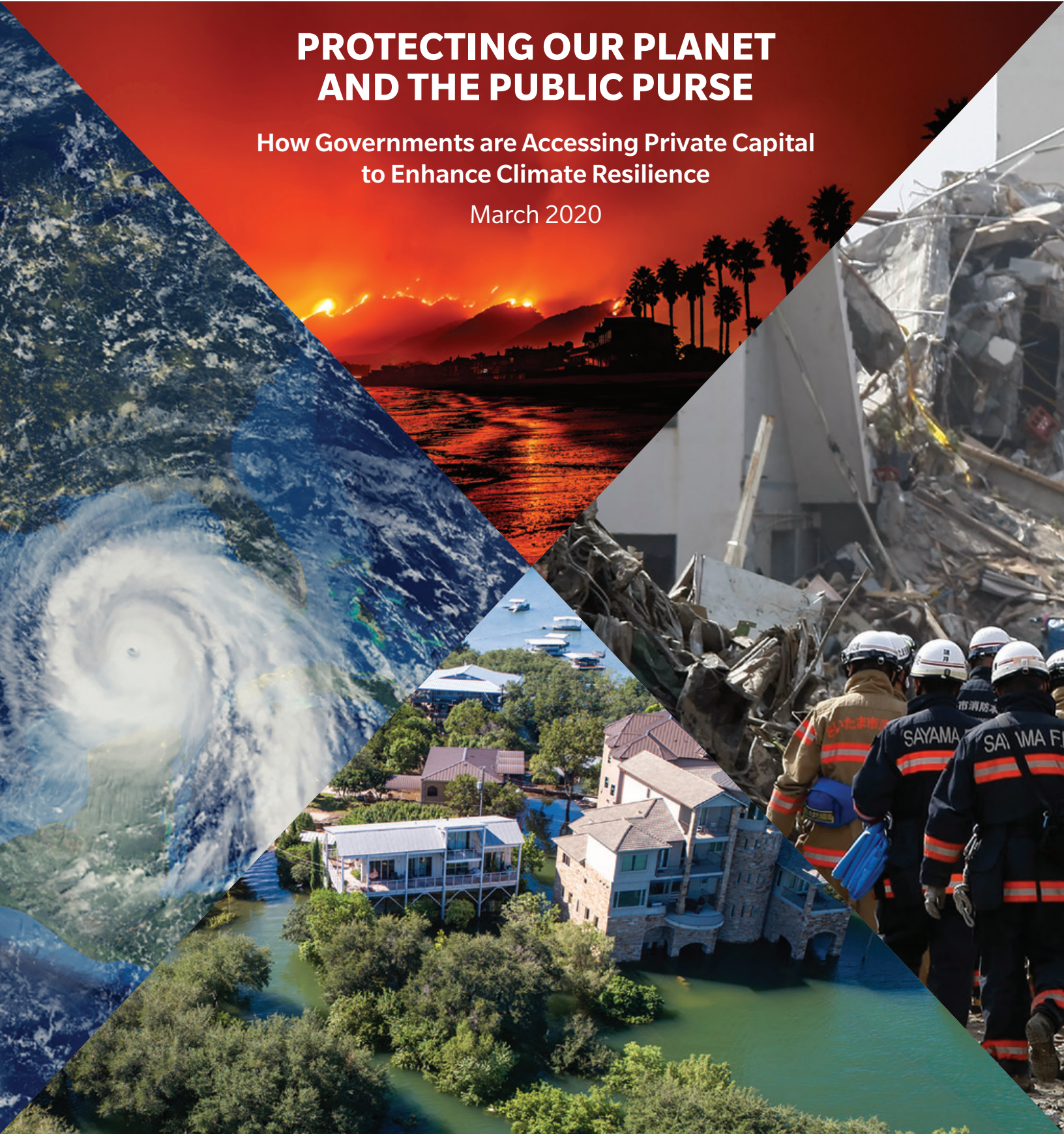


# PROTECTING OUR PLANET AND THE PUBLIC PURSE

How Governments are Accessing Private Capital  
to Enhance Climate Resilience

March 2020



## EXECUTIVE SUMMARY

The risk landscape for public sector entities is changing rapidly: extreme weather, climate change, mass migration and unfunded social liabilities are set to become the risks of our age. These interlinked issues will dominate both governmental and commercial agendas for decades to come.

- Climate change and demographic challenges have put societies and nation states on the cusp of one of the most significant periods of change in recent times. As these dynamics play out, governments and their constituents are confronted with multiple challenges. Interest rates remain at historic lows while many countries around the world are navigating challenges associated with aging populations. Both public and private pension systems are coming under increasing strain: a one percent decline in interest rates increases calculated pension liabilities by almost 20 percent while reducing plan funding rates by 10 percent.<sup>1</sup> The implications of this, coupled with rising elderly care, have enormous implications for governments around the globe.
- Climate change dynamics are only going to accentuate the challenges associated with shifting demographics and strained government finances. Natural catastrophes are becoming more frequent, and the intensity for certain perils is also likely to increase. Put simply, weather extremes will become more extreme. This bodes ill for the future: the cost of natural catastrophes is increasingly being assumed by governments as insurance penetration for climate-related risks falls behind rising loss trends.
- Some of the most pessimistic scenarios associated with climate change point to major economic and societal upheaval. Rising sea levels, more extreme precipitation and wildfire events are three of the more prominent risks associated with climate change. Beyond the more obvious threat to properties and infrastructure in areas of the highest population growth (i.e. urban centers and coastal regions), millions of people could be displaced from these high-risk areas. The scale of change will vary significantly by location: some regions are likely to see minimal effects while others will experience disproportional impacts. Effective risk transfer and mitigation strategies within the public sector will play a crucial role in offsetting wide ranging financial and socio-economic impacts.

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<sup>1</sup> Bloomberg Opinion. December 17, 2019. "Negative Rates and QE Are Destroying Our Pensions" by Mark Gilbert

**“The arguments are clear: countries need to move more quickly if they are to address the reality of climate change and its attendant financial challenges.”**

Governments therefore need to rethink how to fund catastrophic events that go largely unbudgeted and create a strain on public resources when they occur. A culture of reliance on government assistance surrounding disaster relief has emerged, which puts pressure on governments to provide assistance after catastrophes occur and prompts a perception of moral obligation. These macroeconomic costs are projected to increase significantly.

However, there are signs that governmental entities are beginning to take proactive steps to understand and manage the risks that they hold and implement processes designed to improve their financial resilience. They have a willing and able partner in the reinsurance industry. The sector remains well capitalized and the level of sophistication and expertise developed over decades in dealing with market-changing catastrophe events puts it in an unrivalled position to withstand most conceivable loss scenarios. By working closely with reinsurance carriers and intermediaries, governments can also make important progress in quantifying the impact of climate change.

This report touches on several risks confronting public sector entities and outlines six case studies that demonstrate how governments are turning to the reinsurance market for innovative risk mitigation solutions. The arguments are clear: countries need to move more quickly if they are to address the reality of climate change and its attendant financial challenges. To enhance the financial resilience of our communities, effective risk management practices must be brought to bear.

# 1

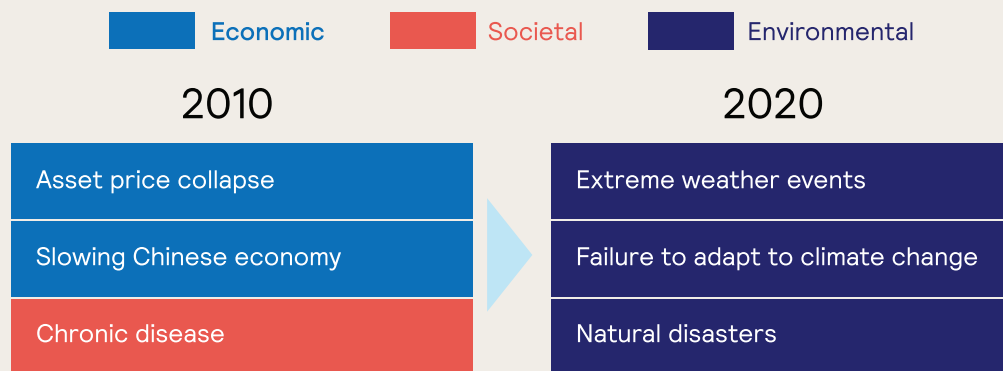
## CLIMATE CHANGE IN CONTEXT



According to Antonio Guterres, Secretary General of the United Nations, climate change is “the single biggest threat to life, security and prosperity on Earth.” Secretary Guterres is not alone in drawing this conclusion. Over 12,000 leaders from various business, political and non-profit arenas polled for the World Economic Forum’s 2020 Global Risks Report identified environmental threats as the top risks facing the world for the coming year (see Figure 1).

Figure 1: The Global Risk Landscape – 2020 vs 2010

(Source: Global Risks Report)



Whereas economic risks featured heavily in 2010 in the immediate aftermath of the global financial crisis, environmental concerns dominate today, reflecting no doubt the series of extreme weather events in recent years and growing concerns about climate change.

The urgency around natural catastrophe and climate change risk is palpable. The diverse and dispersed nature of events in recent years shows that communities, corporations and policymakers must prepare for higher levels of catastrophe losses. At the same time, risks posed by climate change are intersecting with, and in some cases being amplified by, other equally challenging issues that societies must confront. Human migration, aging populations and issues related to global debt will dominate agendas for decades to come. The risk landscape in the public sector is changing rapidly and like never before. From a climate perspective, this is being driven by the following.

- Today, the earth is considered to be approximately 1°C warmer than pre-industrial levels.
- Carbon dioxide forces the Earth’s energy budget out of balance by absorbing thermal infrared energy (heat) radiated by the surface, creating a blanket that retains additional heat in the atmosphere.
- Since 1850, human activity has filled the atmosphere with approximately 1.1 trillion tons of carbon dioxide.

- The Intergovernmental Panel on Climate Change (IPCC) – the United Nations body for assessing the science related to climate change – has found that cumulative emissions of carbon dioxide since 1850 now exceed 55 percent of the total that scientists predict will lead to significant climate stress.
- In 1950, carbon dioxide concentrations exceeded 300 parts per million (ppm) for the first time in over three million years.
- If warming is to be contained below 2°C, atmospheric concentrations cannot exceed 450 ppm – current atmospheric carbon dioxide concentrations are 410 ppm.
- Today’s global population of 7.7 billion inhabitants is six times higher than in 1850 and there are now 3.2 billion more people living on the planet than in 1980.
- The world’s growing global population now emits approximately 36 billion tons of greenhouse emission every year – for context, imagine the state of Connecticut (5,500 square miles) covered in a 3,200-foot-thick blanket of gas.
- Research on coastal exposures worldwide underlines the threat posed by sea level rise, with an estimated 150 million people living on land that will be below the high-tide line by 2050.

