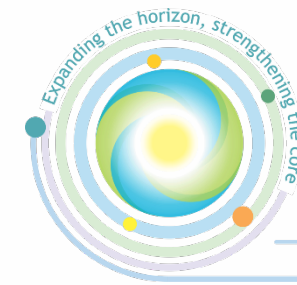




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4<sup>th</sup> - 6<sup>th</sup> March, 2019 | Mumbai, India

## Risks from Climate Change and their impact on work of Insurance Practitioners

### Speaker(s)

Alasdair Smith, R&E Board, IFOA

Marjan Qazvini, Climate Change Guide Working Party- Life, IFOA

Shradha Shroff, Climate Change Guide Working Party- GI, IFOA

Ravi Lal



**Institute  
and Faculty  
of Actuaries**

Session #  
Dated

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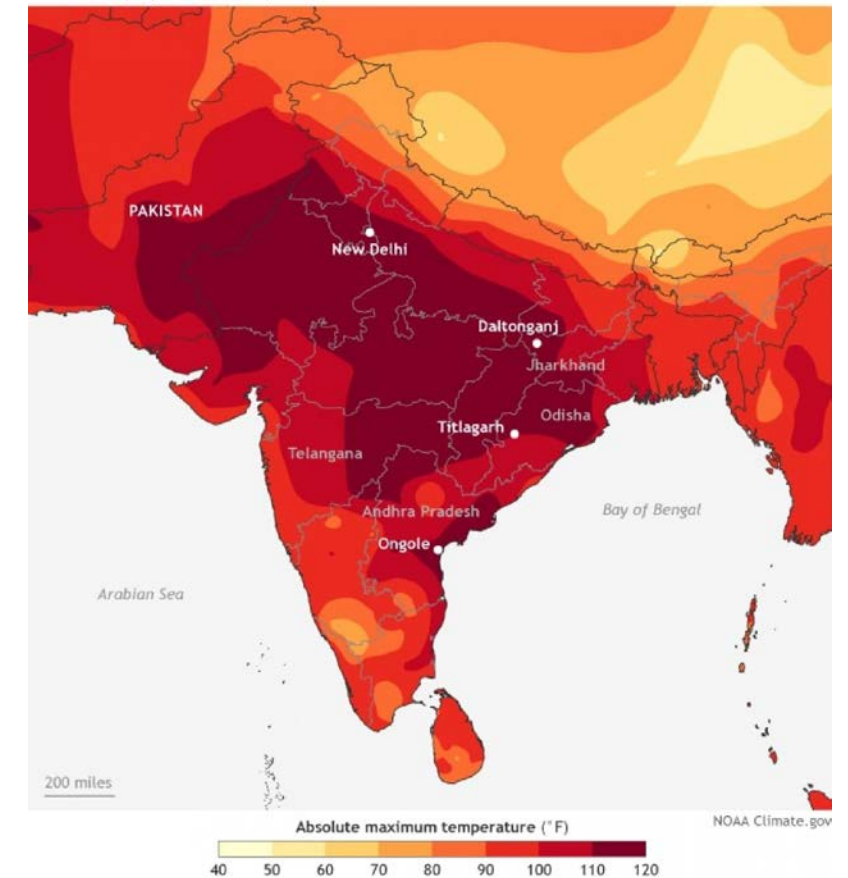
# Is Climate Change really happening? Does it pose any threat?

The scientific evidence is clear and unequivocal that the climate is changing and that the change is man-made, IPCC 2014

Scientists are as certain about the link between human behavior and climate change as they are about the link between smoking and lung cancer.

2019 Edition of Global Risks Report , World Economic Forum ranks Environmental threats at the top of the list for 3<sup>rd</sup> year in a row.

Heat wave (May 24-30, 2015)



# Overview of Climate Change- Initiatives

## Paris Agreement

- Agreement dealing with greenhouse-gas-emissions mitigation and adaptation, starting in the year 2020
- Long-term goal to keep the increase in global average temperature to well below 2 °C above pre-industrial levels; and to limit the increase to 1.5 °C

