on a pace to exceed that total, with as much as $42 billion in natural disaster insured losses during the first six months of the year.[6] These numbers were driven largely by weather events like wildfires, extreme temperatures and cyclones, all of which are expected to become more frequent, more severe, or both as the average temperature of the planet rises. Clearly, property and casualty insurers, as well as reinsurance companies, are on the front lines of physical risk, and they also often have their own models for understanding the financial impact of climate change. Though it is impossible to judge whether these models are being used to best price future climate risks over long-term time horizons.

[5] Jasper Jolly, "2021's Extreme Weather Leads to Insurers' Biggest Payout in 10 Years," The Guardian, July 21, 2021.

[6] The Coupled Model Intercomparison Project brings together many different climate models from scientific groups around the world and coordinates the data from each into overarching and standardized simulations of future climate drivers. The latest round, CMIP6, were largely made available ahead of and for the IPCC's 6th assessment report.

It is also noteworthy that only 36% of the insurance companies in the S&P 500 responded to our enquiry. It is conceivable that specialists in things such as disability, health insurance, automobile insurance, or directors and officers (D&O) insurance feel less vulnerable to physical risk. Yet physical hazards affect all kinds of insurance underwriting, and several of the companies that did not respond note that physical hazards pose risks they're working to understand and adapt to, often through CDP reports or company websites.[7]

The bottom line for financial companies with respect to physical climate risk is this: They have a lot of value at risk and not enough information to fully assess their assets' vulnerabilities.

Healthcare, Materials, and Consumer Sectors

The other sectors whose response rates exceeded the 13% average included healthcare, materials and both consumer discretionary and consumer staples sectors. Companies within each of these groups may see higher vulnerability. For healthcare companies, climate change will expand the ranges of human and animal pathogens that were formerly more confined to the tropics, and this poses both risks and opportunities for the healthcare sector. For example, according to the World Health Organization, "major vector-borne diseases account for about 17% of all infectious diseases and lead to 700,000 deaths per year." Relationships between climate change and incidence of vector-borne diseases are complex, and in many cases climate change is not the only factor behind changes in such diseases, but in some cases — including Lyme disease and malaria — there is evidence that climate change does affect rates of infection and spread.[8]

In the materials sector, two-thirds of the responders to our enquiry were chemical companies, whose supply chains are already increasingly vulnerable to disruption resulting from climate-related hazards, at times because many chemical plants are located near ports, making them vulnerable to coastal storms and sea level rise.[9] Chemical production that is water-intensive is also increasingly vulnerable to drought. Many companies noted natural disasters, including climate events such as hurricanes, as a risk factor in their 10-K annual report. For example, one materials company noted that hurricane damage to one of its facilities resulted in tens of millions of dollars of damage, recorded as reductions in cost of goods sold and business interruptions. Three other materials companies noted that "natural disasters" or "unfavorable weather" could impact operations, but the disclosures were generic.

Only one mining company responded to our survey, though there is evidence that mining companies already face physical risk. For example, McKinsey notes that "mining is no stranger to harsh climates; much of the industry already operates in inhospitable conditions. But forecasts of hazards such as heavy precipitation, drought and heat indicate these effects will become more frequent and intense, increasing the physical challenges to mining operations."[10]

> **"Consumer-facing companies whose reputations are especially important to them … might be particularly sensitive to perceptions that they are not aware of climate risks."**

Finally, both consumer discretionary and consumer staples companies were slightly more likely than average to respond to our enquiry. These sectors consist of a wide variety of industries and often span the globe in operations, but they have at least one thing in common: Many are consumer-facing companies whose reputations are especially important to them and thus might be particularly sensitive to perceptions that they are not aware of climate risks. Nearly half the respondents in this sector were in retailing operations and two were in the hotels business; both of these areas rely on dependable customer services that are vulnerable to disruption.

In all four sectors, we saw little indication that the companies were aware of and taking steps to create plans to adapt to the emerging hazards.