The potential economic consequences of the changing climate are striking. Some estimates predict that gross domestic product (GDP) will fall by 25 percent should temperatures rise by 3°C by 2100. If no action is taken, some scientists predict that temperatures will rise by 4°C. Economists suggest this would translate into a 30 percent decline in global GDP. Not only would that be worse than the Great Depression, where global trade fell 25 percent, but it would also be permanent.<sup>2</sup>

### **A CLEAR AND PRESENT DANGER**

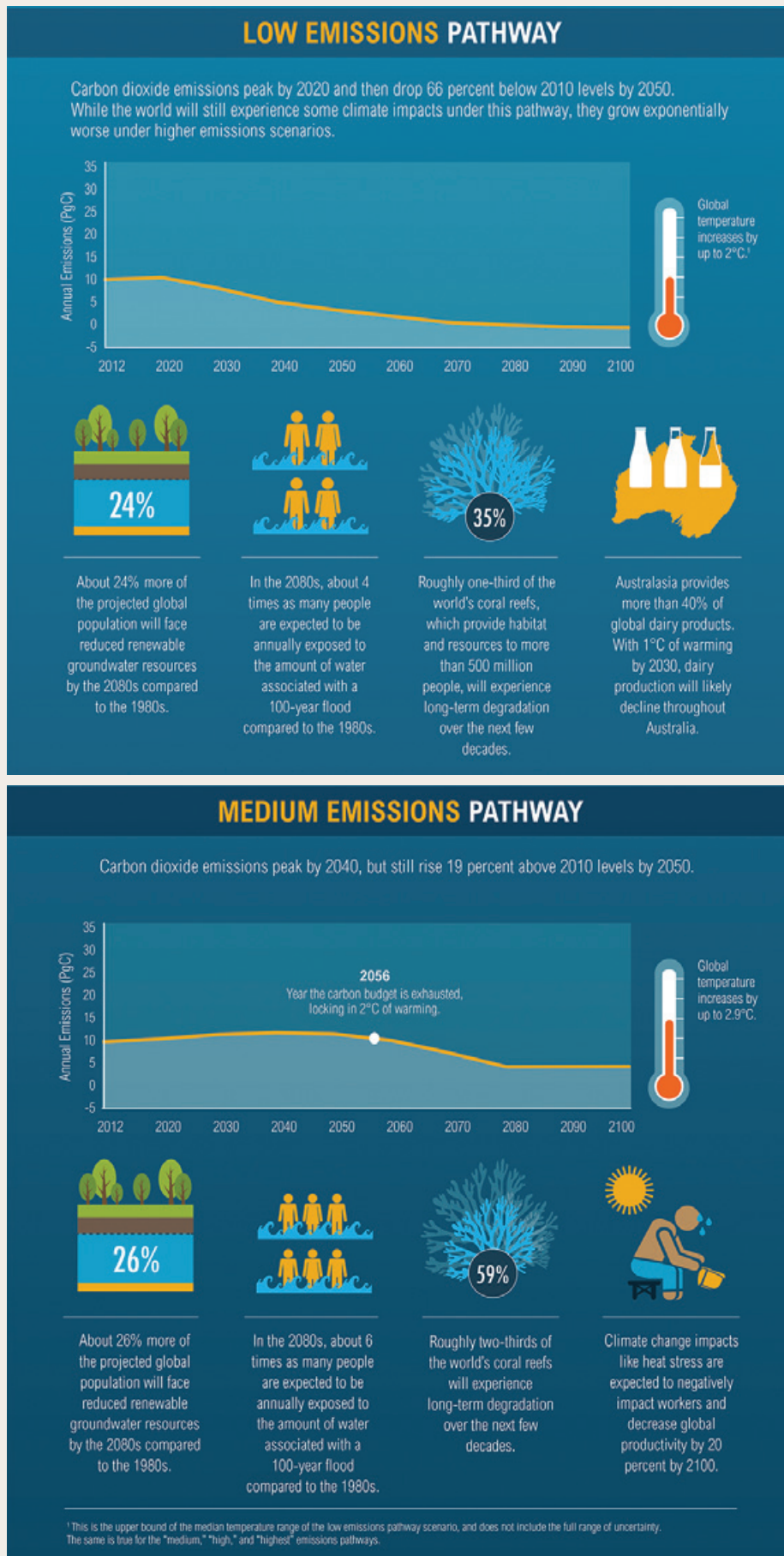
This has spurred governments into action to address the issues associated with climate change. However, after initial optimism about the desire for cooperation at a global level, a sense of realism has subsequently taken hold. Targets agreed in the Paris Agreement, which attempts to bring nations together to combat climate change and adapt to its effects, are already facing challenges.

A recent assessment of the milestones in the Paris Agreement shows that the world is unlikely to meet the targets established by its signatories. The most recent (fifth) IPCC report suggests that the world is not on course to prevent global temperatures rising 2°C above pre-industrial levels. The consequences of this are stark. In Figure 2 (on pages 7 and 8), the World Resource Institute outlines four emission pathways from 2010 to 2050.

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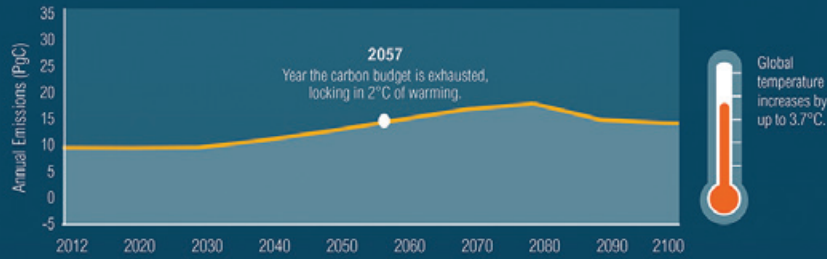
<sup>2</sup> <https://www.thebalance.com/economic-impact-of-climate-change-3305682>

Figure 2: Four Carbon Dioxide Emission Pathways (Source: World Resource Institute)



## HIGH EMISSIONS PATHWAY

Carbon dioxide emissions peak by 2080, but still rise 34 percent above 2010 levels by 2050.



About 32% more of the projected global population will face reduced renewable groundwater resources by the 2080s compared to the 1980s.



In the 2080s, about 7 times as many people are expected to be annually exposed to the amount of water associated with a 100-year flood compared to the 1980s.



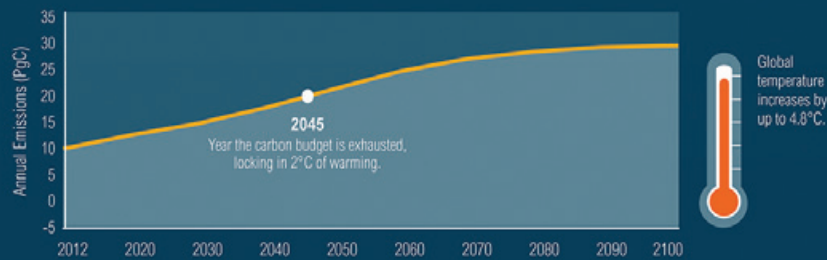
Ranges of many of the world's plant and animal species will decrease by more than 50 percent by the 2080s with 3.5°C of warming.



With temperature increases of 3-4°C, agricultural production and global food security could see negative impacts so large-scale they cannot be adapted to.

## HIGHEST EMISSIONS SCENARIO

Annual carbon dioxide emissions continue to rise through 2100, rising 108 percent above 2010 levels by 2050.



About 38% more of the projected global population will face reduced renewable groundwater resources by the 2080s compared to the 1980s.



In the 2080s, about 12 times as many people are expected to be annually exposed to the amount of water associated with a 100-year flood compared to the 1980s.



More than 4°C of temperature rise will likely bring decreased agricultural production, loss of critical ecosystem functions, and extinction of many animal and plant species.



Soybean yields in the Amazon would drop 44 percent by 2050. With higher amounts of warming, coffee farming could be virtually impossible in Southeastern Brazil in 2100.



## RISKS AND IMPACTS

The dynamics of climate change need to be understood and managed. Climate scientists and global policymakers have simplified the multitude of risks associated with global warming into the following three major categories:

- **Physical risk:** direct damage to assets by weather and climatic events.
- **Transition risk:** the potential that an abrupt transition to a low carbon economy causes investments to lose value.
- **Liability risk:** the risk of being sued for playing a part in creating climate change.

The social, economic and quality of life impact of these three risks will manifest differently around the globe over the next several decades. The scale of change will vary significantly by location: some regions are likely to be affected more slowly (and marginally) by climate change while others will feel the effects more suddenly (and significantly).

Sea level rise, higher temperatures and more extreme weather events are just three consequences that are likely to cause widespread damage. Individuals, governments and every business sector are likely to be impacted by climate change. Companies dependent on natural resources such as farming, fisheries and tourism could face an existential threat.

Infrastructure is also likely to come under strain as transportation routes and energy production lines are affected. Bridges, tunnels and rail systems could degrade quickly, impacting the transportation of goods and services. Such significant impacts to local communities could cause major displacement of homeowners and significantly alter, or even disrupt, supply chains.

## ECONOMIC CONSEQUENCES

A recent study carried out by Moody's Analytics predicts the economic consequences of climate change through six impact channels – sea level rise, human health effects, heat effect of labor productivity, agricultural productivity, tourism and energy demand.

Referring to projections included in the most recent IPCC report, Moody's says that climate change could cost the global economy close to USD 70 trillion under a warming scenario of 2°C. To put this in context, global GDP totaled approximately USD 80 trillion in 2019.

These headline estimates could nevertheless be considered conservative, given many predictions for global temperature change exceed these targets (including some of the scenarios outlined in the emission pathways outlined in Figure 2). Figure 3 shows the potential consequences of a higher emissions scenario (RCP8.5). Impacts by region will be uneven: most countries could see significant economic deterioration, while others, particularly North American and European nations, are likely to be less affected.

Figure 3: Projected Effect of Temperature Changes on Regional Economies  
(Source: Marshall Burke, Sol Hsiang, Ted Miguel)

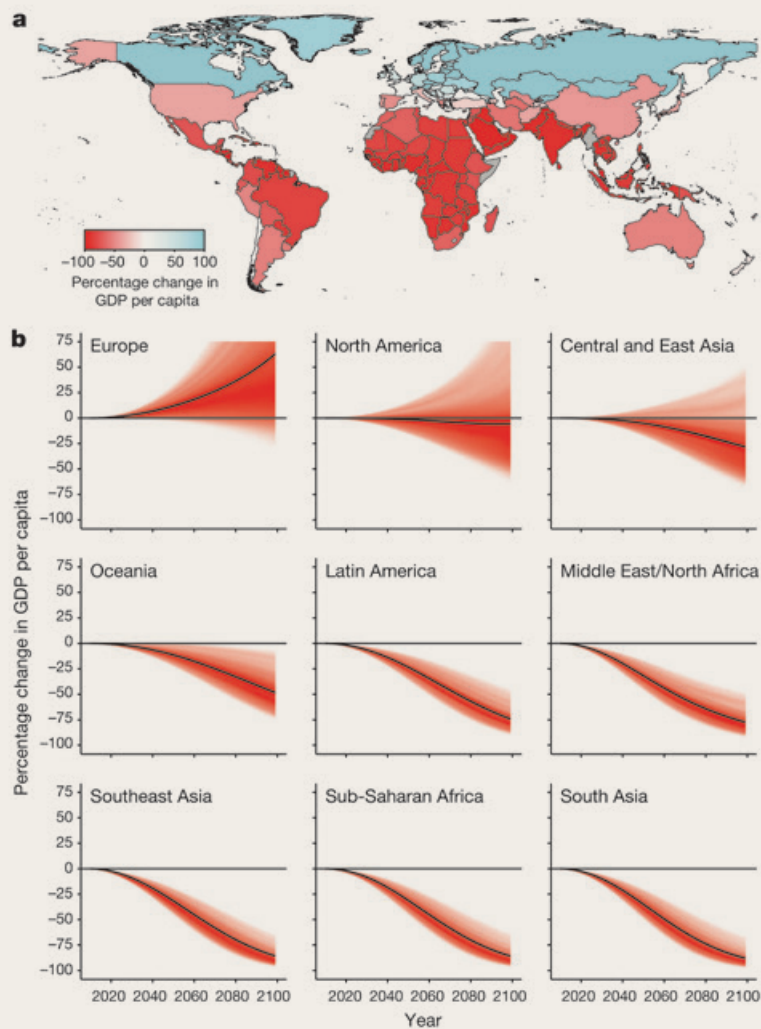
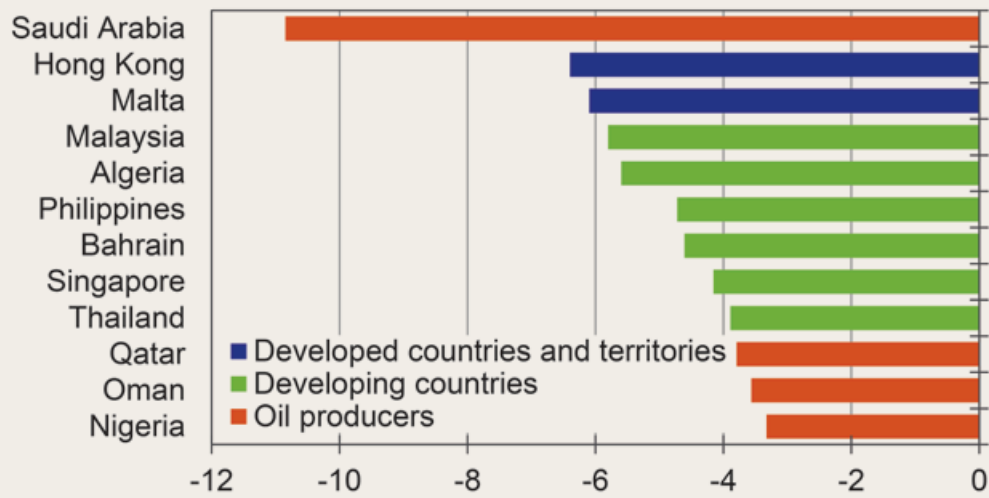


