



SPRING MEETING

MAY 11-13, 2020 • ONLINE EVENT

ERM and Climate Change Risk

Actuaries and Climate Risk - A Consulting Practice Downunder View

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Actuaries and Climate Risk – A Commercial Insurer’s View

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Actuaries and Climate Risk – A Personal Lines View

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IACA February 2016

THERE WILL BE GREEN IN GREEN CONSULTING

[Rade Musulin](#)

There is an American expression that some activities offer a chance to "make some green", referring to profit potential and the color of US dollars. In coming decades actuaries have significant opportunities to turn skills in "green" environmental initiatives into "green" financial rewards.



Despite the best efforts of fossil fuel interests and "I'm not a scientist" political leaders, momentum is building in almost every major country for a profound economic transformation in the energy sector that will affect almost every facet of economic activity. Evidence of this abounds. By 2015 there were more jobs in solar power than coal in the United States, and solar jobs are growing quickly. China is forecast to become the world's largest electric vehicle market by 2020. Geothermal, wind, and wave power generation are growing.

This transformation will affect many aspects of actuarial work. Property insurers will have to adapt coverage for solar panels and batteries. Automobile insurers will have to rate electric vehicles. Insurer asset mix may be affected by green investment initiatives. Weather patterns may change, affecting property and/or agriculture insurance losses. Mortality and morbidity may change due to migration or increasing heat in some areas. Rising seas may pose significant challenges for coastal flood insurance.

One major challenge for coping with climate issues is to break the black and white mindset of people on both sides of the debate. Greens and skeptics alike often fall into the trap of taking extreme positions with an almost religious conviction that their view of the future is correct and certain. In reality, the earth's climate is an incredibly complex and unpredictable system in which future states should be described stochastically.

Risk and uncertainty are at the core of actuarial science. Climate change adaptation is an exercise in risk management in the face of uncertain future states. Actuaries can play a significant role in this process.

I recently wrote three articles illustrating some ways actuaries can contribute, "[Demographics, Development, and Disasters](#)", "[Rising Tides](#)", and "[Rising Tides Downunder](#)". The basic premise of this work is that actuaries can adapt tools we use in our traditional work (such as catastrophe and economic capital models) to tackle problems like the optimal investment societies should make in climate change adaptation.

Actuarial organizations are increasing activity in various climate related work. The International Actuarial Association (IAA) has formed the "Resource and Environment Working Group" ([REWG](#)) to "serve as a working group within the IAA devoted to environment issues that can affect the work of actuaries in

Page 17 International Association of Consulting Actuaries



Need for climate risk disclosure grows

- Government and regulatory
 - APRA, Reserve Bank, ASIC (Aust.)
 - Bank of England (UK)
 - European Commission (EU)
 - NAIC (US)
 - MAS (Singapore)
 - and many more...
- Internal governance
 - Board
 - ERM
 - Strategy
- Shareholders
 - Activist investor groups
 - Institutional investors
- Investment Funds
- Rating Agencies (S&P, AM Best)
- Customers
- General public, whose motivation may have been increased by recent severe weather



Taskforce on Climate-related Financial Disclosures



”

Increasing transparency makes markets more efficient, and economies more stable and resilient.

- Michael R. Bloomberg, Chair

<https://www.fsb-tcfd.org/>

Established by G20 and FSB to provide information for investors and create a more stable transition to a low carbon economy. The TCFD is a framework for measuring and reporting climate risk.



Global regulators' views

“To bring climate risks and resilience into the heart of financial decision making, climate disclosure must become comprehensive, climate risk management must be transformed, and sustainable investing must go mainstream.”

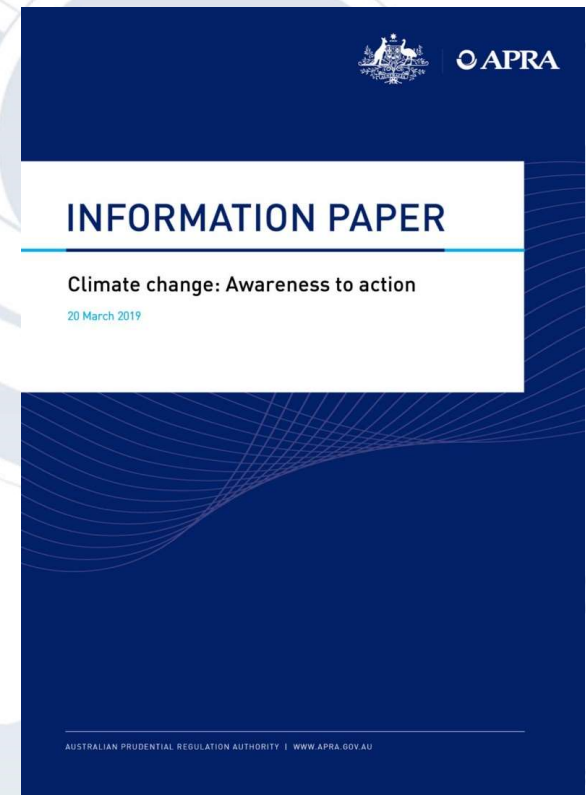
Mark Carney, Governor, Bank of England

“APRA is embedding the assessment of climate risk into our ongoing supervisory activities. We intend to probe the entities we regulate on their risk identification, measurement and mitigation strategies. We expect to see continuous improvement in how entities are preparing for the transition to the low-carbon economy. Additionally...we are strongly encouraging entities to adopt the TCFD recommendations around disclosure.”

Geoff Summerhayes, Executive Board Member, Australian Prudential Regulation Authority

“Finance, innovation and technology are a force for good, to overcome challenges and improve lives. Climate change is the ultimate challenge for humankind. It cannot be that the two objectives of being green and pursuing growth are irreconcilable. With imagination, innovation, technology, determination, we can reconcile them.”