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[7] See, for example, Allstate Corporation's 2020 response to the CDP Climate Change questionnaire and Richard Marshall, "Implications of Climate Change for Life Insurers and Pension Schemes," Willis Towers Watson, June 30, 2021.
[8] Kristin Marshall and Anthony Schiavo, "In the Path of Destruction: Preparing for Climate Change in the Chemical Industry," Lux Research, May 4, 2020.
[9] Lesley Evans Ogden, "Climate Change, Pathogens, and People: The Challenges of Monitoring a Moving Target," BioScience, Volume 68, Issue 10, October 2018.
[10] Lindsay Delevigne, Will Glazener, Liesbet Grégoir, and Kimberly Henderson, "Climate Risk and Decarbonization: What Every Mining CEO Needs To Know," McKinsey Sustainability, Jan. 28, 2020.

Low responders

Companies in the energy, industrials, real estate, communication services, information technology and utilities sectors had lower-than-average response rates for reasons that are not immediately apparent. That is particularly true in the case of real estate and energy, whose properties and assets are difficult and expensive to shift geographically. For instance, an estimated 35% of real estate assets globally are exposed to climate-related events such as flood risk, sea level rise and coastal flooding, hurricanes and typhoons.[11] Even more might be vulnerable in the longer term to more chronic risks like heat. Heat is particularly corrosive for companies that depend on outdoor labor, including, inter alia, food production, materials and industrials. But even real estate may have more medium- and long-term mobility for adaptation to physical risks than energy, where oil and gas production facilities do not have the luxury of moving to less exposed locations. IT and communications companies do have physical assets in vulnerable regions, and some of those assets, including facilities such as large data centers, may also be difficult and expensive to relocate.

Utilities are a special case. At least in some cases, and perhaps for all electric utilities, disclosure of physical locations is actually prohibited for security reasons, given the vulnerability of the nation's electric grid to terror or cyberattacks meant to cripple key capacity. While they may not be able to disclose the locations of facilities and infrastructure, however, utilities are clearly on the front lines of climate risk; already, we have seen one bankruptcy that can be directly tied to the new regime of climate change-induced wildfires in California. In fact, any utility in the western United States may face the same kinds of risk that put PG&E into bankruptcy court, in 2019 with the landscape becoming hotter and drier, and still the interface between wildlands and urban lands is expanding. The combination is a recipe for hotter, faster-moving wildfires that could imperil any business, and certainly affect any utility's transmission, distribution and even generation assets. They also put utilities at increasing risk of being assessed with wildfire liabilities, as sparks from transmission lines or right-of-way maintenance have already been shown to have ignited damaging wildfires. Moreover, when destructive fires do burn, there is much higher likelihood that soils on slopes damaged by wildfire will turn into debris torrents or mudslides in future rains. This is just one example; utilities have also proven vulnerable to other physical climate hazards in many other locations, and whether they disclose their physical locations or not, their general territories are known, and investors view utilities as particularly vulnerable.

The responses

The most common response to our enquiry was companies reporting that they already disclose location data (Table 2). However, in some cases, what these companies regard as adequate location disclosure is still at too distant a scale to be useful in physical risk assessment. Some of the responders disclosed locations by city, state or country rather than including street addresses or latitude/longitude data, as requested. Disclosures at the city-state level may be sufficient to gauge a company's exposure to geographically extensive risks such as drought or heat, but they are not specific enough to reveal risks that depend not only on geography but proximity to water sources, such as inland or coastal flooding or sea level rise.