Fig 3: a, b, Change in GDP per capita (RCP8.5) relative to projection using constant 1980–2010 average temperatures. a, Country-level estimates in 2100. b, Effects over time for nine regions. Black lines are projections using point estimates. Red shaded area is 95 percent confidence interval, colour saturation indicates estimated likelihood an income trajectory passes through a value.

Breaking impacts down further shows that two groups of countries are most likely to be affected negatively by climate change: nations in hot climates, particularly emerging economies such as Malaysia, Algeria, the Philippines and Thailand, and oil producers such as Saudi Arabia, Qatar and Oman (see Figure 4). The first group will suffer tourism and productivity impacts while the second will also have to navigate falling oil prices and its huge impacts on government revenues.

Figure 4: Real GDP Projections for Countries Exposed to Climate Change by 2048<sup>3</sup>  
 (Source: Moody's, World Bank)



**REGULATORY ACTION**

Without a change in behavior, climate change has the potential to reshape the global economy. Several provincial and state governments are focusing on mitigation measures in order to attempt to alleviate the economic impacts associated with climate change. Regulatory scrutiny is also increasing in various countries, with certain jurisdictions highlighting the risks posed to the global financial system by the physical, transition and liability risks associated with climate change (see callout box on page 12 for details on the United Nations’ and Bank of England’s (BoE) related climate stress tests and risk assessment initiatives).

<sup>3</sup> Based on the ‘business as normal’, highest emission scenario RCP 8.5.

Given climate change has the potential to cause economic and systemic instability, it falls within the purview of prudential regulation. Extreme weather events linked to human-driven climate change clearly bring physical risks that could impact economies. And moving towards a less polluting, greener economy means that some sectors of the economy face the prospect of a significant shift in asset values and/or higher costs of doing business.

It is nevertheless important to point out that the (re)insurance market is well placed to help governments confront this uncertainty and volatility. The (re)insurance sector remains well capitalized and the level of sophistication and expertise developed over decades in addressing previous market-changing events puts it in a strong position to confront the prospect of more frequent and severe weather events in the future. The sector also has the knowledge and expertise to help stakeholders develop a more robust risk management framework to mitigate climate-related issues.

#### **UNITED NATIONS ENVIRONMENTAL FINANCE INITIATIVE (UNEP FI) AND BANK OF ENGLAND STRESS TESTS**

There have been two prominent examples recently where global frameworks and regulatory interventions have attempted to drive action on issues related to climate risk. In 2017, the United Nations Environmental Finance Initiative (UNEP FI) issued recommendations from the Financial Stability Boards taskforce on climate-related financial disclosures. Sixteen banks and 20 investor groups launched initiatives in 2018 to implement these recommendations. Eighteen insurance and reinsurance companies have joined forces to pilot these initiatives as well.

Under the BoE's climate stress test, insurers and banks operating in the UK will be forced to disclose their exposures to climate change and outline how they would respond to the effects of a temperature rise of up to 4°C.

The BoE has published proposals to test the performance and health of the United Kingdom financial system for a range of climate-linked financial risks. These tests are expected to uncover the extent of the financial sector's exposure to climate risks, and gauge company responses. The BoE will initially release aggregate results for the banking and insurance sectors, although it has not ruled out publishing individual company results in the future.

A photograph of a residential neighborhood at dusk. In the foreground, several large, multi-story houses with tiled roofs and lit windows are visible. In the background, a large fire is burning on a hillside, with bright orange and yellow flames and smoke rising into the sky. The overall scene is dramatic and highlights the physical risk of climate change.

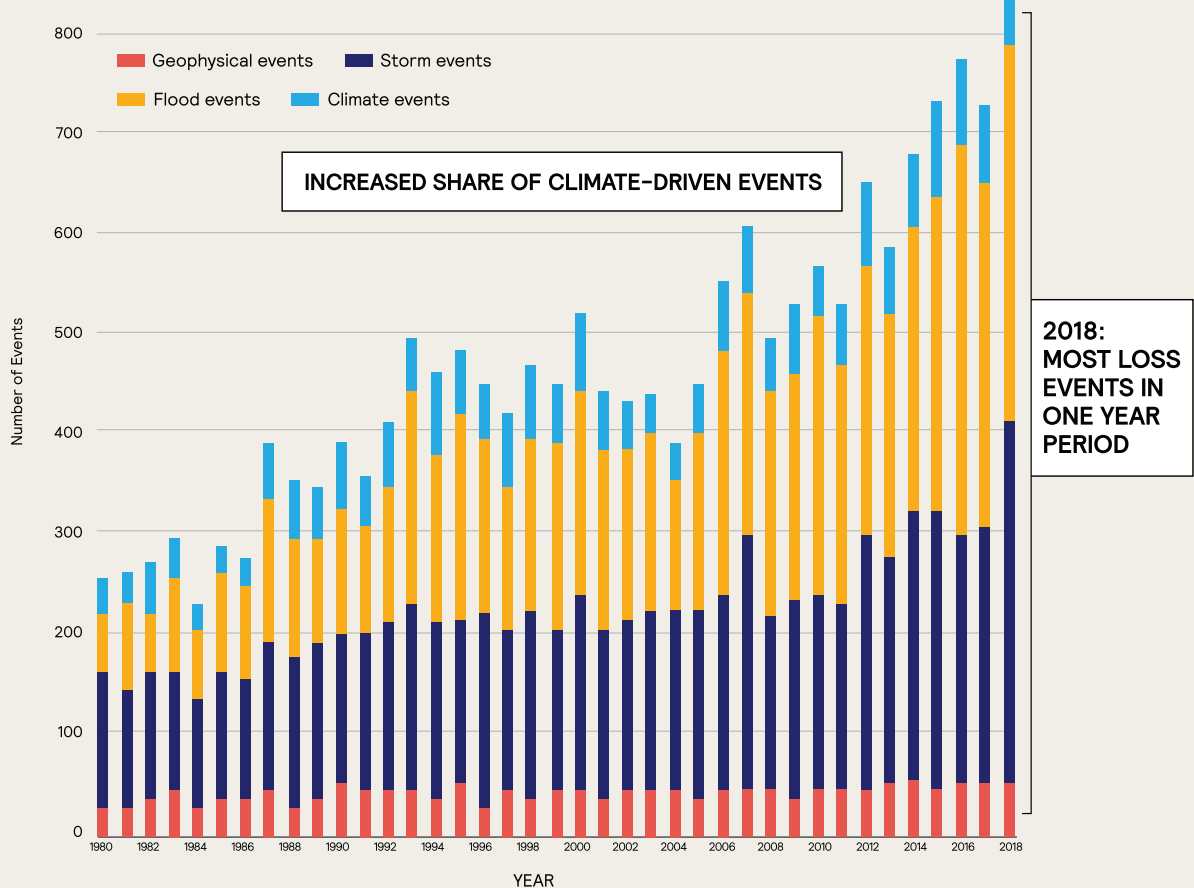
## 2

## THE PHYSICAL RISK OF CLIMATE CHANGE

Attributing a single event to climate change remains difficult at present but the long-term trend is clear: natural catastrophes are becoming more frequent and the intensity for certain perils is also estimated to increase.

According to Munich Re, there were close to 850 natural catastrophe events in 2018 (see Figure 5), the highest number on record and a three-fold increase from the early 1980s. In the past decade, the quantum of natural catastrophes has increased by over 70 percent. Climate-related events, particularly hurricanes, typhoons and floods, account for virtually all of this increase. This trend could accelerate in the future as some climate research finds increased persistence in jet stream patterns that could cause a succession of catastrophe events over the same region during an individual season.

Figure 5: Number of Natural Catastrophe Events Worldwide – 1980 to 2018 (Source: Munich Re)



Accounted events have caused at least one fatality and/or produced normalised losses ≥ US\$ 100k, 300k, 1m, or 3m (depending on the assigned World Bank income group of the affected country).

The increased frequency of catastrophes reinforces the need for governments worldwide to prepare for more climate-driven events in the future. The continued appeal of living in areas exposed to weather-related risks is also having a significant bearing as more people are being affected by events that would otherwise have gone unnoticed or unreported.

### **CLIMATE MODELS**

Predictions about how climate change will manifest across different regions of the globe are still subject to uncertainty. The macro trend of rising global temperatures is clear and has already been addressed in this report: human-induced warming has reached approximately 1°C above pre-industrial levels and is also increasing at approximately 0.2°C per decade.

The more localized impacts are less clear cut. Global climate models, many of which have been in use for over a decade, are designed to model the entire world and run over long time horizons. By their very nature, they are unable to resolve more localized events (such as tornados and hailstorms), but they perform well at capturing and forecasting observed global warming trends. Climate experts are also increasingly able to extrapolate shifts in smaller scale, impactful events, by measuring temperature and moisture trends from the climate models that are more/less conducive to these types of catastrophes.

A strong consensus is therefore being formed on the broad impacts of climate change, and these are supported by scientific theory and data observations. Global warming has already caused multiple observed changes in the climate system. These changes include increases in both land and ocean temperatures, as well as more frequent heatwaves in most land regions and marine areas.