Ong Ye Kung, Board Member, Monetary Authority of Singapore



Australian financial firms are making disclosures



Categories of climate risk

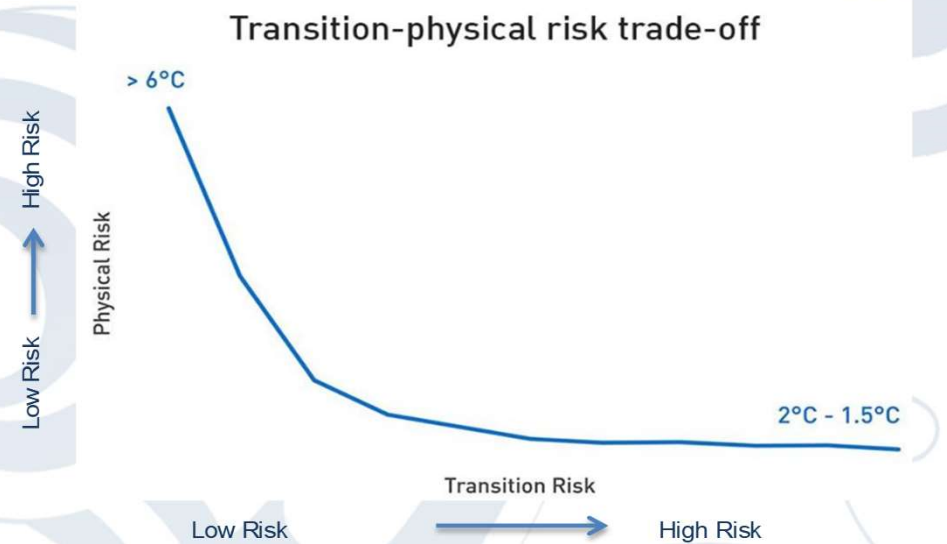


Source: Australian Prudential Regulation Authority



Physical and transition risk interaction

- Physical (e.g. bushfire from heatwaves) and transition (e.g. decarbonization or carbon taxes) risks are inversely related
- Their time horizons differ:
 - Physical risk is gradual
 - Transition risk can emerge quickly
- Reducing physical risk has large long-term benefits but often involves significant near-term costs
- This helps explain the politics
- Finding the right policy mix requires a long-term view of both cost and benefit, as is common in social programs



Finity climate risk practice



Climate risk assessment

We provide an initial assessment of your current exposure to 'Transition' and 'Physical' risk and will detail the impacts that climate change has had on your company to date. This will include impact on costs to date and assessment of how you can manage/monitor impacts in the future.



Weather risk linked parametric pricing

We have extensive experience using weather data including weather data including weather station observations, gridded data and reanalysis datasets. We have used these to calibrate a number of parametric insurance covers, taking into account effect of climate change and long term cycles (IOD, IPO, ENSO).



Scenario testing

With significant uncertainty around the range of possible future outcomes, scenario testing can be used to enhance the strategic conversation about the future. We can help determine what scenarios will provide the most value to your organisation and help articulate the impact of these scenarios on your business.



Climate disclosures

Concerns about the threat to global financial stability from climate-related risks have culminated in the Task Force on Climate-related Financial Risk Disclosure (TCFD) releasing a globally consistent framework for climate disclosures. This has received widespread support from investor groups, regulators and financial institutions.



Industry leading natural peril models

Our natural peril **models**, provide accurate address level risk information for each property in Australia. Using the available science we re-calibrate these models for a future warmed environment to provide an understanding of how this risk will change under various future scenarios.



Financial modelling process

We can work with you to build a financial model that is needed to measure climate risk impacts i.e. translating changes in the physical risk into financial impacts. This will be a robust and flexible process that can incorporate the science as it continues to evolve.



General skills required include

- “Traditional” actuarial tools such as pricing, reserving, capital management, ERM
- Strong understanding of catastrophe risk, including underlying meteorology, and how catastrophe models work (CCRMP)
- Literate in climate science to understand various future scenarios
- Ability to grasp macroeconomic concepts and how decarbonization may affect the economy
- Knowledge of investment practices and sustainable finance
- Skill in financial modeling



Climate risk assessment example (I)

- Risks must be evaluated by considering various future scenerios
- Physical risk
 - Develop views of future physical risk
 - Scientific literature
 - Catastrophe models
 - Identify and measure insurer's exposure to physical risks
 - Pricing, policy wordings, underwriting
 - Reinsurance
 - Insurer's own physical assets, e.g. buildings
- Transition risk
 - Customer base
 - Investment portfolio
 - Political environment (e.g. risk of change in government policies)



Climate risk assessment example (II)

- Litigation risk
 - Shareholder action for not avoiding foreseeable risks
 - Regulatory issues
- Action plan examples
 - Build climate risk into ERM framework, risk registers, etc.
 - Establish investment policies on carbon assets
 - Stress test reinsurance structures
 - Perform strategic review of markets and customers
 - Will current policyholder base be viable after decarbonization?
 - What new opportunities may emerge?
 - Develop “green” practices, such as buying carbon offsets or reducing carbon footprint of the organization



What is actuarial about climate risk?

- We have relevant skills:
 - Extreme events
 - Tail risk
 - Discounting (we need to compare future events to current costs)
 - Stochastic thinking (climate risk is uncertain)
 - Skill in financial modeling
 - And many more...
- Climate risk affects what we do:
 - Pricing
 - Product development
 - Capital management
 - Reinsurance
 - Enterprise risk management
 - Financial condition reports
 - Etc.



Actuarial associations are focusing on climate

HOME | PRESS ROOM | CAS LAUNCHES CLIMATE CHANGE RESOURCE LIBRARY

CAS LAUNCHES CLIMATE CHANGE RESOURCE LIBRARY

04/29/2020 —




The Casualty Actuarial Society (CAS) has now launched its **Climate Change Resource Library**, a compendium of past meeting and seminar presentations, recordings, articles and research papers all related to the impacts of a changing climate on P&C insurance risks. As CAS members know, actuaries are uniquely positioned to record, report on and analyze climate change data. The CAS is pleased to provide this new resource to CAS members and the public as part of its thought leadership on the global issue of climate change.