13%

of S&P 500 companies responded to our engagement

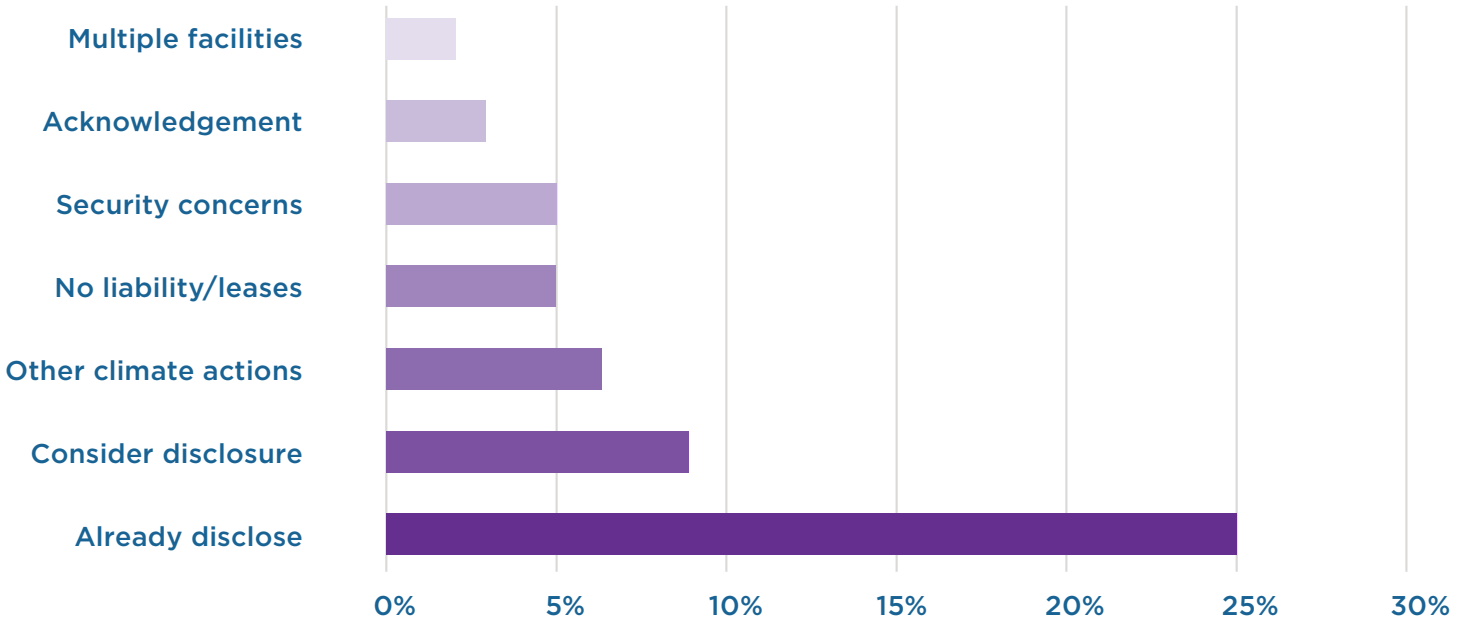
Several other companies noted that they do not currently disclose the type of location information we asked for but acknowledged the need for it and said they would consider disclosing it. Still others declined to disclose location information due to security risks, and there are several states that do not allow disclosure of specific locations of key infrastructure facilities on security grounds. Three of the companies that noted security concerns were electric utilities. It is nonetheless interesting to note that in many cases, the locations of assets are often disclosed in the media following catastrophic events, and utility companies themselves have often disclosed significant damages to their facilities by climate-related events. We found it interesting that one pharmaceutical company declined to provide location information on security grounds, while other pharma companies provided the information; the same was true in the information technology sector.

Seven respondents declined to provide specific locations either because they did not feel they had any exposure to physical risk or because they had so many locations (indicated by "multiple facilities" in Table 2, below) that they did not feel it was likely that physical hazards could knock out a sufficient number to have a material impact. In at least one case, that of a railroad company, the logic was puzzling, as their assets, while spread over broad geographies, are not entirely discrete, and at some level the viability of those assets is dependent on the viability of all or many parts of the network.

[11] See, for example, Jamie Powell, "Climate Change: The CMBS Angle," Financial Times, Oct. 28, 2019.

