

Climate Change and Business Risks

In November 2014, the Monmouth-Ocean Development Council, the SBA and Small Business Development Council and the U.S. Resilience Project convened a Resilience Workshop in Lakewood New Jersey — about 10 miles from the coast. Storm surge and rising sea levels are becoming a fact of life for this region. Indeed, sea levels along the New Jersey coast have risen faster than the global average. A few miles down the coast in Atlantic City, where records extend back to 1912, sea levels have risen by an average rate of 1.5 inches per decade during the period of record. The effective rate of sea level rise is faster than average because the land is subsiding at the same time. It is estimated that economic losses in New Jersey will likely increase by between 64 percent and 174 percent by 2050 due just to sea level rise. By 2100, New Jersey is expected to see an increase in losses of between \$1.4 billion and \$3.7 billion.

This White Paper addresses:

- Section 1: What Companies Are Doing to Prepare for Climate Change
- Section 2: Small Business Challenges and Perspectives from Lakewood

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Section 1: What Companies Are Doing to Prepare for Climate Change

The short answer is: Most are not preparing yet — or not preparing very well. The section covers some of the recent reports that are moving the topic of climate change from the science pages to the business pages.

The non-profit, Ceres, conducted a 2014 survey of the insurance industry — arguably an industry in the forefront of risk analytics and risk management. [See Appendix I] Although the insurance industry is ahead of others in dealing with climate change, only nine out of 330 insurance companies surveyed, earned a “Leading” rating from Ceres in preparing for climate change. The majority of insurance companies were in the “Beginner” or “Minimal” range. A 2014 report, entitled *Risky Business*, detailed the estimated financial impact of climate change by region and sector. Its companion volume, *American Climate Prospectus: Economic Risks in the United States*, quantified the impacts of climate change in energy, food, labor, health and other key sectors. A 2012 report by CERES imagined the potential impacts of climate change for specific industry sectors.

Insurer Climate Risk Disclosure Survey Report & Scorecard: 2014 Findings & Recommendations

CERES

October 2014

Of the 330 insurance companies surveyed: only nine had strong governance structures in place to address climate change; enterprise-wide climate risk management programs; computer-models to manage risk; programs to engage stakeholders on the topic of climate risks; and processes to measure and reduce greenhouse gases.

“In general, most of the companies responding to the survey reported a profound lack of preparedness in addressing climate-related risks and opportunities. Only nine insurers, or three percent of the 330 companies overall, earned a “Leading” rating. The vast majority of insurers (83 percent) earned “Beginning” or “Minimal” ratings. Just over 10 percent of the insurers overall — 38 of 330 companies — have issued public climate risk management statements articulating the company’s understanding of climate science and its implications for core underwriting and investment portfolios.” [See Appendix I for the questions on the survey that yielded these ratings].

Two Key Recommendations

- **Better Risk Analytics:** Insurers must augment existing CAT models to include forward looking loss scenarios based on the latest climate science and encompassing a wide range of perils, e.g., sea-level rise, storm surge, wind, intense precipitation, heat etc.
- **Engage with Key Stakeholders on Climate Risk:** Insurers will find it prudent and profitable to address climate risk issues with their key stakeholders: policyholders, regulators, investors, brokers/agents, and policymakers. Such efforts include advocating for investments in resilient public infrastructure and climate research, educating policyholders regarding how they can mitigate climate risks in their homes and businesses, and promoting climate smart insurance products.

Climate Change Risk Criteria for Insurers: AM BEST Company

Source: Insurer Climate Risk Disclosure Survey Report & Scorecard:
2014 Findings & Recommendations

Operating Performance and Business Profile Factors	Climate Change Threats
Stability of underwriting and investment results	Significantly increases future uncertainty and unpredictability of both underwriting and investment risks; physical damages and economic impacts may be more highly correlated.
Underwriting skills and adequacy of rates	Emerging risks and opportunities require strengthened underwriting and challenge rate adequacy. Key markets, especially in coastal areas, may become less insurable, thereby increasing market competition and downward rate pressure.
Loss reserve and development patterns	Adverse loss development related to climate litigation, especially in Director and Officer (D&O) liability and Errors and Omissions (E&O) liability, may force significant reserve strengthening.
Predictive analytics & catastrophic modelling	Insurers must augment existing models to include forward looking loss scenarios based on the latest climate science and encompassing a wide range of perils, e.g. sea-level rise, storm surge, wind, intense precipitation, heat etc.
Spread of risk (geography, line, distribution)	Insurers that have high concentrations of insured property in a given location/region e.g. coastal or product line, D&O liability for oil and gas sectors, will be highly exposed to large losses and/or market uninsurability
Business reputation & public image	Reputational risk from non-renewal of policies, broad marketplace withdrawal and denial of coverage. Reputational risk related to GHG producing companies in which insurers hold debtor equity (failure to adequately consider and address environmental, social and corporate governance risks (ESG) risks is a growing concern for many companies).