Some of the items include:

- Conference Presentations
 - “Climate Change and Catastrophes - Correlation or Causation?” (2018 Annual Meeting)
 - “Climate Change - The New Normal” (2019 Spring Meeting)
 - “Getting in Deep: Flood Risk in a Warming World” (2019 Annual Meeting)
- CAS Publications and Research
 - “Worldwide Tropical Cyclone Activity Measured Using The Actuaries Climate Index® Methodology” (2018 CAS E-Forum)
 - “The SLR Factor: As Sea Levels Rise, the Flood Risk Equation Changes” (Mar/Apr 2019 Actuarial Review)
- 2019 Interviews with Doug Collins, FCAS, on The Weather Channel

To view the library, visit cassact.org/climatechange




International Actuarial Association
Association Actuarielle Internationale

Climate Change, Insurance and Vulnerable Populations

Discussion Paper

Resource and Environment Working Group
October 2019




Contact: media@actuariesclimateindex.org

Actuaries Climate Index Reaches New High for Sixth Consecutive Quarter

Index's five-year average continues an upward trend


Washington, D.C., Arlington, VA, Schaumburg, IL, and Ottawa, ON (February 27, 2020) — The five-year moving average of the Actuaries Climate Index (ACI) reached a new high for the sixth consecutive quarter, according to the latest data release that includes summer 2019.

“The amplification of climate extremes and rising sea levels continues according to the latest seasonal measurements,” says Doug Collins, Chair of the Climate Index Working Group.

The ACI is a measure of long-term changes across an array of observed weather extremes and sea level in Canada and the United States, and is expressed in units of difference (standard deviations) from the mean for a 30-year reference period from 1961 to 1990. After reaching a value of 1.8 standard deviations in spring 2019 (inward upward from a preliminary calculated value of 1.6 due to data updates) above the index's historical reference period, the ACI's five-year moving average stands at 1.22 as of summer 2019.



Actuaries Climate Index - USA & Canada



Risk Alert: Climate-Related Risks

KEY MESSAGE: Actuaries should ensure that they understand, and are clear in communicating, the extent to which they have taken account of climate-related risks in any risk-related decisions, calculations or work.

What are the risks?
A series of small risks showing persistent attention to specific issues across the P&C risk categories to track carefully should the consequences of actions they are taking.

This information is the Risk Alert is non-mandatory guidance which can assist in protecting the public interest.

This Alert is relevant for the following members:
All members

Relevant content:
There is an increasing body of evidence demonstrating that climate-related issues represent a material risk to future economic stability affecting environmental, social and governance matters. Many clients of actuaries are exposed to this risk.

A Task Force on Climate-related Financial Disclosures (TCFD) has been established under the auspices of the [Financial Stability Board](http://www.fsg.com) with members from across the G20 to develop a consistent approach to disclosures of material climate-related risks for use by companies when providing information to investors, lenders and other stakeholders.

CLIMATE CHANGE BLOG



Climate Change Blog - October 2019

This month, we are looking at the Australian Sustainable Finance Initiative (ASFI), the work that they are currently doing, and why it is relevant to actuaries.

by JAMES YAP and EVELYN YONG



Australian Actuaries Climate Index

AUSTRALIA



5-year Temperature Index

Canadian actuaries calling for mandatory financial reporting around climate change

Staff | September 24, 2019

The Canadian Institute of Actuaries is asking financial stakeholders to take climate risks more heavily into account.

In a letter addressing Canada's governments, corporations and investors, the institute said quantifying and disclosing the financial impacts of climate change are key actions that will help mitigate the risk to global temperatures and will help Canadians adapt to the changing climate.

The letter said stakeholders should prioritize national-level data collection on the financial impacts of floods, wildfires, wildfires and other climate-related events. It also suggested policies be put in place that mandate financial reporting of climate-related risks and opportunities. Further, it said relevant parties should use environmental, social and governance principles in financial and investment decisions-making.

Read: Global investors call for government action on climate change

“Our actuaries work across diverse areas, including property and casualty insurance, pension plans, investments and more,” said Marc Jurek, fellow and president of the CIA, in a press release. “All of these areas see trends of uncertainty caused by changes in our climate, and we believe they are all pointing to the same conclusion: now is the time to act.”

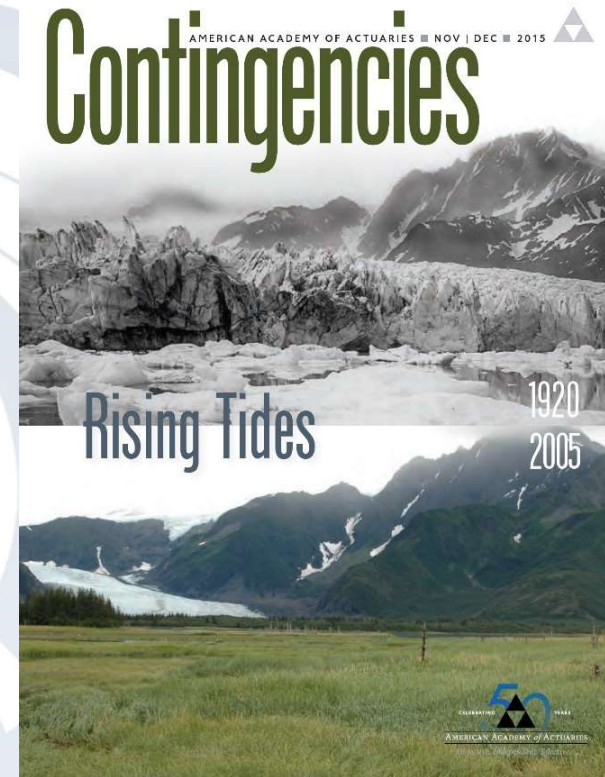
The letter also said Canadians would be able to better understand the financial risks of climate change if a database of information existed outlining how governments, insurers, individuals and organizations are paying for the ramifications. At present, available data is highly localized, inconsistent and its collection isn't mandatory, which results in major gaps.