Two insurance companies also noted that their assets were intangible and thus not vulnerable to physical risk. Still others noted that they only lease facilities and thus have no material risk. In the latter two cases, this logic is questionable; damage to intangible assets can have significant impacts on companies, and insurance payouts for catastrophes have been rising at rates so rapid that, in some cases, major insurance companies have pulled out of especially vulnerable areas. In the case of leased facilities, physical risks can still halt business operations, and that can have financial impact. One hospitality company, for example, noted in response to our enquiry that it does not own most of its hotels. While this may make property damage a moot point, business interruptions at leased facilities can still affect financial performance.

TABLE 2: Number of Respondents, by Type of Response



Source: Impax Asset Management calculations

Overall, there was little indication that companies truly are taking the physical risks of climate change seriously. While some do report on the locations of their assets in ways that enable investors to conduct physical risk assessments, few of them had any discussion in their own reporting about how climate change could affect business operations through acute or chronic hazards.

Executive suite approaches to physical risk

Of the companies that did mention physical hazards and risks, there was considerable variation in thinking.

The most concerning responses were those of companies that asserted they have no physical risk, either because they have so many facilities that no single event could cause material problems, or because they only lease facilities. This is an unacceptably narrow view of physical risk.

In fact, there are many ways that any business, in any facility (leased or owned) can be exposed to physical risk: through its supply chain, in its own operations, and downstream (see Figure 1).[12] Moreover, as we have seen, climate-related events do not happen one at a time; a company with operations in many places isn't necessarily protected from significant impact solely due to geographic dispersion. Any company whose management thinks there is no threat from climate physical hazards is likely to be blissfully ignorant — and the bliss will likely disappear quickly.

[12] Natalie Ambrosio Preudhomme, "Understanding Industry Relative Exposure to Physical Impacts of Climate Change," Four Twenty Seven, June 7, 2021.

FIGURE 1: Pathways for Climate Risk Exposure

Source: Four Twenty Seven, "Understanding Industry Relative Exposure to Physical Impacts of Climate Change," June 7, 2021.

Many companies that had little or nothing to say about physical risk did several times outline other approaches to climate change, most often including things like targets (including science-based targets) for emissions reduction, purchases of renewable energy, and TCFD reporting. While commendable that companies are taking these steps, none of them, with the possible exception of TCFD reporting, will provide companies much protection from physical risk. But TCFD reporting, provided it includes scenario analysis that covers a breadth of emissions reduction pathways [such as Representative Concentration Pathway (RCP) 8.5, 6.0 and 4.5] can provide significant insight into how companies are seeing their own vulnerability to physical risk and may also illuminate what steps they are taking to mitigate or manage those risks. Using standardized scenarios such as this, along with information from companies about how their plans and adaptation affect the vulnerability of their business models to physical risk, will be helpful for investors.

9%

of S&P 500 companies mentioned or discussed climate-related impacts in their recent annual or quarterly reports