Risky Business: Economic Risks of Climate Change in the United States

Risky Business Project, 2014

The American economy is already beginning to feel the effects of climate change. These impacts will likely grow materially over the next 5 to 25 years and affect the future performance of today's business and investment decisions in the following areas:

- 1. Coastal property and infrastructure.** Within the next 15 years, higher sea levels combined with storm surge will likely increase the average annual cost of coastal storms along the Eastern Seaboard and the Gulf of Mexico by \$2 billion to \$3.5 billion. Adding in potential changes in hurricane activity, the likely increase in average annual losses grows to up to \$7.3 billion, bringing the total annual price tag for hurricanes and other coastal storms to \$35 billion. If we continue on our current path, by 2050 between \$66 billion and \$106 billion worth of existing coastal property will likely be below sea level nationwide, with \$238 billion to \$507 billion worth of property below sea level by 2100.
- 2. Agriculture.** A defining characteristic of agriculture in the United States is its ability to adapt. But the adaptation challenge going forward for certain farmers in specific counties in the Midwest and South will be significant. Without adaptation, some Midwestern and Southern counties could see a decline in yields of more than 10 percent over the next five to 25 years, with a 1-in-20 chance of yield losses of these crops of more than 20 percent.
- 3. Energy.** Greenhouse gas-driven changes in temperature will likely necessitate the construction of up to 95 gigawatts of new power generation capacity over the next 5 to 25 years. This is the equivalent of roughly 200 average coal or natural gas-fired power plants, costing residential and commercial ratepayers up to \$12 billion per year.

American Climate Prospectus: Economic Risks in the United States 2014

Rhodium Group, 2014

Energy Impacts of Climate Change: Superstorm Sandy demonstrated the extent to which coastal storms can disrupt energy supply. Storm surge and high winds downed power lines, flooded substations and underground distribution systems, and damaged or shut down ports and several power plants in the Northeast. More than eight million customers in 21 states lost power, further threatening vulnerable populations reeling from the effects of the storm. Sandy also forced the closure of oil refineries, oil and gas pipelines, and oil and gas shipping terminals, impeding fuel supply in the region. More than half of total U.S. energy production and three quarters of electricity generation takes place in coastal states.

The concentration of critical facilities in vulnerable coastal areas creates systemic risks, not only for the region but the nation as a whole. The Gulf Coast is a prime example. The region is responsible for half of U.S. crude oil and natural gas production and is home to nearly half the country's refining capacity, with nearly 4,000 active oil and gas platforms, more than 30 refineries, and 25,000 miles of pipeline. It is also home to the U.S. Strategic Petroleum Reserve (SPR), with approximately 700 million barrels of crude oil stored along the Gulf Coast for use in the event of an emergency. With a substantial portion of U.S. energy facilities located in the Gulf, isolated extreme weather events in the region can disrupt natural gas, oil, and electricity markets throughout the United States.

Outside of the Gulf Coast, other regional energy hubs are also at risk. The National Oceanic and Atmospheric Administration warns that outside of greater New Orleans, Hampton Roads near Norfolk, Virginia, is at the greatest risk from sea-level rise and increased storm surge. The area is home to important regional energy facilities, including the Lamberts Point Coal Terminal, the Yorktown Refinery, and the Dominion Yorktown power plant. On the other side of the country, many of California's power plants are vulnerable to sea-level rise and the more extensive coastal storm flooding that results, especially in the low-lying San Francisco Bay area. An assessment done for the California Energy Commission found that the combined threat of sea-level rise and the incidence of 100 year floods in California puts up to 25 thermoelectric power plants at risk of flooding by the end of the century, as well as scores of electricity substations and natural gas storage facilities.