Currently, the CIA is a partner behind the Actuaries Climate Index, which has mapped out extreme weather events and sea levels in Canada and the U.S. since 1961, demonstrating an increase in these events. The institute argued the index could be enhanced if it included data on the costs of these events.



COVID-19 and climate risk

- COVID-19 is exposing many problems that may emerge in a warming world, including the importance of multi-national coordination, exposure to supply chain disruptions, and a need for massive government investment
- Will clear warnings be ignored (again)?
- Firms need to take climate risk seriously:
 - The science is beyond question regarding measurements and general projections; “dispute” involves causation, transition dislocation, and what action(s) should be taken
 - Stakeholders expect the risk to be considered (regulators, shareholders, the general public)
 - Climate risk creates opportunity



<http://www.ozgator.com/publications/MusuliniRisingTidesArticle1115.pdf>



Actuaries and Climate Risk – A Commercial Insurer's View

Barry Franklin, FCAS, CERA, MAAA
EVP & Chief Actuary, Zurich North America



IFoA Climate Change Guidance for GI Practitioners

Relevance to General Insurance

Physical Risks – “The first-order risks which arise from weather-related events, such as floods and storms.”

Transition Risks – “The financial risks which could arise for insurance firms from the transition to a lower-carbon economy”

Liability Risks – “Risks that could arise for insurance firms from parties who have suffered loss and damage from climate change, and then seek to recover losses from others who they believe may have been responsible.”

Impacts on Key Focus Areas for GI Actuaries

Pricing and Underwriting

Reserving

Catastrophe modelling

Reinsurance

Investment

Risk management

Capital management



World Economic Forum Global Risks 2020

Figure I: The Evolving Risks Landscape, 2007–2020

Top 5 Global Risks in Terms of Likelihood



Top 5 Global Risks in Terms of Impact



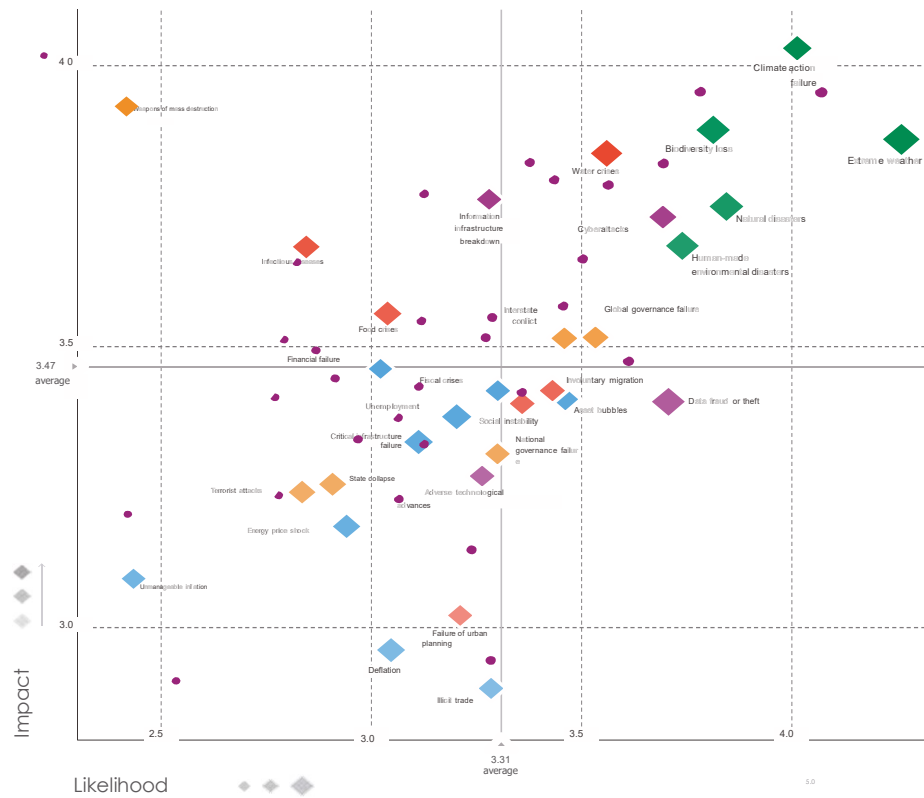
■ Economic
 ■ Environmental
 ■ Geopolitical
 ■ Societal
 ■ Technological

Source: World Economic Forum 2007-2020, Global Risks Reports.
 Note: Global risks may not be strictly comparable across years, as definitions and the set of global risks have evolved with new issues emerging on the 10-year horizon. For example, cyberattacks, income disparity and unemployment entered the set of global risks in 2012. Some global risks have been reclassified: water crises and income disparity were reclassified as societal risks in the 2015 and 2014 Global Risks Reports, respectively.



World Economic Forum Global Risks 2020

Figure II: The Global Risks Landscape 2020



What Can Commercial Carriers Do?

- Pricing & Underwriting
 - “Balance” catastrophe exposure across perils
 - Evaluate terms and conditions to manage BI exposure in view of global supply chain risk
 - Utilize satellite imagery and geocoding to aid risk selection (flood, wildfire)
- Reserving
 - Apply learnings from recent events (2019 spring floods/prevented planting, delayed planting/late harvest and early freeze for crop, e.g.)
 - Recognize subtleties in reserving defense costs for climate litigation - venue shopping, evolving theories of liability and litigation strategies (from GL to D&O, e.g.)
 - Assess impact of frequency/severity of storms on claim settlement timelines and costs when catastrophes do occur



What Can Commercial Carriers Do? (cont.)