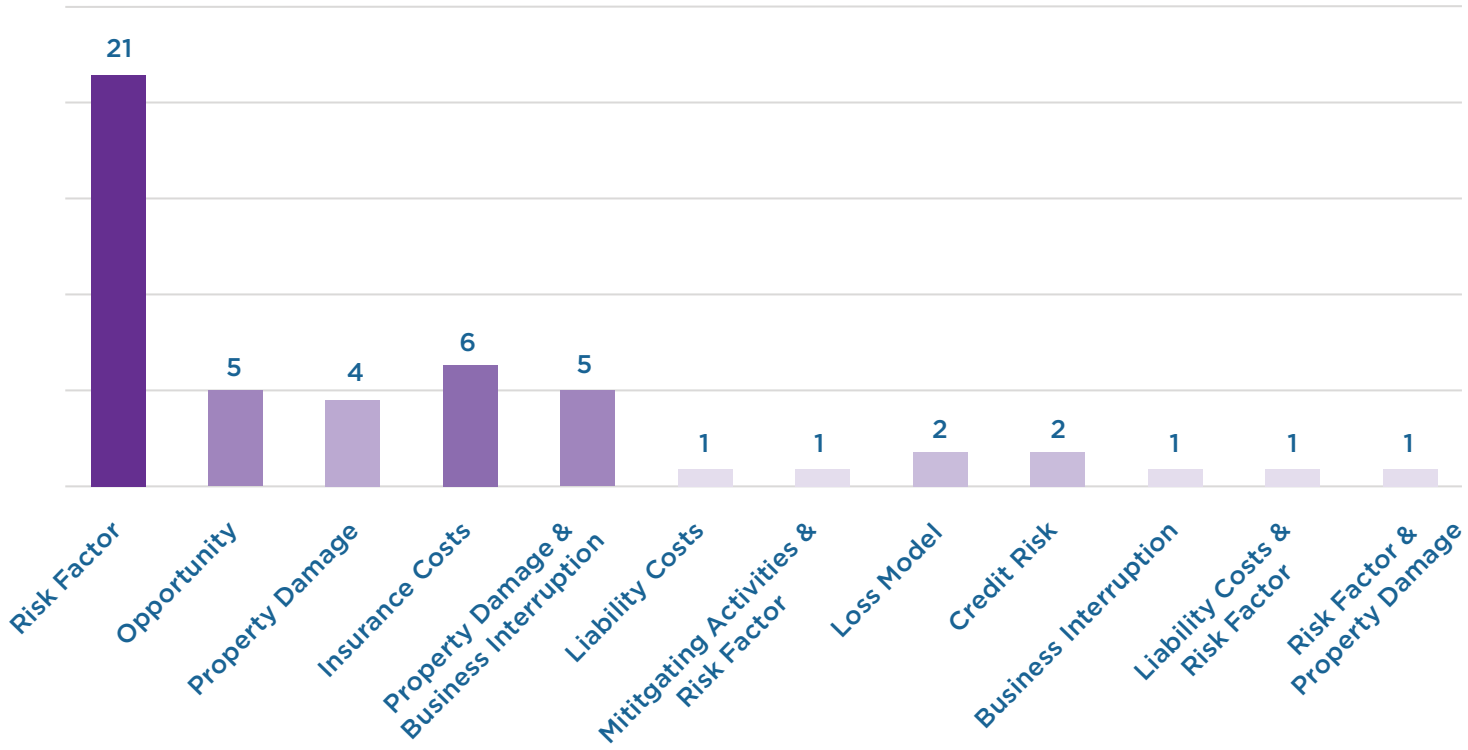
Source: Impax analysis

Several companies also noted that they are aware of physical risks and have incorporated them into business continuity plans (BCPs). That useful first step was almost always taken because the company had already experienced a significant climate-related event. For instance, one hospitality company was obliged to send a ship to one of its hotels to rescue guests after a severe hurricane deprived the hotel of power, water, staff and supplies. But BCPs are only a first step. Most BCPs are written with the expectation that a business interruption due to a natural or manmade disaster is both rare and unique. It is increasingly clear that the probability of disastrous events has increased significantly and that in any given year a company may experience several events affecting its own operations or value chain.

Examples abound. One recent paper[13] showed that supply chain shocks from heavy rains in Japan caused multiple negative economic shocks that persisted for nearly two months afterwards. Our own research showed that among the S&P 500 constituents, 43 companies reported impacts from the hurricane season of 2020 alone in annual 10-Ks or quarterly 10-Qs, and eight more reported impacts from the freezing weather in Texas. Most of the impacts were negative (see Tables 3 and 4). An internal analysis of the recent 10-Ks and 10-Qs of the S&P 500 constituents found that only 43 companies appeared to mention or discuss climate-related impacts, and in most cases this did not extend beyond a broad and unspecific mention of climate disasters/acute events in their general risk factors.

[13] Hiroyasu Inoue, "The Economic Impact of Heavy Rains on Supply Chains," Social Science Research Network, June 28, 2021.