Physical Risks from Climate Change

Ceres, 2012

This document was designed as a guide for businesses to help chart a course for disclosing and managing climate change risks.

Industry	Impact of Climate Change	Business Risk
Agriculture	Water scarcity	Increased crop failures
	Floods/rainfall intensity	Increased irrigation needs
	Rising sea level and saline intrusion	Loss of productive land
	Changes in pest/disease distribution	Commodity price volatility
	Loss of biodiversity	Water scarcity/conflicts
Electric Power	Weather volatility	Reduced output due to inadequate quality and quantity of water
	Extreme heat and cold	Damage to infrastructure
	Water scarcity	Volatile demand
	Surging seas and flooding	Increased transmission losses due to heat load

Industry	Impact of Climate Change	Business Risk
Mining	Water scarcity	Constraints on exploration, processing, refining and site rehabilitation
	Extreme heat	Damage to infrastructure and facilities
	Rising sea level	Higher decommissioning costs
	Thawing permafrost and land ice	Disrupted transportation routes /reduced port availability
	Increased exposure to disease	Risks to worker health and safety
Oil and Gas	Increased intensity and duration of extreme weather events	Damage to infrastructure and facilities
	Rising sea level, higher storm surges, and increased coastal erosion	Rising risks to employee safety and health
	Land and sea ice melting and permafrost thawing	Altered access to fossil fuel reserves
	Water scarcity and droughts	Constrained production of water-intensive oil and gas resources, such as oil sands, and water conflicts Disruption of transport and distribution systems
Tourism	Increased weather extremes and variability	Damage to infrastructure and facilities
	Rising sea level and coastal erosion	Decreased attractiveness of tourism Destinations
	Increased wildfires	Disruptions of transportation
	Changes in precipitation patterns and snow reliability	Altered tourist seasons

The Big one: The East Coast's \$100 billion hurricane event

Swiss RE

Thinking of Sandy as a once in 500 year risk is misleading, according to Swiss Re's Megan Linken. "Although Sandy was unusual in a meteorological sense, it wasn't a particularly intense storm and lacked the widespread high winds and rainfall that can occur with a Northeast hurricane. It's highly unlikely that we will see a hurricane with the same characteristics as Sandy. However it's very likely [1 in 50 years] that we will see, and in fact, have seen, other hurricanes in the Northeast that would have caused economic damages equal to or greater than those caused by Hurricane Sandy if they were to occur today. Sandy is a harsh reminder of what greater event potentially awaits us. If the 1821 Hurricane were to happen today, it would cause 50% more damage than Sandy and potentially cause more than \$100 billion in property losses stemming from storm surge and wind damage."

2. The Small Business Challenges and Perspectives from the Lakewood Resilience Workshop

According to the U.S. Chamber Foundations Business Civic Leadership Center, of the 60,000 to 100,000 small businesses negatively affected by Hurricane Sandy, up to 30 percent are estimated to have failed as a direct result of the storm. The majority of small businesses operate out of a single physical location. According to the U.S. Small Business Administration, up to 90 percent of small businesses get the majority of their business from within two miles of their front doors. This makes small businesses more vulnerable to loss compared to larger companies that have backup resources at alternate facilities or branch locations. As a result, small businesses will be more heavily impacted by technological or telecommunications failures, the absence of employees, power failures, supply chain interruptions, and rising insurance costs. Direct damage from extreme weather events such as flooding, sea-level rise, storm surge, and drought will impact small businesses more severely than a larger business with more financial and human capital.