In addition, there is substantial evidence that human-induced global warming has also led to an increase in the frequency, intensity and/or amount of heavy precipitation events at a global level, as well as an increased risk of drought. While average global rainfall amounts are not expected to grow substantially, the

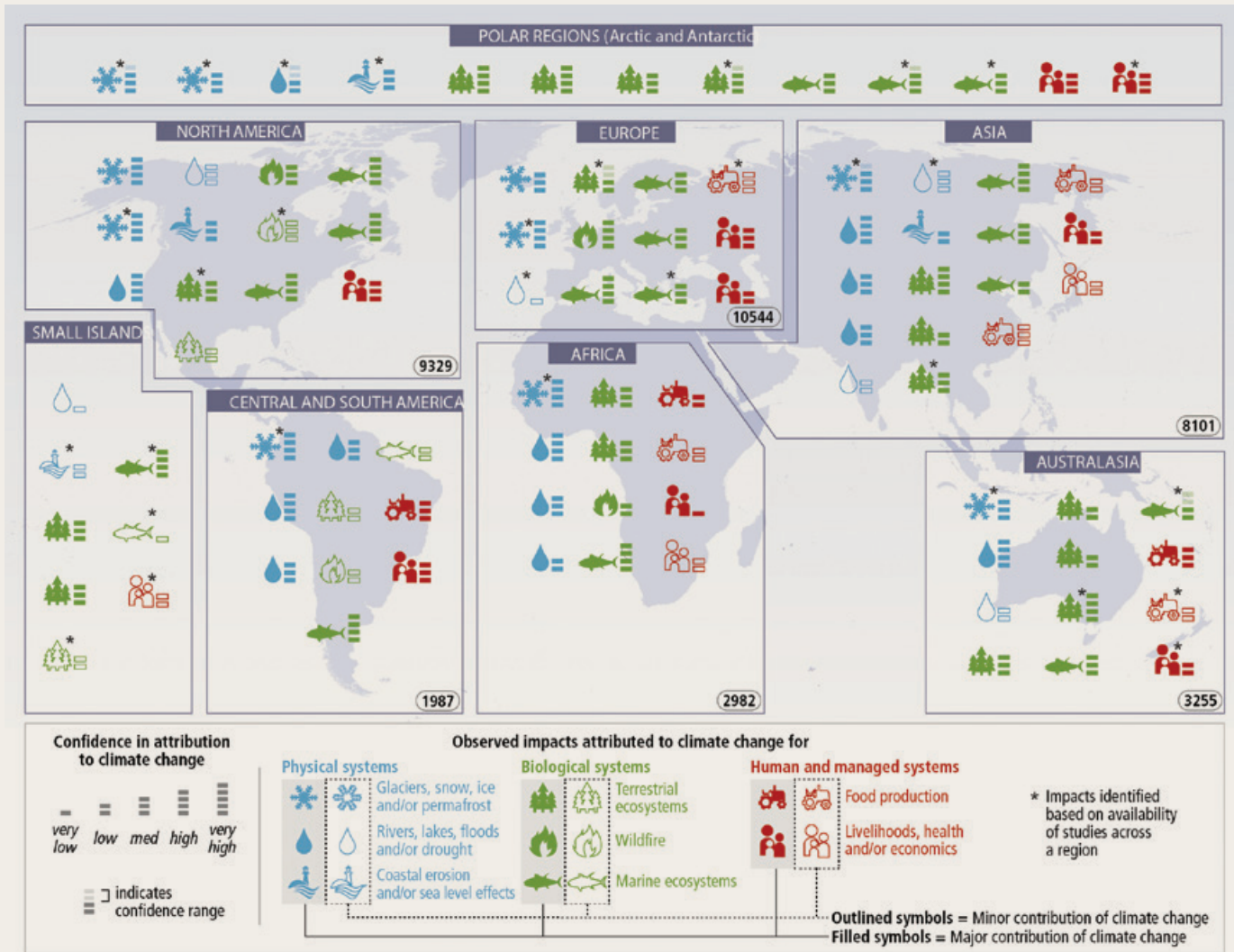
daily (and sub-daily) rainfall amounts are forecast to increase, in part down to the pure physics of the atmosphere holding more moisture in warmer climates and conditions becoming more optimal for storm development and increased intensity.

**UNEVEN IMPACTS**

Put simply, extremes will become more extreme, with wetter areas getting wetter and drier areas getting drier. Figure 6 outlines in some detail the perils and impacts various regions around the world are expected to experience under different climate change scenarios.

Figure 6: Impacts of Climate Change on Regions Worldwide

(Source: IPCC)





Impacts will clearly vary by location, with some regions only marginally affected while others will experience disproportionately severe effects. The level of information contained in Figure 6 is worthy of an entire paper, but for the purposes of this report, we briefly address two consequences of climate change that are front and center: sea level rise and wildfire.

### SEA LEVEL RISE

Sea level rise due to climate change is considered to be one of the biggest threats to properties and infrastructure worldwide. Global (mean) sea levels rose by about eight inches between 1901 and 2010, and the rate of increase appears to have accelerated in recent decades.

The IPCC projects a further rise of between seven inches and 15 inches by the 2050s, and an additional 12 to 44 inches by the 2090s (see Table 1). More extreme sea level rise scenarios may occur depending on the stability of the Antarctic ice sheets, and an increase of eight feet by the year 2100 is possible (although not probable).

Table 1: Global Mean Sea Level Rise Scenarios (Source: *National Climate Assessment*)

	2046-2065	2100
Low emissions scenario Significant carbon reductions (RCP 2.6 scenario)	7-13 inches	12-24 inches
High emissions scenario Minimal carbon reductions (RCP 8.5 scenario)	9-16 inches	24-44 inches

Note that there is a considerable range of scenarios around these mean values.<sup>4</sup>

Sea level rise will inevitably bring wide-ranging consequences to coastal properties across the globe. New research published by Climate Central in *Nature Communications* argues that the consequences of rising sea levels have been underestimated and that some 150 million people are now living on land that will be below high-tide line by 2050.

Impacts on mega-cities, urban centers that have populations of more than 10 million, will be particularly pronounced. Figure 7 illustrates the share of certain cities' 2010 populations that would be below sea level in the event of particular increases in global

<sup>4</sup> IPCC SROCC, 2019: Special Report on the Ocean and Cryosphere in a Changing Climate, Intergovernmental Panel on Climate Change. <https://www.ipcc.ch/srocc/home/>, accessed November, 2019.

temperature. The lighter shade of red depicts the projected percentage of a city's population that would be situated below sea level assuming a 2°C increase in global temperature while the darker red provides corresponding projections assuming a 4°C increase.

It is important to note that Figure 7 focuses exclusively on mega-cities exposed to sea level rise and does not address other underinsured natural perils. Nor does it include smaller population centers that do not meet the 10 million mega-city threshold. By 2030, the United Nations expects 60 percent of the world's population will be living in cities, bringing immense implications to economic and social policy.

Mitigation initiatives need to be front and center of government policy in responding to these developments. After all, protective measures like seawalls and other barriers have enabled over 110 million people to live in places below the high tide line for years. But given the accelerated rise in sea levels projected to take place over the next several decades, vulnerable communities will need to invest vastly greater sums in such defenses if they are to survive.

Figure 7: Percentage of Populations Affected by Rising Sea Levels in Selected Cities in 2010

(Source: Climate Central)



Percentage of population affected by rising sea levels in selected cities in 2010

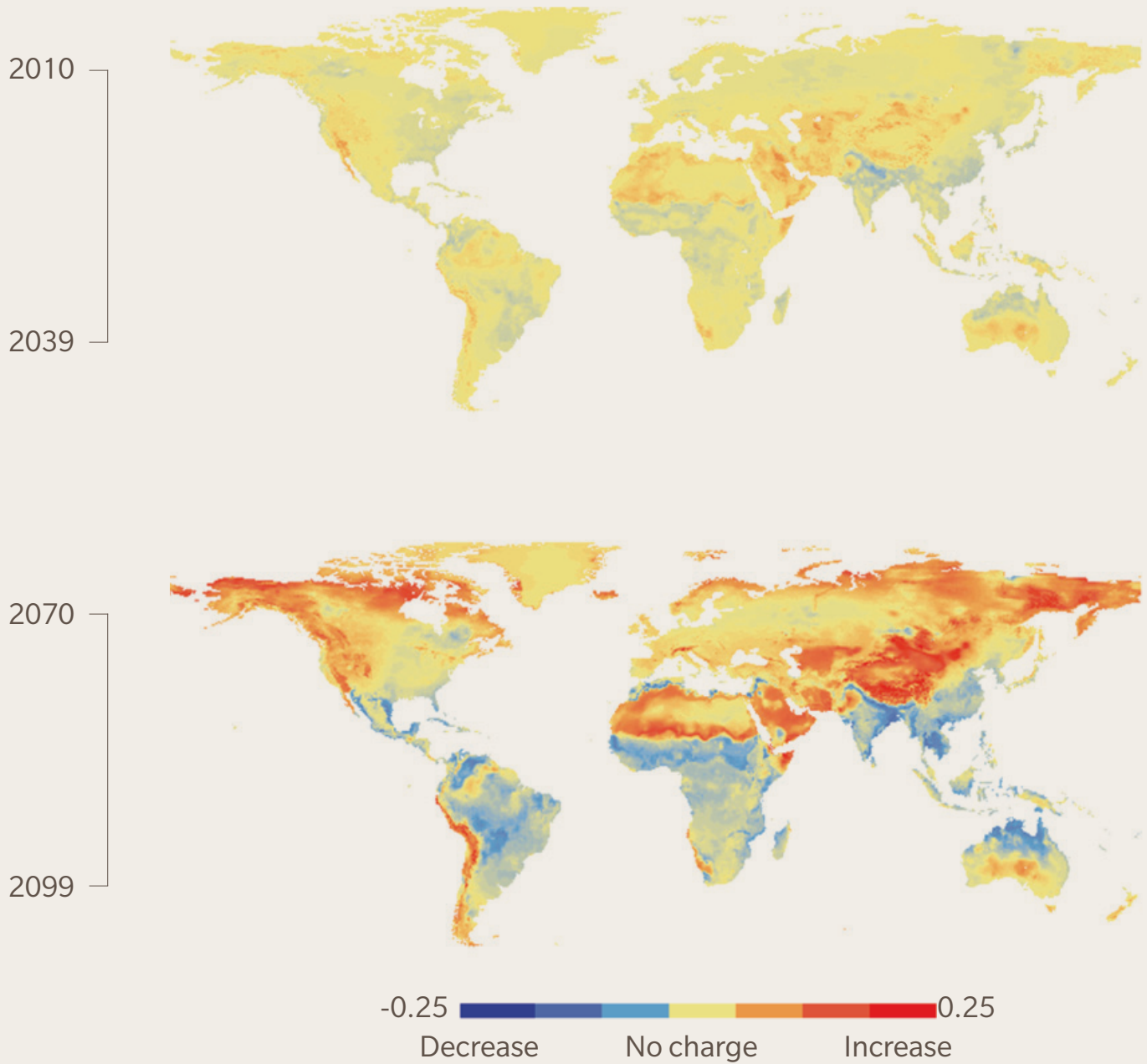
\* only urban agglomerations with total 2010 populations exceeding 10 million are included in this analysis

## WILDFIRE

Wildfire is another peril likely to be impacted by climate change. Data from recent years shows that fire seasons have lengthened and modeling studies predict significant increases in fire activity in high-risk areas.

Figure 8: Expected Change in Wildfire Probability Under Climate Change – 1971 to 2000 Baseline

(Source: Moritz et al)



A warming climate that brings increased drought and higher temperatures will inevitably result in more frequent and severe fires. More heat and drought increases forests' vulnerability to wildfire as fuels become more likely to burn. Global climate models, which look at wildfire risk into the mid to late 21st century, find that climate change is increasing the probability of extreme fire conditions around the globe (see Figure 8).