TABLE 3: Reported Impacts from 2020 Hurricane Season in the US

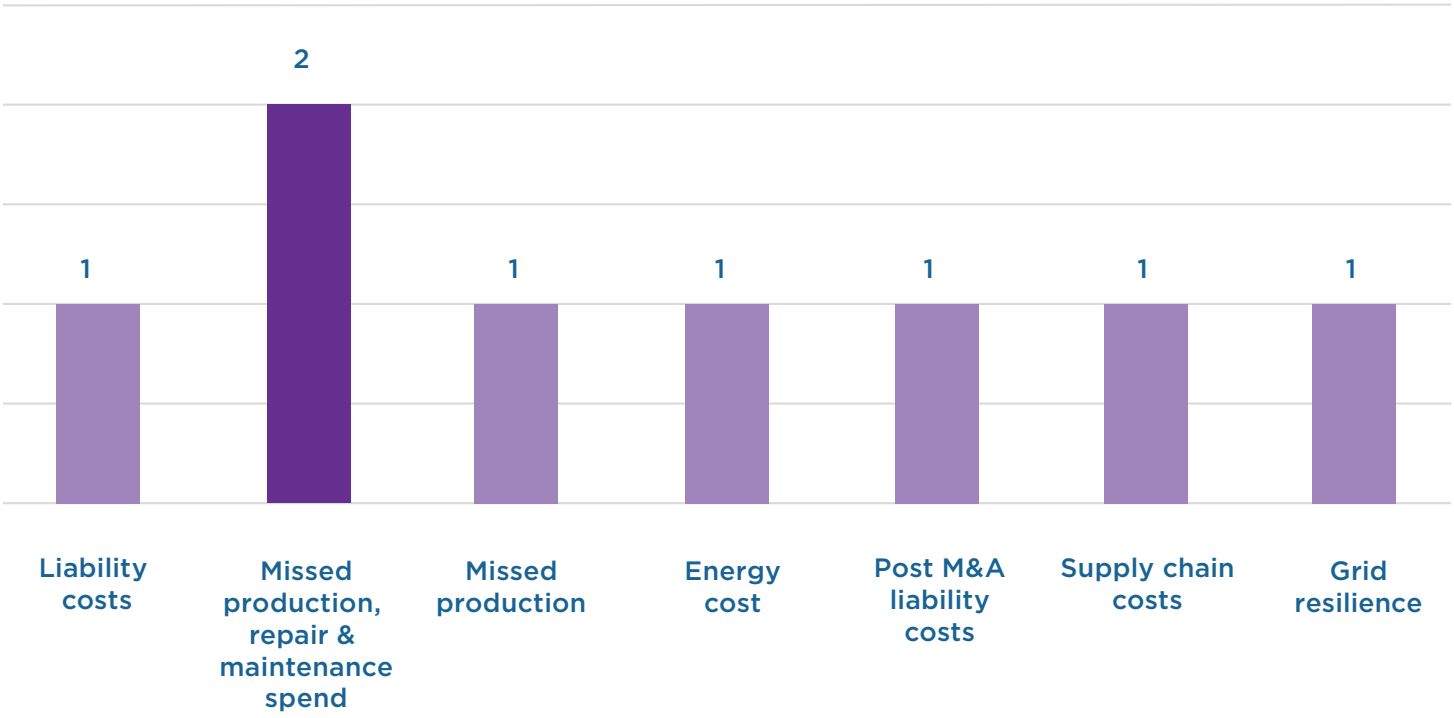


Source: Impax Asset Management calculations

- **Risk Factor:** The company makes a passing comment toward climate-related hazards in the risk factors section of their 10-K only.
- **Opportunity:** The company notes business opportunity related to climate-related hazards, but no discussion of risk.
- **Property Damage:** Costs associated with climate hazard-related damage to a company's property mentioned by a company.
- **Insurance Costs:** The company references heightening costs associated with insurance markets.
- **Property Damage & Business Interruption:** As above + below.
- **Liability Costs:** Company mentions costs relating to breaches of responsibility that are being litigated against in some form.
- **Mitigating Activities & Risk Factor:** As above + the company makes reference to activities undertaken to mitigate the impacts of climate-related hazards.
- **Loss Model:** A specific subset of mitigating activities whereby a company has explicitly stated setting risk limits within a "probably maximum loss" metric within insurance.
- **Credit Risk:** Company makes specific reference to risks associated with credit due to climate-related hazards.
- **Business Interruption:** Company reference to operational downtime due to climate-related hazards.
- **Liability Costs & Risk Factor:** As above
- **Risk Factor & Property Damage:** As above