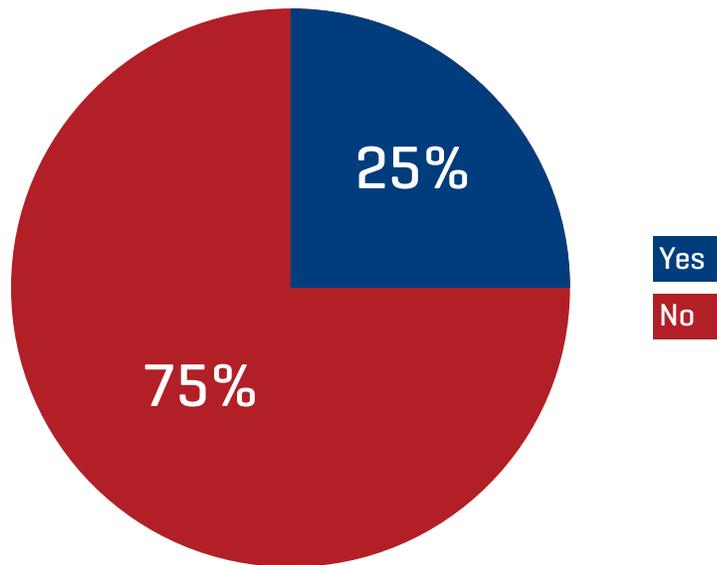
Snap Polls

With voting equipment donated by the Travelers Institute, workshop participants were able to vote on how they manage risks. While half the participants had some form of crisis management or business continuity plan, only a quarter addressed climate change risks.

How Do You Think About Managing Disruptions?



Does Your Business Continuity Plan Address Climate Risks?



Tony McDonald, Director, Urban Coast Institute at Monmouth University explained why climate risks will become a key challenge for New Jersey:

- A 4 foot rise in sea level would result in losses exceeding \$10 billion dollars along New Jersey's 210 mile coastline; and
- EPA study at Long Beach Island, NJ on sea-level rise projected that \$160-190 million would be needed to be spent for each 1-3 foot rise in sea level to protect a stretch of this 18 mile island.

He noted that one of the major gaps is the lack of a business perspective in both the planning and financing of climate change initiatives. Significantly, most of the funding and planning tends to be backward-looking, rather than looking ahead to where we want to be.

McDonald laid out some key challenges and obstacles for business and for policy makers:

1. How to Balance risk with the Cost-Benefits of Mitigation? This is not well understood at any level of government or in most businesses — and the data is lacking for a rigorous analysis.

Three aspects must be addressed:

- **Exposure:** What does sea-level rise do to a company's risk exposure? How much of that exposure is insured?
- **Mitigation:** How do we buy-down risk? How do we invest — and in what — at the individual, community, state and country level.
- **Adaptation:** How do we make a business case for taking action now for a long-term event? Adaptation may be outside the frame of reference for local officials and small business owner.

2. Who Pays? This is a big issue that many are reluctant to address. “Move Away” is not always a practical or affordable answer, particularly for small business and disadvantaged populations. These groups in particular lack the processes, skills, technology and information to manage the new risks of climate change.

3. Lack of Consistent Management of Coastal Risks. A National Academy study, which asked how communities are managing coastal risk found that risks were not being managed consistently.

4. Lack of Leadership and Coordination. The vast majority of funding for coastal disasters is provided only after the disaster has occurred. It does not stimulate a framework for thinking about risks, resilience or adaptation. By the same token, emergency management personnel who have tremendous knowledge about the risks are not the ones making investment decisions about the infrastructure.

5. Misalignment of Risks, Rewards Resources and Responsibilities. Flood insurance tends to incentivize people to stay in high-risk areas. By contrast, there is a lack of incentives to help persuade people to leave high risk flood areas. The current incentive structure often has two perverse consequences: inefficient systems and established constituencies who will defend the status quo.

Among the risk management recommendations included:

- National vision for coastal risk management that crosses agencies
- Federal government needs to work with states to develop an assessment of risk.
- Federal government should investigate how regulations create better incentives for desired outcomes: long-term view, cost sharing, and spread of best practices.
- Identification of incentives to improve pre-disaster risk mitigation — and who must create them.

Risks to New Jersey from Sea-Level Rise

Nathaniel Forbes, a business continuity expert and lecturer, opened the Lakewood Workshop with a few key observations.

First, the one thing known about climate change is that actions by small groups is not going to alter the immediate future. What’s happening today was caused by actions years ago — and any changes made today might have beneficial effects far into the future. But, climate volatility is going to happen. We may not know the degree — or how it will affect the participants in the Workshop personally. But, Forbes quoted research that New Jersey is expected to get 80 high-water level incidents per year as a result of sea-level rise.

Second, governments may not be there to help. It is not because they are bad; it is because the scale with which they have to deal is beyond the capacity of every government on the planet. This is true for earthquakes in China or Typhoon Haiyan in the Philippines. Governments are overwhelmed. Individuals and businesses need to be able to take care of themselves.

Yet, the hardest problem is convincing people to prepare. Many experts recommend 72 hours of supplies, a flashlight, extra batteries, and potable water. By the same token, experts also tell us to exercise more, eat less fat and drink more water to stay healthy — and we do not do that either. The human brain is wired to believe that disasters won't happen. And, there are few commercial incentives for business to alter that mindset.