Events in Australia at the end of 2019 reinforced the threat posed by the peril when the New South Wales Rural Fire Service Commissioner reported an unprecedented number of wildfires raging across Australia's most populous state.<sup>5</sup> The cause of the fires has been attributed to a sustained period of above-average temperatures and below-average rainfall.<sup>6</sup> Bushfires & Natural Hazards Co-operative Research Centre stated that traditional fire seasons in the region were starting earlier and "the cumulative fire danger" was growing.<sup>7</sup>

More intense heatwaves and sustained higher temperatures also increased the number of wildfires in Europe in 2018/2019. During the summer of 2019, Spain, Portugal and Southern France battled the largest blazes seen in over 20 years, with over 2,100 wildfires impacting the European Union this year alone.<sup>8</sup>

Similar observations and findings have been seen in California, where unprecedented wildfire damage has taken place over the past three years. The Camp Fire in 2018 claimed 88 lives and destroyed more than 18,500 structures, becoming the largest global loss event of the year.<sup>9</sup> This was followed shortly by the Woolsey Fire in Southern California. Economic and insured losses from The Camp Fire alone have been estimated at over USD 16 billion (economic) and USD 12 billion (insured), respectively.<sup>10</sup>

Figure 9 shows how temperatures in California have not only increased significantly over the last decade but also how spring heat has become more pronounced earlier in the year and persists through the summer.

<sup>5</sup> Paolo Zialcita, "Wildfired Rage in Australian State" "We've Simply Never Had This Number of Fires," NPR, November 8, 2019, accessed December 4, 2019, <https://www.npr.org/2019/11/08/777649636/wildfires-rage-in-australian-state-we-ve-simply-never-had-this-number-of-fires>.

<sup>6</sup> Ibid.

<sup>7</sup> "Is Climate Change to Blame for Australia's Bushfires?" BBC News, November 11, 2019, accessed December 4, 2019, <https://www.bbc.com/news/world-australia-50341210>.

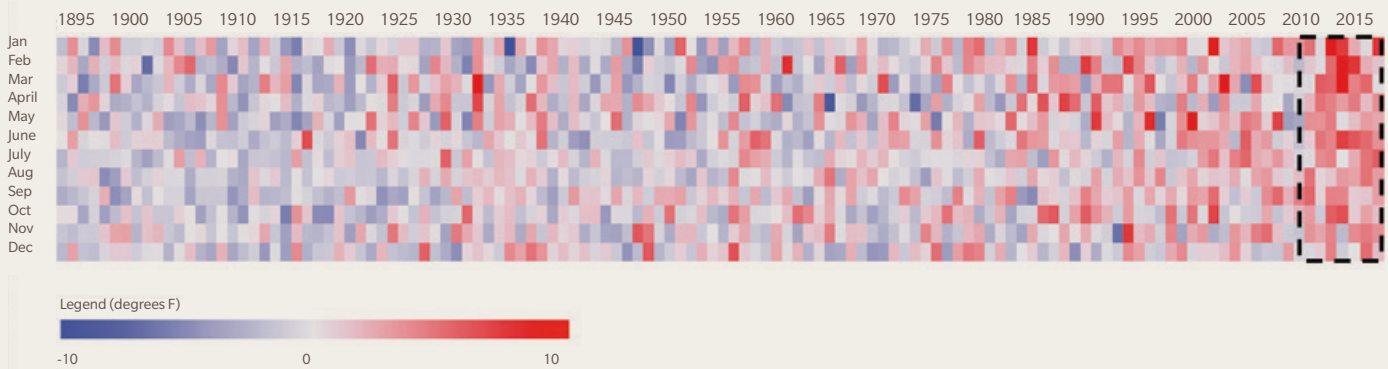
<sup>8</sup> Data Source: European Commission – European Forest Fire Information System (EFFIS)

<sup>9</sup> "Natural catastrophes and man-made disasters in 2018: "secondary" perils on the frontline". Swiss Re Institute – Sigma. No 2/2019.

<sup>10</sup> Munich Re: *The natural disasters of 2018 in figures*: <https://www.munichre.com/topics-online/en/climate-change-and-natural-disasters/natural-disasters/the-natural-disasters-of-2018-in-figures.html>

Figure 9: Temperature Trends in California

(Source: NOAA)



Changing weather patterns are clearly influencing wildfire activity in California and elsewhere, yet climate change is only part of problem. Losses are also being driven by more people living in wildfire-prone areas across all regions. In fact, the wildland-urban interface (WUI) in California has expanded by 60 percent since 1970 and now contains 4.5 million homes. The infrastructure required to support people living and working in these spaces is also a potential ignition source.

Such demographic trends are explored in further detail in the next section. Changes in exposure concentrations are only going to exacerbate the impact of climate change. The United Nations Population Fund estimates that over 85 percent of the population in developed nations will live in urban areas by 2050 (compared to 65 percent in developing nations).<sup>11</sup> Many of these cities are exposed directly to sea level rises.

Governments need to focus on mitigation strategies to help alleviate the impacts of future events. Continually increasing dollars at risk from climate change (as well as population growth in catastrophe-prone areas) can be mitigated by relatively simple, and in many cases, cheap measures such as building code adherence. Embracing and supporting the research and implementation of such initiatives is essential to the health of the public sector and the broader economy. Even more importantly, mitigation reduces the personal distress of those unfortunate enough to be involved.

<sup>11</sup> United Nations, Department of Economic and Social Affairs, Population Division (2019). *World Urbanization Prospects: The 2018 Revision* (ST/ESA/SER.A/420). New York: United Nations.

# 3

## LIFTING THE BURDEN FROM GOVERNMENTS



The specter of climate change points to a future that will see more frequent and severe weather events. This is likely to increase reliance on governments to absorb more costs. Insurance penetration is already falling behind rising loss trends and the cost of disasters is increasingly being borne by governments.

### THE PROTECTION GAP

The difference between total and insured costs depicted in Figure 10 is known as the “protection gap,” a large component of which falls back on governments. The phenomenon of nations bearing an increasing share of climate costs is occurring around the world, particularly in developing countries where private insurance for both businesses and individuals is less prevalent (see Figure 11).

Figure 10: Total vs Insured losses for Natural Catastrophes – 1980 to 2018

(Source: Munich Re)

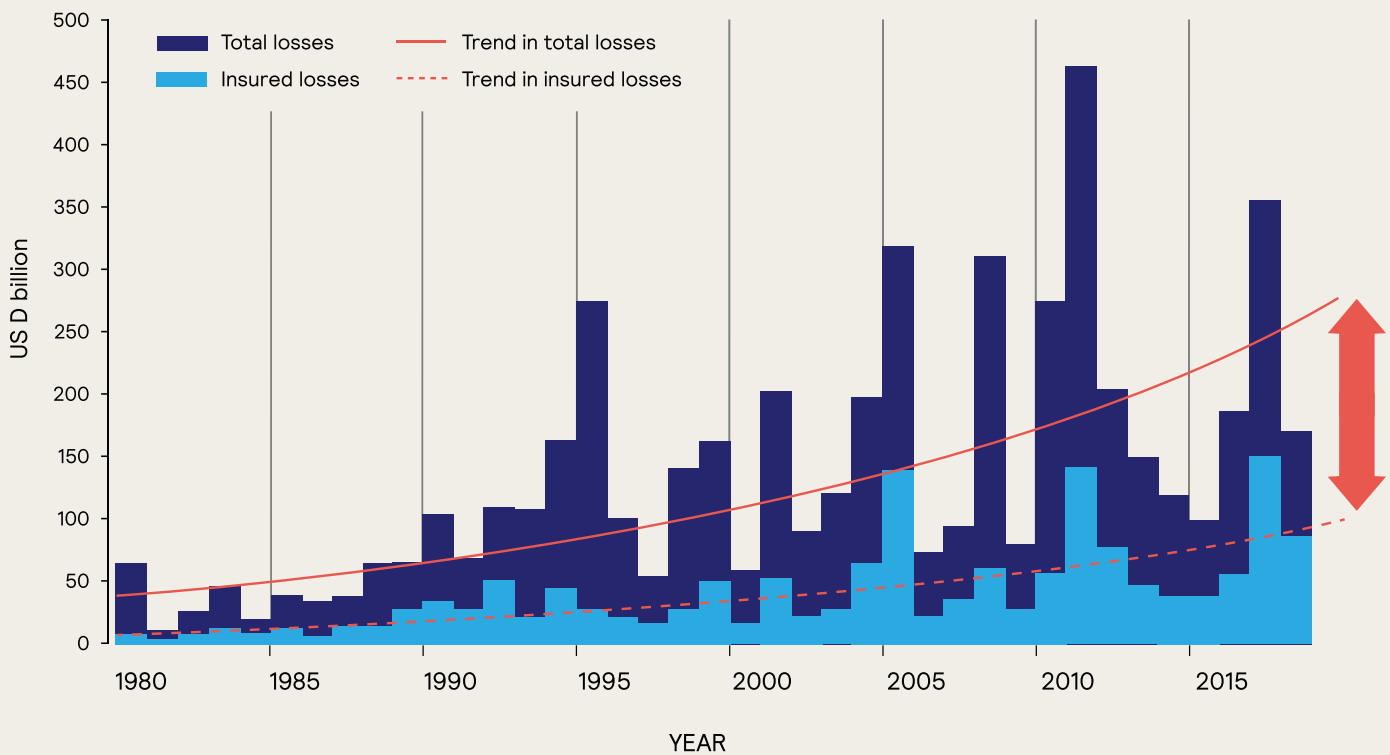
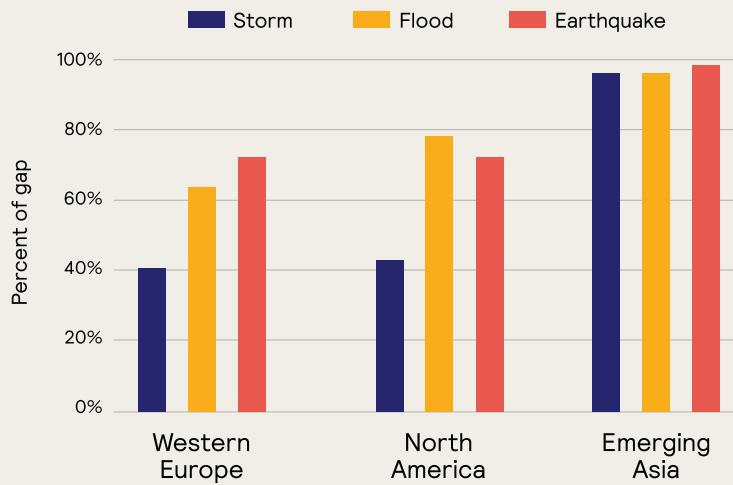


Figure 11: Cost of Natural Catastrophes as a Percentage of Gap by Region  
(Source: Munich Re, Geneva Association)



Insurance penetration issues also exist in mature economies, where flood and earthquake are typically underinsured. In Western Europe, approximately 40 percent of total costs from storms fall to governments or back onto disaster victims, compared to in excess of 60 percent and 70 percent for flood and earthquake, respectively. A similar issue exists in North America, although the level of underinsurance for flood is worse here.

The lack of flood insurance in the United States is reflected in Figure 12, which shows that two of the country’s top three events that required the highest percentage of federal relief funding relative to total damage involved significant flooding (Superstorm Sandy and Hurricane Katrina). The other trend to emerge from this data is that disaster spending has risen steadily over the past 50 years.