[13] Hiroyasu Inoue, "The Economic Impact of Heavy Rains on Supply Chains," Social Science Research Network, June 28, 2021.

TABLE 4: Reported Impacts from the Texas Storm in 2020



Source: Impax Asset Management calculations

Conclusions

We asked S&P 500 companies a very simple question: Where are the facilities whose loss or damage might be a material event? What we derived from the companies' responses and our engagements with them is a warning signal: Companies are not ready for the effects of climate change. Of all the companies we spoke to or heard from, we found just three that had seriously considered their liabilities due to physical risk and had plans for adapting to or mitigating those risks.

The choice is straightforward: Companies that aren't prepared to deal with a more chaotic weather system in the future are likely to be unprepared to deal with a series of increasingly frequent and severe shocks. For investors, that sends a signal: There's a lot of value at risk, and right now, most of it is unpriced.

Globally, the need to reduce greenhouse gases is urgent, and while most nations did sign up to significant reduction targets, almost none of them are on track to fulfill their commitments. It is likely no longer possible to keep warming below 1.5°C, and without immediate and deep cuts in emissions, we will likely surpass 2°C. The impacts will be catastrophic. While we redouble our efforts to avoid putting greenhouse gases into the atmosphere, and work on both manmade and nature-based solutions to remove carbon from the atmosphere, we must also prepare for a future that will be very different from the past. There are trillions of dollars of value at risk.

3

Number of S&P 500 companies that we conclude have seriously considered their liabilities due to physical risk and have plans for adapting to or mitigating those risks

Source: Impax analysis

The authors would like to thank Eri Yamaguchi, ESG Investment Officer at New York State Common Retirement Fund, whose insights have been essential to this engagement.

Julie Gorte, Ph.D.

Julie Gorte is Senior Vice President for Sustainable Investing at Impax Asset Management LLC, the North American division of Impax Asset Management Group and investment adviser to Pax World Funds. She oversees environmental, social and governance-related research on prospective and current investments as well as the firm's shareholder engagement and public policy advocacy. Julie is also a member of the Impax Gender Analytics team.

Prior to joining the firm, Julie served as Vice President and Chief Social Investment Strategist at Calvert. Her experience before she joined the investment world in 1999 includes a various number of roles. Julie spent nearly 14 years as Senior Associate and Project Director at the Congressional Office of Technology Assessment. Additionally, she has held the roles of Vice President for Economic and Environmental Research at The Wilderness Society, and Program Manager for Technology Programs in the Environmental Protection Agency's policy office and Senior Associate at the Northeast-Midwest Institute.

Julie serves on the boards of the Endangered Species Coalition, E4theFuture, Clean Production Action and is the board chair of the Sustainable Investments Institute.

Julie received a Ph.D. and Master of Science in resource economics from Michigan State University and a Bachelor of Science in forest management at Northern Arizona University.

Matthew Wright

Matthew is a Research Analyst, specializing in research into physical climate risk and engagement on the theme of climate, with a focus on carbon emissions and water impact reporting. He researches stocks globally, with a broad focus on the water value chain.

Matthew joined Impax in June 2020 after completing a three-month internship during the summer of 2019, followed by contract work on the development of a model that assesses physical climate risk exposure for each investment.

Matthew earned a Master's degree in Environmental Technology with a focus on Environmental Economics and Policy, and a Bachelor's degree in Geophysics from Imperial College London. His previous experience includes founding a startup focused on financial climate risk and working as a Business Analyst.

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