Looking for Competitive Benefits. Forbes told the story of Brew Works in Singapore, the first and largest microbrewery. Run by an American, the restaurant serves more people in one location than any other in Singapore. It is favorite place for out-of-town, particularly Western guests. The owner asked for help after 9/11, believing that it might be a target for terrorism. As they were working on a risk management and business continuity strategy, the SARS [Severe Acute Respiratory Syndrome] burst into the headlines. Forbes asked the group: "What happens to restaurants during an epidemic? Business goes to zero."

It turned out that the risk management planning and preparations for terrorism were equally relevant for disease. But, going one step further, Forbes encouraged the owner to ask: How could we make this restaurant more resilient in the face of an epidemic. And the answer was "Home Delivery." The change in his business gave him a new opportunity on a day-to-day advantage, but a dominant advantage in times of disease or disaster.

The same is true for climate change. By knowing the risks and potential impacts, businesses can gain insights in how to improve their own competitive position. Forbes led an interactive session to identify key risks for small businesses. He asked participants to rank the impact on elements that could affect small businesses:

- **Infrastructure:** Water, electricity, communications transportation, sanitation;
- **People:** Customers, suppliers, stakeholders, family;
- **Community:** Schools, hospitals, government, public infrastructure [parks, etc.], private property; and
- **Business:** Retail, services, manufacturing, non-profit.

As an example he noted that power and communications could be affected by sea-level rise. Forbes pointed out that potable water is actually less than 10 percent of water use. After agriculture, electricity is the biggest consumer of fresh water for cooling. Supplies of fresh water could be put at risk by contamination of fresh water sources by seawater or by damage to underground pipeline systems from the corrosive impacts of saltwater. Nation-wide, there are 280 plants in coastal areas in the United States that could be affected by sea-level rise and flooding. Similarly, in communications, Forbes pointed out the basement switches could be flooded or buried wires damaged. But, even above-ground wires could be affected if soggy ground allows the poles to topple. Forbes also asked participants to consider the risks to employees, customers and stakeholders. Stakeholders could mean investors. But, for many small businesses, family members are stakeholders. The closure of schools, for example, affects the business because it affects the families.

Highest Risk Priorities of Workshop Participants:

- Limitations on food or fuel pose the highest risks.
- Transportation: If people cannot go to work, supplies cannot come in, debris cannot get out and evacuation routes may be closed.
- Rules and regulations of municipalities, particularly land use rules which will affect the ability of people and businesses to deal with climate change, suggest that voters need to be informed and proactive.
- Potential impact on schools was a high priority. If the kids are not able to go to school, how can the parents go to work? If the schools are needed for shelters, how will they function as schools?

One group concluded that the determination of risk priorities varied widely, depending largely on how far from the coast the business was located.

Competitive Opportunities that Stem from Risks:

- Coping with Loss of Infrastructure: Opportunities for portable services: portable ATMs, hot spots, generators, showers, laundry facilities. One group noted that the military already provides such restoration services in war-torn areas, which could be transferred to the civilian sector.
- Coping with Lack of Water: Waterless bathing and waterless shampoos.
- Coping with loss of communications: Today, the information booth is only incoming, but it could also be outgoing to provide information to the community.
- Coping with Transportation Barriers: Buses can go down to accommodate handicapped passengers, why not hydraulic systems that go up to enable them to pass through flooded areas.
- Coping with the Impacts of Power Outages: A more robust point-of-sale system that can operate without electricity and that integrate inventory, customer management and employee notification system.
- Coping with Loss of Schools: Create ability for schools to operate in a mobile fashion — perhaps on-line, where possible. People: opportunity to go into companies and create employee assistance programs.
- Increasing Employee Readiness: Create a service that enables companies to help their employees prepare.

Appendix I: What Makes a Climate Change Leader?

Ceres used the following interview template to rank insurance companies as leaders or laggards in climate change risk management. (But arguably, many of these sections could apply to any company.)

Question One: Does the company have a plan to assess, reduce or mitigate its emissions in its operations or organizations?

Question Two: Does the company have a climate change policy with respect to risk management and investment management? If yes, please summarize. If no, how do you account for climate change in your risk management?