Figure 12: Percentage of Federal Relief for Select U.S. Events – 1950 to 2013  
(Source: Wharton Risk Center, Guy Carpenter)

Disaster	Federal Relief as % of Total Damage
Superstorm Sandy (2012)	>75*
Hurricane Ike (2008)	69
Hurricane Katrina (2005)	50
Hurricane Andrew (1992)	42
Hurricane Hugo (1989)	23
Hurricane Diane (1955)	6

\* Based on USD 60 billion federal relief figure (including the USD 9.7 billion additional borrowing capacity provided to the federally-run NFIP to pay its flood insurance claims).



### REGIONAL INEQUALITIES

The potential for accentuated global inequalities under climate change is borne out by how the protection gap falls across higher and lower income groups, as shown in Figure 13. The 7.0 earthquake that struck Haiti in 2010, killing up to 230,000 people (two percent of the island’s population), caused between USD 7.8 billion and USD 8.5 billion of damage, equating to approximately 120 percent of the country’s GDP.<sup>12</sup> This compared extremely unfavorably to New Zealand, where public-private partnerships significantly limited the quantum of losses falling to its government after the powerful earthquake of 2011 (see Table 2). Most studies, particularly those focused on developing countries, consistently call out the devastation catastrophes can have on the long-term development prospects of impacted economies.

Figure 13: Cost of Natural Catastrophes as a Percentage of Gap by Income Group  
(Source: Munich Re, Geneva Association)

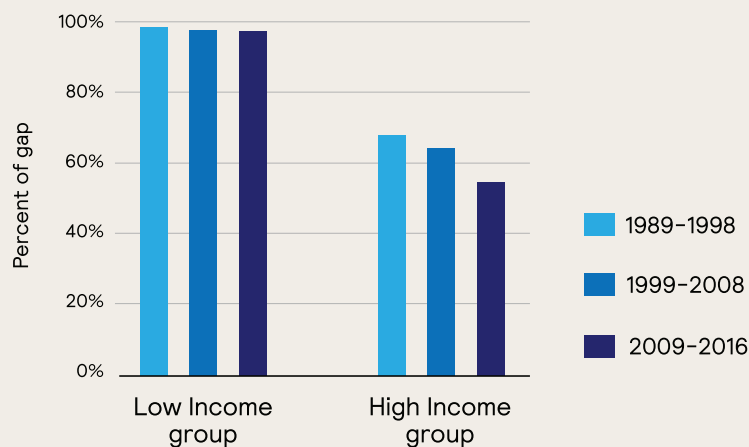


Table 2: Earthquake Insurance Penetration – Haiti (2010) vs New Zealand (2011)  
(Source: Swiss Re)

	Haiti (7.0 magnitude)	New Zealand (6.3 magnitude)
Economic loss (USD billion)	8.8	36.6
Uninsured loss (USD billion)	8.7 (99%)	7.3 (20%)
As % of GDP	120%	18%

<sup>12</sup> “Haiti Earthquake Facts, Its Damage, and Impact on the Economy”, Kimberly Amadeo, June 2019.

Even in developed countries, where some argue that the GDP impact from catastrophes is less of an issue, the insurance gap has huge implications for communities, households and businesses that suffer losses directly. Consider the dynamics experienced after Hurricane Harvey's landfall in the United States in August 2017, which dropped over 40 inches of rain in the Houston vicinity over three days.<sup>13</sup> For homeowners who had purchased flood insurance from the National Flood Insurance Program (NFIP), the average recovery was USD 120,000, more than seventeen times the payouts received by those that suffered loss without flood insurance (the average government assistance payout was only USD 7,000).<sup>14</sup>

The lack of insurance penetration for flooding events in the United States is a huge issue. News sources placed NFIP take-up rates in areas impacted by Harvey at just one in five, or a "gap" of 80 percent, consistent with findings discussed above. There is clearly scope for the private (re)insurance market to take on a greater proportion of U.S. risk than it does presently, given it remains exceptionally well capitalized and is looking for opportunities to deploy capital into new risk pools. Strikingly, only a quarter of Harvey's total economic loss was covered by the private market.

### **DEMOGRAPHIC AND FINANCIAL CHANGES**

While societies and governments grapple with these dynamics, a number of other equally complicated demographic and financial trends are likely to exert significant fiscal pressures on nations worldwide over the next three decades. The following three trends are most pressing: 1) population shifts and migration that are concentrating and adding to exposures in catastrophe prone areas, 2) aging populations that will reshape the global workforce in the years to come and 3) publicly-held debt that remains fixed at historically high levels.

### **MIGRATION**

Many factors drive human migration and it is difficult to draw a straight line of causation to any single cause. There is nevertheless increasing recognition (including from the United Nations) that economic, social, political and environmental issues will propel cross-border and internal migration for years to come. Climate change is certainly a key driver behind this trend: the World Bank says "mobility is emerging as the face of climate change."

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<sup>13</sup> The fact that Harvey stalled over Houston for over three days is consistent with recent research that highlights the propensity for hurricane forward motion to slow as a result of climate change.

<sup>14</sup> <https://www.houstonchronicle.com/news/houston-texas/houston/article/Harris-County-homeowners-without-flood-insurance-12973727.php>.

Indeed, the World Bank released a report in 2018 (titled *Groundswell; Preparing for Internal Climate Migration*) that focused on the implications of migration-related issues in Sub-Saharan Africa, South Asia and Latin America (regions that contain 55 percent of the developing world's population). The World Bank estimates that almost 145 million people will migrate from areas stressed by climate change.

The poorest people and countries will be hardest hit by increased migration, and urban areas are likely to be stressed by an influx of people. A study funded by the European Union's joint Research Centre, with contributions from the U.S. Department of Energy and led by scientists from Columbia University in New York, established a trend that correlates extreme weather events with increases in the number of asylum seekers. Europe, which has recorded increases in immigration and asylum requests in recent years, could see activity triple in the decades to come.

### **AGING POPULATIONS**

Governments are also grappling with the implications of aging populations, a trend that is only set to worsen over the next two to three decades. The number of people aged over 60 globally has tripled since 1950 and is expected to grow from 900 million (recorded in 2015) to roughly 2.1 billion by 2050.<sup>15</sup> At the same time, average global life expectancy will increase from 65 years to 75 years.

China, Russia, the United States, Europe and Japan (to name a few) will have to deal with the reality of aging populations. Predicting the exact financial impact on societies is challenging, as other factors such as migration and changing economic models will influence outcomes. At the very least, governments should plan for higher pension and healthcare costs, as well as provisions for other related support that citizens often turn to governments to provide.

### **GOVERNMENT DEBT**

Increased costs are likely to put government finances under further strain; a worrying prospect given current levels of debt. According to the Institute of International Finance, government debt globally will climb to USD 70 trillion in 2019 (up from USD 65 trillion in 2018), led in large part by more borrowing in the United States.

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<sup>15</sup> Forbes, 2018 and "The Impact of an Aging Population on Economic Growth: An Exploratory Review of the Main Mechanisms" (2016)

The global average debt to GDP ratio has increased by more than 225 percent (weighted by country GDP). While economists debate the appropriate levels of borrowing in the current low interest rate environment, at a fundamental level, increasing levels of government debt-to-GDP imply that borrowing is growing at a rate faster than economic growth.

Increased levels of debt mean that future generations across the globe will be forced to spend more on servicing government debt, rather than supporting central societal needs and services such as healthcare, security and education. In an already competitive environment, finding the financial resources for recovery from growing disaster losses will become more challenging in the future.

Taking the United States in isolation illustrates the extent of the problem. Debt-to-GDP in 2017 stood at 75 percent and this is projected to grow to 140 percent by 2050. Average debt over the past 50 years was 39 percent.<sup>16</sup> This is clearly unsustainable and underlines the fact that policy changes will be required at some point.

As nations come to terms with their own circumstances, difficult choices will have to be made. All of the challenges discussed in this section carry with them immense fiscal costs. Much of these costs fall to governments to address. The opportunity for closer collaboration between the private (re)insurance market and governments to address the direct challenges of catastrophe event funding is therefore clear. Increased insurance penetration will also bring the added benefit of improving societies' understanding of risk and their associated costs.

As the section that follows shows, this process is already underway. These "green-shoot" initiatives provide templates that can be used by other governments seeking to improve how they manage and finance catastrophe risks.

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<sup>16</sup> "Federal Budget Policy With An Aging Population and Persistent Low Interest Rates" by Douglas Elmendorf and Louise M. Sheiner, *The Journal of Economic Perspectives* (2017).

A satellite view of Earth from space, showing a large hurricane with a distinct eye and spiral cloud bands over the Caribbean Sea. The surrounding landmasses, including North and South America, are visible in shades of green and brown. The ocean is a deep blue, and the atmosphere is filled with white clouds. The curvature of the Earth is visible at the top right.

# 4

## **PUBLIC-PRIVATE PARTNERSHIPS**

Most catastrophe losses, whether caused by natural perils or other events, represent unbudgeted demands on public finances. Money spent to replace critical infrastructure (for example) inevitably draws money and resources away from other important community initiatives.

Fortunately, the reinsurance market's ability and desire to innovate has seen it emerge as a capable private partner for public sector risk at a time when governments worldwide are looking to transfer risks from public to private balance sheets. A number of public-private partnerships have already been brought to market to help alleviate the burden from governments.

### **U.S. FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) & THE NATIONAL FLOOD INSURANCE PROGRAM (NFIP)**

After Hurricane Katrina struck Louisiana in 2005 and caused USD 160 billion in economic damages, the financial burden on FEMA increased significantly. The situation was compounded when Superstorm Sandy hit the East Coast of the United States in 2012, resulting in the NFIP's deficit rising to USD 24 billion at the time.<sup>17</sup> By current statute, the NFIP is required to repay this debt to the U.S. Treasury. Numerous reports have been written questioning FEMA's ability to do this, given the exposure held by the program and the NFIP's available finances. The annual cost to service its debt currently exceeds USD 400 million.

In consultation with the U.S. Congress, FEMA turned to the reinsurance market in 2014 to explore the feasibility of risk transfer to offset mounting losses within the NFIP. FEMA completed this work as part of the "Flood Insurance Risk Study" which included an in depth analysis of the NFIP's insurance portfolio around which it developed a sophisticated risk transfer program to share a portion of flood risk with private markets.

### **TRADITIONAL PRIVATE REINSURANCE**

In early 2017, FEMA became the first U.S. federal agency to purchase private reinsurance (with a program limit of just over USD 1 billion). Total premium for this first of its kind placement was USD 150 million. The key terms meant the program would be triggered if a natural catastrophe caused flooding-related losses falling between USD 4 billion and USD 8 billion, with FEMA entitled to recover 26 percent of any amount between these two thresholds.

Months after this landmark policy was placed, Hurricane Harvey struck Houston and its surrounding areas in 2017. Total damages from the hurricane reached USD 125 billion and FEMA's NFIP policyholders suffered almost USD 10 billion in losses.

<sup>17</sup> <https://fas.org/sgp/crs/homesec/IN10784.pdf>

A full payout (of just over USD 1 billion) from the private reinsurance market was triggered within weeks of the hurricane coming ashore in Texas. The net result represented a significant return on the investment of USD 150 million in premium. More importantly, it provided immediate funding to pay claims to flood-insured survivors affected by Harvey. Ultimately, FEMA's reinsurance program saved U.S. taxpayers over USD 850 million; money that would otherwise have added to FEMA's deficit and related interest payments.