- Catastrophe Models
 - Assess impact of placing greater weight on recent severe events
 - Use higher return periods in evaluating potential exposure to portfolio
- Reinsurance
 - Focus on counterparty credit risk management
 - Utilize CAT bonds and other financial instruments as part of overall strategy
- Investment
 - “Harmonize” Underwriting and Investment risks to avoid inconsistency/overexposure
 - Consider “Green bonds” as a high quality class of debt investments
 - Recognize the opportunities and risks associated with climate transition



What Can Commercial Carriers Do? (cont.)

- Risk Management

- Ensure regular risk assessments and ORSA stress scenarios include climate change impacts
- Raise awareness with company management & boards utilizing recognized sources (WEF Global Risks Report, e.g.)
- Work with intermediaries and customers to share knowledge, focus on need for mitigation, resilience
- “Connect the dots” across the organization to monitor exposures, trends

- Capital Management

- Incorporate explicit climate shocks in tail event scenarios
- Ensure effective mitigation plans exist to respond to capital stresses



Zurich Insurance Group Actions

As an insurer:

- General: Signatory to UN Principles for Sustainable Insurance
- Physical Risks – Managing our accumulations/working with customers and communities to build resilience; embedding climate change stress scenarios in ORSA; launched the Zurich Flood Resilience Alliance in 2013
- Transition Risks– Adjusting asset allocations, underwriting portfolio to de-emphasize carbon-intensive industries (thermal coal, shale oil, etc.)
- Liability Risks – UW actions through portfolio management, actively and successfully defending climate-related litigation against current and former customers; LPT of legacy liabilities; strategic use of reinsurance; maintenance of conservative capital position

As a corporate entity

- LEED certified building locations
- Elimination of single-use plastics
- Reduction in travel through webex, other remote meeting capabilities
- Reductions in printing
- Extensive use of remote working, flex work to reduce commuting and office space footprint requirements
- 3 pronged approach to sustainability – climate change, cyber risk, future of work



UN Principles for Sustainable Insurance

Mario Greco, Group Chief Executive Officer, Zurich Insurance Group

- “At Zurich, we are proud of the steps we have taken to incorporate environment, social and governance (“ESG”) considerations into our core activities of investment and underwriting. Signing the UNEP FI Principles for Sustainable Insurance allows us to build on those efforts by being part of the broader dialogue on the role insurance plays in shaping a more resilient tomorrow.”

Principle 1: **We will embed in our decision-making ESG issues relevant to our insurance business.**

Principle 2: **We will work together with our clients and business partners to raise awareness of ESG issues, manage risk and develop solutions.**

Principle 3: **We will work together with governments, regulators and other key stakeholders to promote widespread action across society on ESG issues.**

Principle 4: **We will demonstrate accountability and transparency in regularly disclosing publicly our progress in implementing the Principles.**



Actuaries and Climate Risk – A Personal Lines View

Parr Schoolman, FCAS, MAAA, CERA,
SVP & CRO, Allstate Personal Property & Liability



Allstate Prosperity Report

“Climate change has a broad impact on Allstate’s business. Understanding weather exposure and underlying trends is important for the property protection products we provide to customers.”

- *“Allstate has advocated for addressing the impacts of climate change over the last 25 years. At the state level, we have helped strengthen building codes, enhance emergency response capabilities and create catastrophe insurance pools.”*

Jess Merten, Executive Vice President & CRO



How are Personal Lines Insurers Impacted?

US Personal Lines insurers

- Physical Risk to properties covered by products we sell
 - Insurability: Can we estimate possible loss events reliably enough to insure them?
 - Volatility: Frequency and severity of events are managed through pricing, underwriting, and reinsurance
- Financial Risk associated with the assets held in our investment portfolio
 - Monitoring our investment portfolio exposure to assets/business most exposed to climate trends
- Reputational/Regulatory Risk driven by social and individual actions
 - The trend towards Environmental, Social, and Governance based investing (ESG) is growing
 - Rate regulation in geographies most exposed to Climate Trends may prevent the ability to price risk appropriately

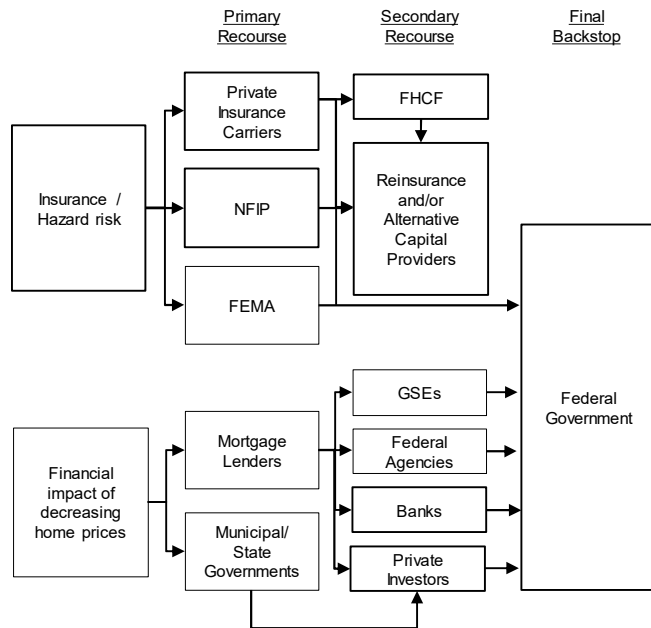


Scenario Analysis is a useful tool to identify exposure to key risks across the key dimensions expected to be impacted

Who Holds the Risk?