Questions to consider include:

- Where in the structure of the company is climate risk addressed?
- Does the company approach climate change as an Enterprise Risk Management (ERM) issue?
- Does the company have a dedicated point-person or team within the company that is responsible for managing its climate change strategy?
- What is the role of the board of directors in governing climate risk management?
- Does the company consider potentially correlated risks affecting asset management and underwriting?
- Has the company issued a public statement on its climate policy?

Question Three: Describe your company's process for identifying climate change-related risks and assessing the degree that they could affect your business, including financial implications.

Questions to consider include:

- How may climate change shift customer demand for products?
- What implications may climate change have on liquidity and capital needs?
- How might climate change affect limits, cost and terms of catastrophe reinsurance, including reinstatement provisions?
- Has the insurer considered creative methods of risk distribution such as contingency plans to reduce financial leverage and resolve any liquidity issues in the event of a sudden loss in surplus and cash outflows as a result of a catastrophic event?
- How are these impacts likely to evolve over time? Does the company have plans to regularly reassess climate change related risks and its responses to those risks?

Question Four: Summarize the current or anticipated risks that climate change poses to your company. Explain the ways that these risks could affect your business. Include identification of the geographical areas affected by these risks.

Questions to consider include:

- Which business segments or products are most exposed to climate-related risks?
- Has the company considered its potential exposure to climate liability through its D&O or CGL policies?
- Are there geographic locations, perils or coverages for which the company has increased rates, limited sales, or limited or eliminated coverages because of catastrophic events? How do those actions relate to assessments of climate change impacts made by the company?
- Has the company examined the geographic spread of property exposures relative to the expected impacts of climate change, including a review of the controls in place to assure that the insurer is adequately addressing its net exposure to catastrophic risk?

Question Five: Has the company considered the impact of climate change on its investment portfolio? Has it altered its investment strategy in response to these considerations? If so, please summarize steps you have taken.

Questions to consider include:

- Does the company consider regulatory, physical, litigation, and competitiveness-related climate risks, among others, when assessing investments?
- Has the company considered the implications of climate change for all of its investment classes, e.g. equities, fixed income, infrastructure, real estate?
- Does the insurer use a shadow price for carbon when considering investments in heavy emitting industries in markets where carbon is either currently regulated or is likely to be regulated in the future?
- Does the insurer factor the physical risks of climate change (water scarcity, extreme events, weather variability) into security analysis or portfolio construction? If so, for what asset classes and issuers (corporate, sovereign, municipal)?
- How does climate change rank compared to other risk drivers, given the insurer's asset liability matching strategy and investment duration?
- Does the insurer have a system in place to manage correlated climate risks between its underwriting and investments?

Question Six: Summarize steps the company has taken to encourage policyholders to reduce the losses caused by climate change-influenced events.

Questions to consider include:

- How has the company employed price incentives, new products or financial assistance to promote policyholder loss mitigation? In what lines have these efforts been attempted, and can the outcome of such efforts be quantified in terms of properties retrofitted, losses avoided, etc.?
- For insurers underwriting D&O, CGL and professional liability policies, what steps has the company taken to educate clients on climate liability risks or to screen potential policyholders based on climate liability risk? How does the company define climate risk for these lines?

Question Seven: Discuss steps, if any, the company has taken to engage key constituencies on the topic of climate change.

Questions to consider include:

- How has the company supported improved research and/or risk analysis on the impacts of climate change?
- What resources has it invested to improve climate awareness among its customers in regulated and unregulated lines?
- What steps has it taken to educate shareholders on potential climate change risks the company faces?

Question Eight: Describe actions the company is taking to manage the risks climate change poses to your business including, in general terms, the use of computer modeling.

Questions to consider include:

- For what perils does the company believe that future trends may deviate substantially from historical trends due to changes in the hazard? Similarly, for what perils, if any, does the company believe that a catastrophe model extrapolating observed trends would be insufficient to plan for maximum possible loss or yearly average loss?
- What steps has the company taken to model or analyze perils associated with non-stationary hazards?
- Has the company used catastrophe models to conduct hypothetical “stress tests” to determine the implications of a wide range of plausible climate change scenarios? If so, over what timescale, in what geographies and for what perils?
- Has the company conducted, commissioned or participated in scenario modeling for climate trends beyond the 1-5 year timescale? If so, what conclusions did the company reach on the potential implications for insurability under these scenarios?