Importantly, underwriters on the program continued their participations when FEMA's program renewed two months later. As a result, FEMA expanded the size of the program to USD 1.46 billion in January 2018. Over the course of that year, through the issuance of its first catastrophe bond, FEMA had nearly doubled its program limit to USD 1.92 billion, at a cost of USD 297 million.<sup>18</sup>

### CATASTROPHE BONDS

FEMA has supplemented its traditional reinsurance protection through the placement of USD 800 million of catastrophe bonds over the past two years. These bonds, a form of insurance-linked securities (ILS), pay capital market investors a set return against the risk that a natural catastrophe of a specific amount or severity occurs within the term of the bond (in FEMA's case each bond has been issued with a three-year term).<sup>19</sup>

The process of developing a risk transfer program provided valuable insights to NFIP leadership in supporting its efforts to create a sound financial framework. Today, the NFIP still spends more than USD 1 million a day to service more than USD 20 billion in debt. Reinsurance has helped to minimize the need for additional borrowing and allowed the program to share losses with private market investors. While broader reforms are still required to address the challenges associated with the NFIP's debt, this stable risk transfer program represents an initial step to create greater stability and sustainability.

**Public-Private Partnerships Can Help To Reduce Disaster Suffering:** Victims of flooding events in the United States that are protected by the NFIP recover more quickly. As stated earlier, homeowners that had NFIP cover recovered an average of USD 120,000 following Hurricane Harvey's landfall in Texas while those that did not have the benefit of NFIP cover received less than USD 7,000. Without insurance protection, floods can wreak financial havoc on victims. Across Harvey's impacted areas, only around 20 percent of individuals had flood insurance.<sup>20</sup> FEMA's goal for the future is it to change this by committing to a target of doubling flood insurance take-up over time across the United States. Crucially, FEMA has expressed support for a viable private sector market to support it in this endeavor.

<sup>18</sup> <https://www.fema.gov/nfip-reinsurance-program>

<sup>19</sup> "National Flood Insurance Program's (NFIP) Reinsurance Program," FEMA, last modified November 7, 2019, accessed December 4, 2019, <https://www.fema.gov/nfip-reinsurance-program>.

<sup>20</sup> <https://www.houstonchronicle.com/news/houston-texas/houston/article/Harris-County-homeowners-without-flood-insurance-12973727.php>

### **THE FUND FOR NATURAL DISASTERS (FONDEN) IN MEXICO**

Mexico has been a pioneer in exploring innovative ways to transfer a portion of its natural catastrophe risk to private investors. More than 20 years ago, the Mexican government created The Fund for Natural Disasters, called FONDEN, which was designed to take a proactive approach to support disaster relief and, importantly, reconstruction and to act as a buffer against multiple losses that occurred in the 1990s.

In 2006, Mexico placed the first catastrophe bond by a sovereign government. In 2009, Mexico once again broke boundaries by becoming the first country to issue a multi-peril catastrophe bond, covering earthquake and hurricane risk, through the World Bank's MultiCat program. More recently, FONDEN placed its fourth catastrophe bond in 2017 via the Global Debt Issuance Facility of the World Bank Group's International Bank for Reconstruction and Development.

FONDEN's reconstruction program has leveraged traditional reinsurance to provide up to USD 250 million of coverage for public assets and eligible low income housing after disasters. Renewed on an annual basis, the program provides additional funding for rebuilding when local or recipient resources are exhausted after a declared disaster. Notably, the program has a detailed structure to create cost sharing with localities or recipients, encourage take-up of insurance protection for publicly owned assets and enforce higher standards for reconstruction following disasters.

Over the life of the FONDEN program, Mexico's government has received roughly USD 280 million from its traditional reinsurance program and an additional USD 200 million from its catastrophe bonds, for a total recovery of almost half a billion dollars.

### **SOUTHEAST ASIA DISASTER RISK INSURANCE FACILITY (SEADRIF)**

The Southeast Asia Disaster Risk Insurance Facility (SEADRIF) is the first regional facility in the Association of Southeast Asian Nations (ASEAN) to address disaster risk financing in a comprehensive manner from risk identification, reduction and preparedness to insurance and resilient recovery.

ASEAN countries are heavily exposed to a variety of natural catastrophe risks while regional catastrophe risk insurance markets are still underdeveloped in terms of non-life catastrophe insurance penetration.

Natural disasters result in different financing needs. For instance, while over 50 percent of losses from the Thai floods in 2011 emanated from the manufacturing sector, the 2015 Myanmar floods predominantly caused losses related to infrastructure. SEADRIF is a key initiative that strengthens regional financial resilience and is designed to be a platform to offer climate and disaster risk financing solutions, responding to the different needs of ASEAN countries.



Developed as an initiative by the ministers of finance and central bank governors from ASEAN+3 countries, SEADRIF was established in July 2019 as a multi-functional regional platform for ASEAN countries to access financial, analytical and advisory and knowledge services and products to strengthen financial resilience against disasters and climate shocks. SEADRIF's work is co-financed by various governments. Its founding members are Cambodia, Indonesia, Lao PDR, Myanmar, Singapore, the Philippines and Japan. The World Bank acts as SEADRIF's lead technical partner, and the ASEAN Secretariat serves as the SEADRIF Secretariat.

The first financial product to be offered by SEADRIF Insurance Company, a licensed direct general insurer in Singapore, is a catastrophe risk pool for Lao PDR and Myanmar. The pool leverages joint reserves and offers market-based finite and parametric catastrophe risk insurance solutions to provide liquidity in the aftermath of disasters such as severe floods.

At the request of the member countries, SEADRIF is also exploring the development of other disaster risk financing solutions such as a joint risk pool for public assets and infrastructure of ASEAN countries. SEADRIF provides a formal, long-term, disciplined approach via a regulated, licensed insurance company with the ability to expand its geographic and product scope in partnership with the reinsurance industry.

### **THE PHILIPPINES CATASTROPHE BOND FOR EARTHQUAKE AND TYPHOON**

Issued by the World Bank, the first ever sovereign catastrophe bond in Southeast Asia provides the government of the Philippines with protection against earthquake and tropical cyclone risk.

The Philippines is frequently impacted by tropical cyclones and earthquakes, which are expected to incur losses of more than USD 3 billion per year to public and private assets. In order to maintain fiscal health and to reduce the impact of natural disaster shocks on the most vulnerable, the Philippine government has developed a comprehensive disaster risk financing and insurance strategy.

Based on an analytical catastrophe risk assessment, the Philippine's DRFI strategy follows a multi-tiered and multi-layered approach by addressing disaster risk financing needs on national, local and individual levels and combining different financial instruments including dedicated disaster funds, contingent credit lines and risk-transfer to the international reinsurance and capital markets.

The Philippines' catastrophe bond, which was listed at the Singapore Exchange in November 2019, has been another milestone for the Philippine government in executing on its disaster risk financing and insurance strategy. In addition, it constitutes a landmark transaction marking a number of firsts such as being the first catastrophe bond ever directly sponsored by an Asian sovereign, the first catastrophe bond listed on an Asian exchange and the first World Bank bond ever listed in Singapore.

The catastrophe bond provides the Philippine government with USD 225 million in protection against earthquake and tropical cyclone risk over three years. It was designed to provide flexible financial resources immediately after a catastrophe event and will pay out on a modeled loss basis with different staged triggers based on the severity of an earthquake or tropical cyclone.

### **CALIFORNIA WILDFIRE FUND (2019)**

Following the devastating wildfires that raged across California in 2017 and 2018, the state's legislature and governor took steps to fund mitigation efforts and provide post-disaster relief to affected homeowners.

Outdated or compromised utility equipment has been found to be the ignition source for some of the state's most destructive wildfires in the last couple of years. As liability claims against large utilities firms have started to mount, many face severe financial instability. In an effort to support the utilities and provide adequate funding for remediation efforts, the state government established the California Wildfire Fund. This fund provides claims-paying protection for the three largest investor owned utilities in the state. The fund will be capitalized mutually by utilities and ratepayers to a total capacity of USD 21 billion over time.

By pooling these resources together into a fund, it allows the state to buy down utility-related wildfire risk and protect against additional debt. There are two requirements to trigger the fund: 1) one of the contributing utility firms must be deemed responsible by the California Department of Fire and Forestry Protection for causing a wildfire and 2) claims must exceed USD 1 billion in a calendar year.

In remarkable speed, the first reinsurance placement was completed in September 2019, providing reinsurance cover for initial fund amounts through May 31, 2020. Aligned with broader state investments in wildfire mitigation and land management, each eligible utility corporation is required by the law to invest USD 5 billion in mitigation activities across safety and infrastructure upgrades over the next three years. These investments must be aligned to their mitigation plans, which need to be submitted to the state annually.

Collectively this public-private partnership has helped support the financial capability of the largest utility providers in California, de-risk the exposure of taxpayers and mandate major investments in mitigation to address wildfire risk.

### **FLOOD RE IN THE UNITED KINGDOM**

Household insurance in the United Kingdom has historically provided flood coverage universally to all. Coverage nevertheless became threatened following persistent flooding in the 1990s and 2000s.

In response, the UK government, in coordination with the private insurance market, entered into a series of voluntary agreements to sustain the availability of flood insurance for individuals. These agreements did not address affordability, and were not intended to be a permanent solution.

Between 2007 and 2016, a series of significant floods occurred across the United Kingdom causing widespread losses. Although flood continued to be covered by insurers, costs and deductibles increased, thereby decreasing the value of coverage to the consumer.

In 2016, the insurance industry, in cooperation with the UK government, established a joint initiative called Flood Re to support the availability and affordability of flood insurance for homeowners most at risk from flooding. Through Flood Re these risks are then shared with the reinsurance market.

Importantly, premiums charged by Flood Re to insurers are based on the properties' council tax band, which are used as a proxy for affordability and a homeowner's ability to pay insurance premiums. The theory is that more affluent homeowners able to buy homes with a higher council tax band should pay more than those in a lower council tax band. The market remains competitive as insurers still set their own pricing, but they do so knowing that their Flood Re premium is set off the fixed rates.

Flood Re transfers GBP 2.2 billion in flood risk annually to the reinsurance market. The UK government does not provide a backstop to Flood Re. As such, Flood Re is required to purchase enough reinsurance to minimize the possibility of any risk being returned to insurers. Flood Re is a privately owned organization with public accountability to parliament, and anticipates being designated by the UK National Audit Office as a public body. Since Flood Re is required to consolidate its accounts into the UK national (public) accounts, it could in theory deliver an unexpected increase to government spending should it experience a significant loss. This potential exposure to government is limited to GBP 100 million by a stop loss protection purchased by Flood Re.

As part of its Transition Plan, Flood Re is actively exploring resilience initiatives including Build Back Better and Property Flood Resilience measures in its efforts to achieve a normalized market that is not necessarily reliant on Flood Re. Mitigation is considered a core component in achieving a stable UK flood insurance market.