An overview of stakeholders in Florida residential real estate market

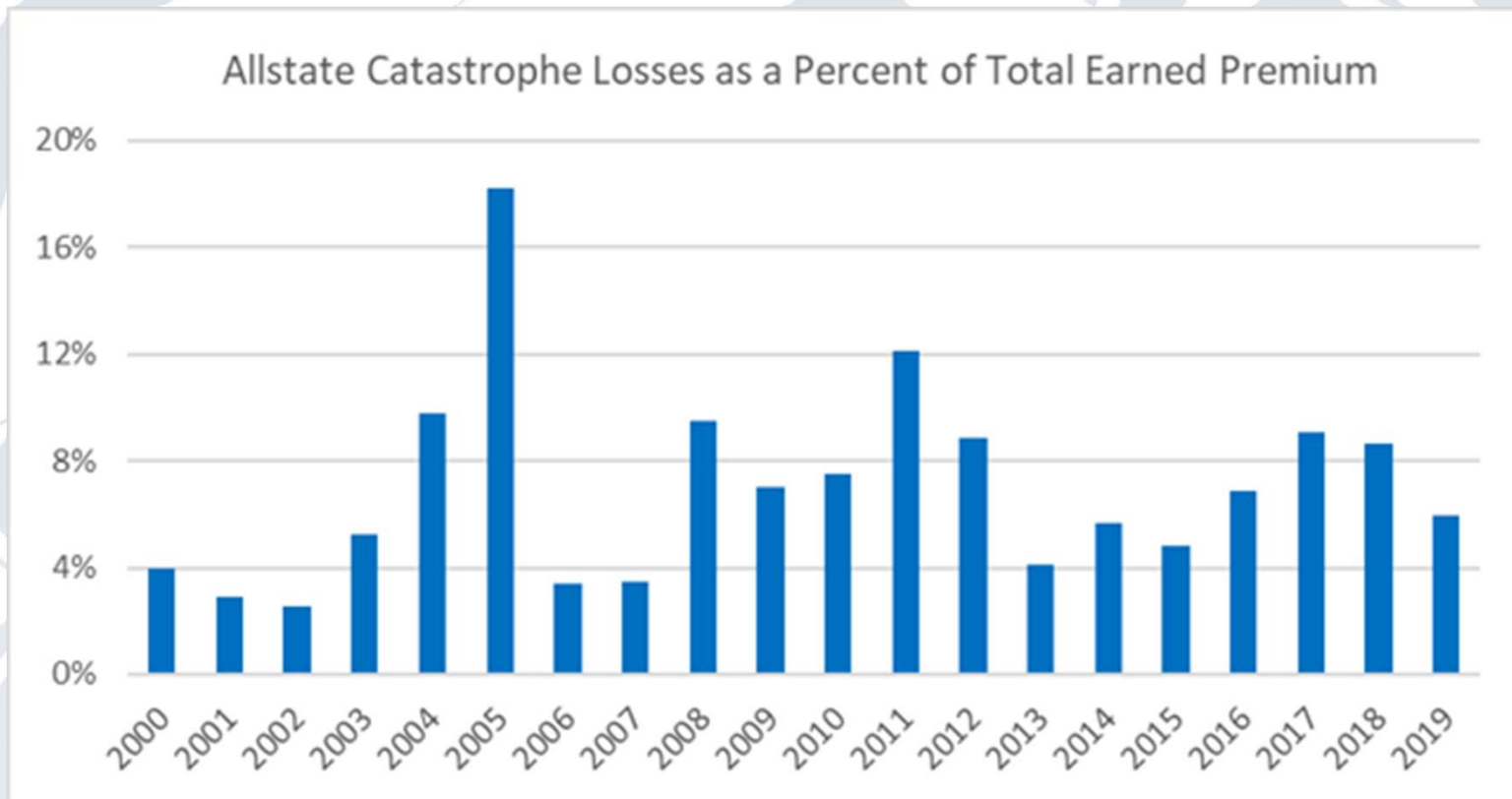
Assumption: Rising sea levels and more frequent severe storms will create more frequent and/or severe flooding causing damage to properties and creating negative impacts on home prices



Source: Adapted from McKinsey's "Climate Risk and Response"

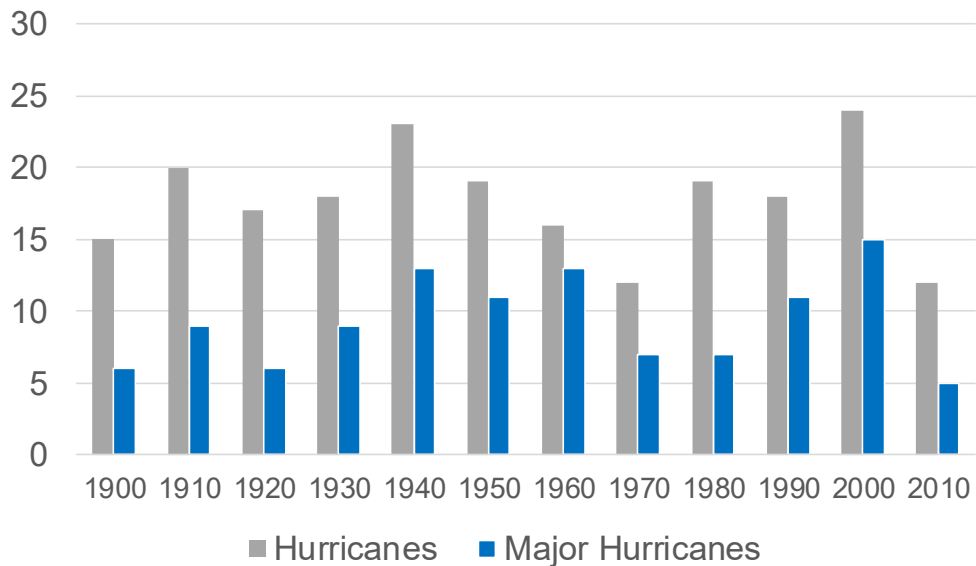
- Mapping the flow of exposure through the social/economic system allows for an evaluation of potential stakeholders to the risk
- For personal lines insurers risk, can exist in both the insurance and investment portfolios
- Reinsurance and catastrophe bond markets provide a mechanism for insurers to mitigate hazard risk
- Risk exposure flows to federal and state programs in both the insurance and financial system
- Regulatory responses to localized events can create additional risk if the economic costs of catastrophe exposure is suppressed

Weather has a significant impact on a personal lines insurer's business...