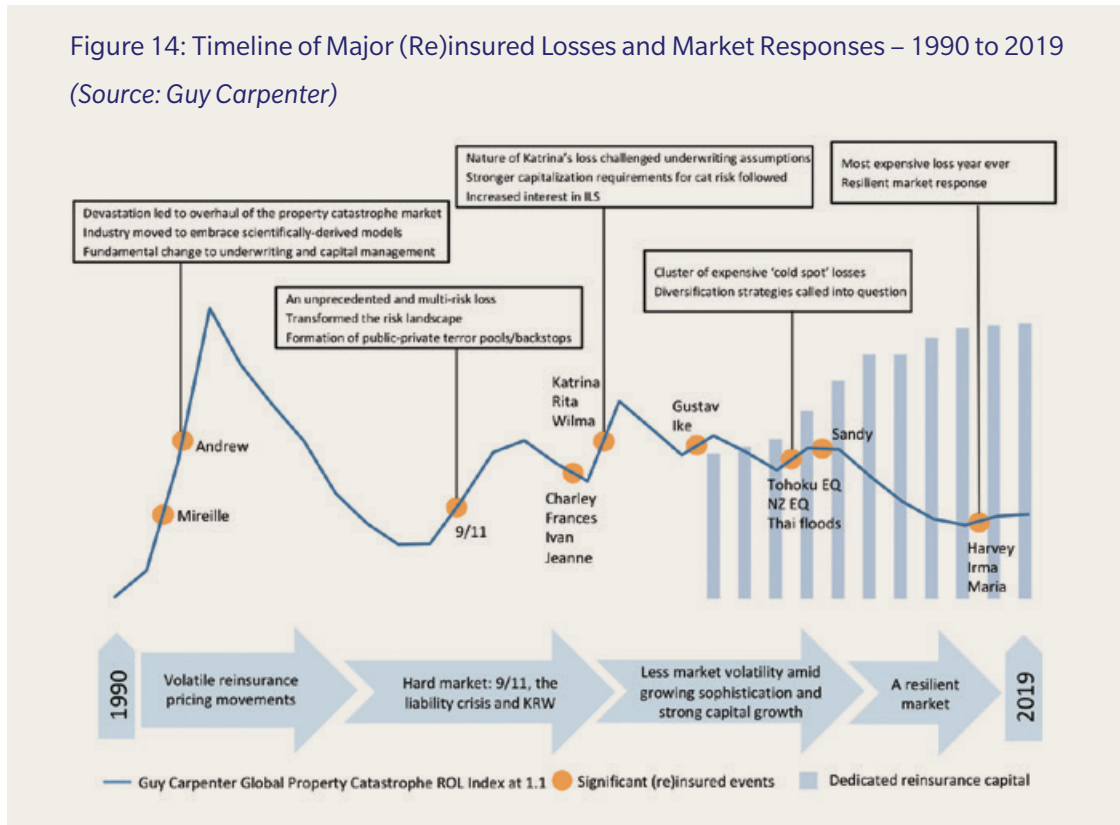
Flood Re has enabled more than 250,000 at-risk households to access more affordable home insurance. Four out of five households with previous flood claims have achieved premium reductions of over 50 percent since Flood Re came into force. Flood Re is in a unique position to act as a convener and the catalyst for change as society seeks to address flood risk.

The background is a light blue gradient with various mathematical symbols and numbers in a dark blue, bold font. Symbols include multiplication signs (x), division signs (÷), and decimal points (.), along with numbers like 3.0, 1.2, 5.0, 3.4, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 23.0, 24.0, 25.0, 26.0, 27.0, 28.0, 29.0, 30.0, 31.0, 32.0, 33.0, 34.0, 35.0, 36.0, 37.0, 38.0, 39.0, 40.0, 41.0, 42.0, 43.0, 44.0, 45.0, 46.0, 47.0, 48.0, 49.0, 50.0, 51.0, 52.0, 53.0, 54.0, 55.0, 56.0, 57.0, 58.0, 59.0, 60.0, 61.0, 62.0, 63.0, 64.0, 65.0, 66.0, 67.0, 68.0, 69.0, 70.0, 71.0, 72.0, 73.0, 74.0, 75.0, 76.0, 77.0, 78.0, 79.0, 80.0, 81.0, 82.0, 83.0, 84.0, 85.0, 86.0, 87.0, 88.0, 89.0, 90.0, 91.0, 92.0, 93.0, 94.0, 95.0, 96.0, 97.0, 98.0, 99.0, 100.0. The symbols and numbers are scattered across the page, some larger and more prominent than others.

**5**  
**REINSURANCE RESILIENCE  
AND VALUE**

The global reinsurance market has been fundamental to the management and mitigation of risk for over 150 years. Its innate ability and desire to innovate and evolve through several different market cycles and periods of change has helped to strengthen the market’s resolve and resilience to losses. Figure 14 shows how the reinsurance market responded to major events over the last 30 years or so.

Figure 14: Timeline of Major (Re)insured Losses and Market Responses – 1990 to 2019  
 (Source: Guy Carpenter)



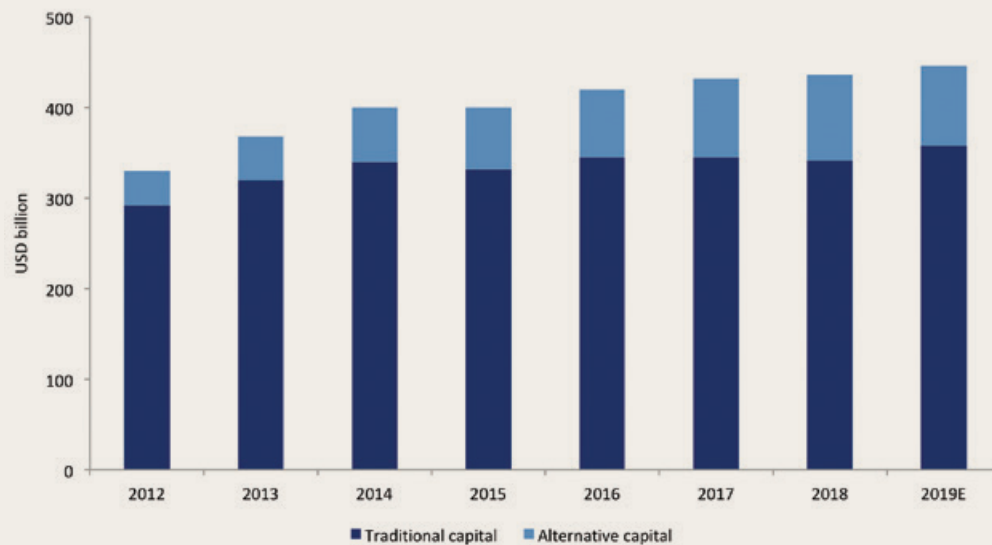
As the risk landscapes shifts because of climate change, shifting population distributions and rising inequalities, there is now an opportunity for governments to put this expertise to work by partnering with the (re)insurance market. These risks are, by their very nature, massively disruptive, but the (re)insurance sector is well placed today to withstand most conceivable loss scenarios.

## DEDICATED REINSURANCE CAPITAL

The availability of capital is, of course, crucial to providing a reliable source of funding for (post-disaster) financial recovery. As Figure 15 shows, the reinsurance sector has been operating in an environment of plentiful capacity and abundant capital for several years now, with total reinsurance capital increasing by close to USD 115 billion, or a third, between 2012 and year-end 2019 to reach close to an all time high of USD 446 billion. This is despite facing record breaking catastrophe losses of USD 240 billion in 2017/2018.

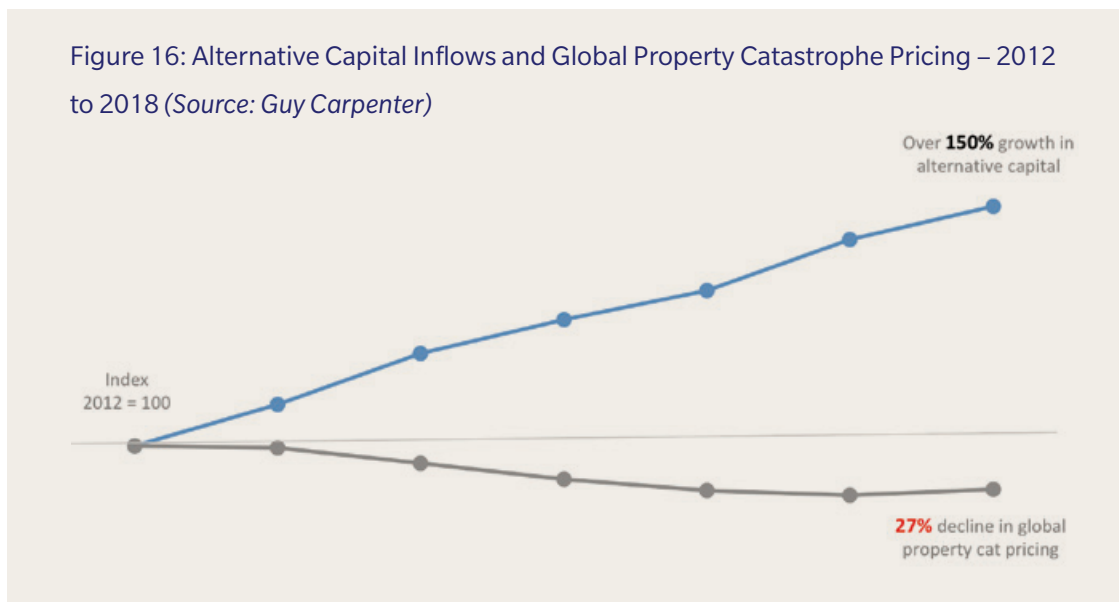
The vast majority of this growth has come from alternative or ILS capital. This asset class, which has been mostly funded by pension fund-provided capital, flowed into the sector more rapidly in 2011/2012 as yields in the ILS market reached as high as 12 percent, with expected losses as low as 3 percent. Such a proposition has proven to be attractive to investors in the wake of the global financial crisis, especially given its additional appeal of low correlations.

Figure 15: Dedicated Reinsurance Sector Capital and Premiums – 2012 to YE 2019  
(Source: Guy Carpenter, A.M. Best)



The entry of tens of billions of dollars of alternative capital into the sector has transformed the market. Alternative capital rose by 150 percent between 2012 and 2018 (see Figure 16). Using the largest class of reinsurance, property catastrophe, as a proxy, this growth unsurprisingly led to a corresponding fall in the cost of reinsurance. It should also be noted that current alternative capital inflows represent only a small fraction of the volumes that could potentially arrive from the capital markets, although market conditions would, of course, dictate the opportunity to deploy additional capacity at acceptable risk parameters.

Figure 16: Alternative Capital Inflows and Global Property Catastrophe Pricing – 2012 to 2018 (Source: Guy Carpenter)



### PRIVATE-PUBLIC PARTNERSHIP

Putting reinsurance capital to work to create new coverages and meet evolving demands from public sector entities will be crucial as new risk pools emerge. At a time when governments worldwide are being forced to bear a growing share of natural catastrophe losses, and face multiple challenges in funding increasing costs associated with aging populations and higher debt, the reinsurance market has already established itself as a capable private partner for the public sector.

The findings and observations in this paper outline the potential magnitude of change and challenge that climate and demographic shifts could bring to nations in the years and decades to come. More importantly, the report also shows that the reinsurance market is a resolute and capable partner for public sector risk. Guy Carpenter looks forward to working with governments and markets to help de-risk public sector balance sheets through risk transfer to the private sector.



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is a leading global risk and reinsurance specialist with more than 3,100 professionals in over 60 offices around the world. Guy Carpenter delivers a powerful combination of broking expertise, trusted strategic advisory services and industry-leading analytics to help clients adapt to emerging opportunities and achieve profitable growth. Guy Carpenter is a business of Marsh & McLennan (NYSE: MMC), the world's leading professional services firm in the areas of risk, strategy and people. The company's 76,000 colleagues advise clients in over 130 countries. With annual revenue of \$17 billion, Marsh & McLennan helps clients navigate an increasingly dynamic and complex environment through four market-leading businesses including Marsh, Mercer and Oliver Wyman. For more information, visit [www.guycarp.com](http://www.guycarp.com) and follow Guy Carpenter on LinkedIn and Twitter @GuyCarpenter.

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