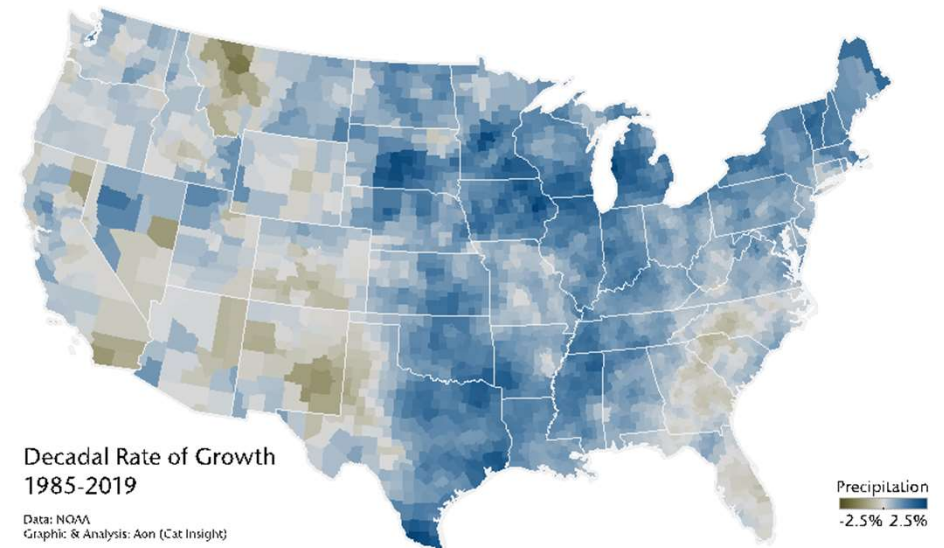


...so long term weather data must be monitored for inflection points in trends...

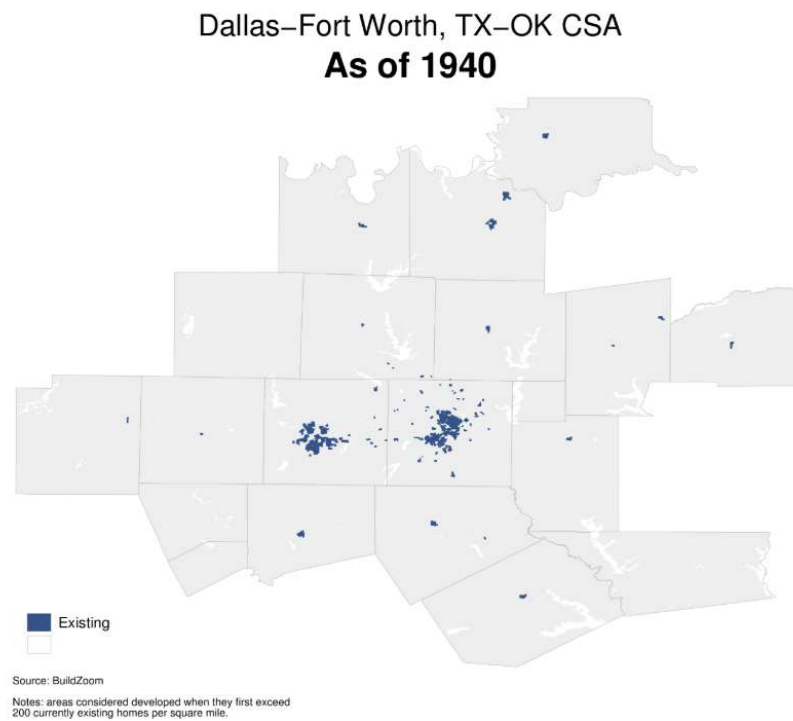
Number of US Hurricane Landfalls by Decade



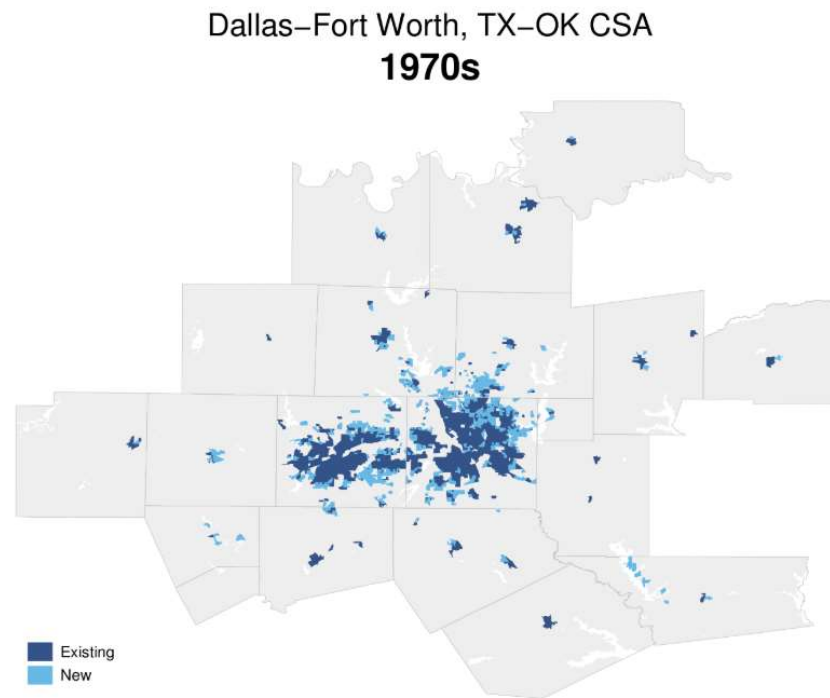
Changes in US Precipitation 1985 - Current



...and exposure adjustments to historical losses is an important consideration



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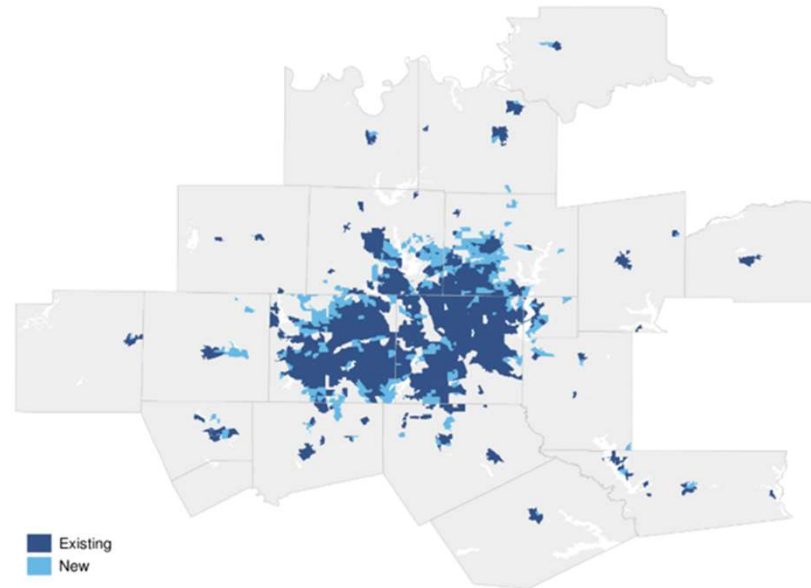


Source: BuildZoom
Notes: areas considered developed when they first exceed 200 currently existing homes per square mile.



...and exposure adjustments to historical losses is an important consideration

Dallas–Fort Worth, TX–OK CSA
2000s

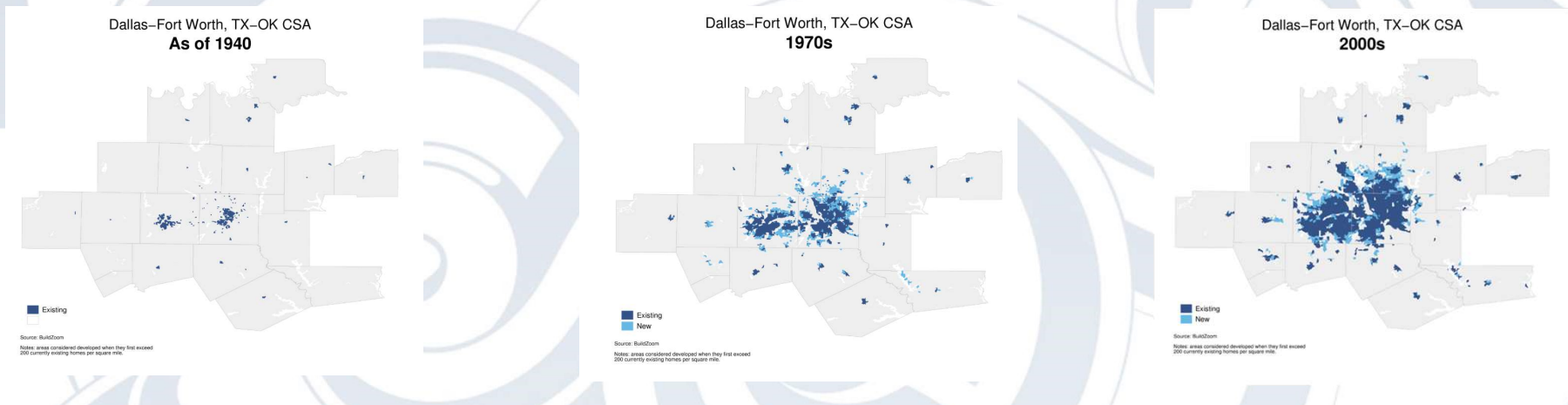


Source: BuildZoom

Notes: areas considered developed when they first exceed 200 currently existing homes per square mile.



...and exposure adjustments to historical losses is an important consideration



- Median US home size increased 55% from 1975 to 2018
- Housing units in Dallas increased over 230% over same time period
- Impact = The same tornado path or hail storm could have ~4X increase in exposure to loss today vs. 40+ years ago

Catastrophe models and reinsurance can be useful to quantify short term costs for ratemaking

- Personal lines property coverage is usually provided in 12 month contracts that can be re-priced annually at each renewal
- Catastrophe models are useful in converting historical weather patterns and long term historical trends into estimates of current exposure
- Reinsurance and catastrophe bonds can be utilized to mitigate volatility and convert exposure to catastrophe risk into a transparent cost that can be used in rate filings



Changes in stakeholder activities around climate change and sustainability risk will likely emerge faster than climate trends

The trend towards Environmental, Social, and Governance based investing (ESG) is growing

- The International Capital Markets Association has issued guidelines to create classifications for Green, Social, and Sustainability Bonds
- ESG based investment funds and bond issuance is growing, \$570B ESG themed bonds issued in 2019, and ESG based AUM rising to \$12T
- Large institutional investors have been making climate risk a top priority, and if current pressures continue to build, companies may see their cost of capital impacted

The aging infrastructure and electrical grid of many regions, leave areas less resilient to severe weather events

- Investments in municipal bonds as well as commercial real estate must consider local, long term resilience including sustainability of market values and tax bases
- Resiliency in residential properties can be enhanced through improved building codes, the development of impact resistant shingles, as well as the increased use of fire resistant materials in new construction



Questions and Discussion