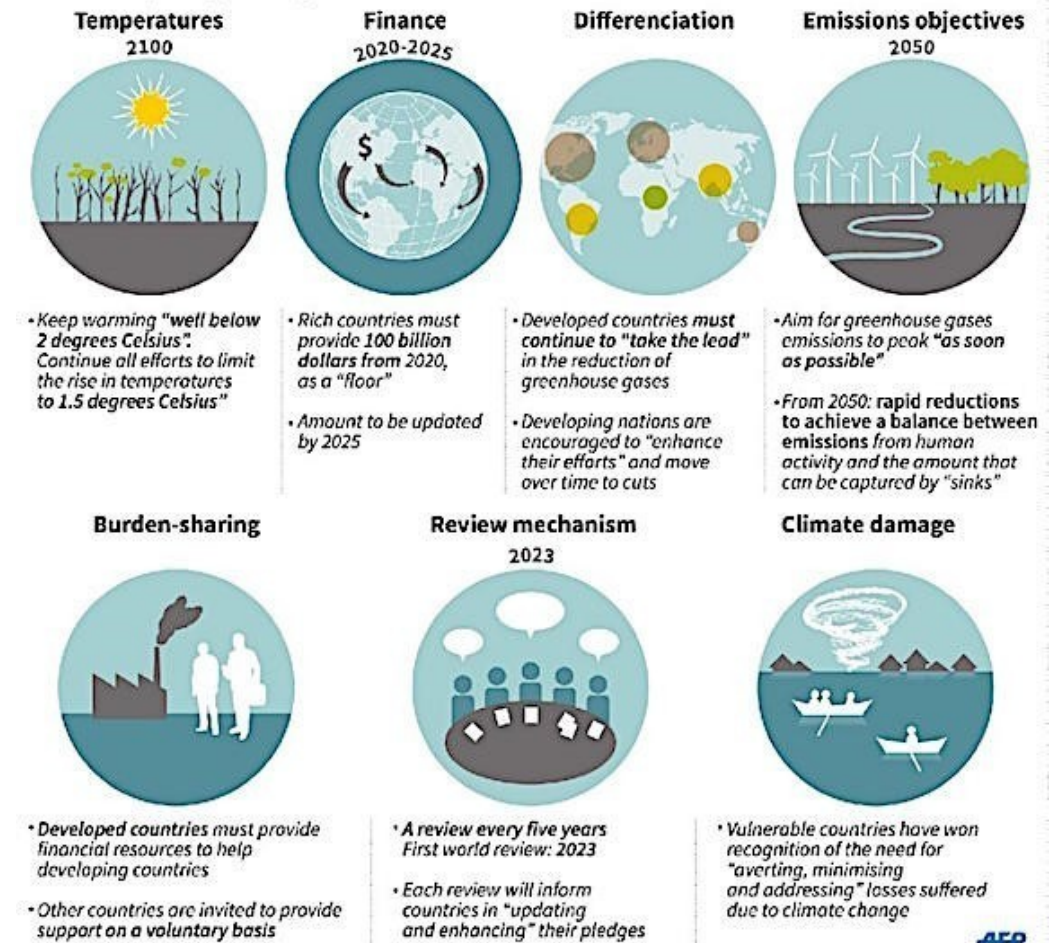
## Task Force on Climate Related Disclosures (TCFD)

- Recommendations around four thematic areas that represent core elements of how organizations operate:
- Governance
- Strategy
- Risk management
- Metrics and targets



## The Paris climate agreement: key points

The historic pact, approved by 195 countries, will take effect from 2020



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# *What are Climate Risks?*

# What are climate risks?

Mark Carney, Governor of Bank of England, broke climate risk into three areas:

- Physical Risk
- Transition Risk
- Liability Risk

Peruvian farmer sues German energy firm RWE

Court: Netherlands endangering citizens with emissions

Exxon Mobil sued for 'climate deceit' in US

MILLENNIUM POST | New Delhi | Friday, 6 October, 2017 mp nation | 5

## Extreme rainfall events over central India have tripled since 1950: study

OUR CORRESPONDENT

**NEW DELHI:** Extreme rainfall events have tripled since 1950 in central India and killed over 69,000 people across India while leaving 17 million homeless, says a study by weather scientists.

The paper, by scientists in India, US and France, has been published by Nature Communications journal in its October issue.

The states that witnessed the worst incidents of extreme rainfall events include Gujarat, Maharashtra, Madhya Pradesh, Chhattisgarh and Telangana as well as parts of the Western Ghats -- Goa, north Karnataka and south Kerala.

"There have been 268 reported flooding events in India over 1950-2015 affecting about 825 million people, leaving 17 million homeless and killing 69,000 people (according to the International Disaster Data Base)," the study said.

According to lead author Roxy Mathew Koll, a scientist with the Indian Institute of Tropical Meteorology, a premium research body under the Ministry of Earth Science (MoES), extreme rainfall is defined as more than 15 cm of rain in a day and 'spread over a large region, enough to cause floods'.



Sorbonne University, Paris, are co-authors of the paper.

Rajeevan attributed global warming and its impact as a major reason for the erratic and extreme weather pattern over the region.

"As the atmosphere and the oceans are getting warmer due to increasing carbon dioxide, a result of human activities, atmosphere holds more moisture. This results in two factors. The first is that warm moist air is lighter than cold dry air and hence makes the atmosphere unstable as it rises up," Koll explained.

TIMES CITY

THE TIMES OF INDIA, KOCHI | SATURDAY, SEPTEMBER 20, 2014

## El Nino imbalance affecting monsoon

Sudha Nambodi @timesgroup.com

**Kochi:** If you have been wondering why the south west monsoon is changing its pattern each year, then blame it on the changing temperatures in the western Indian Ocean. A promise of heavy rain for a few days suddenly changing track and moving away has now become a recurrent occurrence.

While countries across the world have been looking for reasons that contribute to global warming, a new study published in the American meteorological society (AMS) last week said that the warming of the Indian Ocean has contributed much to the increase in sea surface temperature (SST) across the world.

The southwest monsoon reaches the country from a western Indian Ocean direction and hence any changes in the ocean-atmosphere temperature will surely affect monsoon pattern here.

"It is known that the Indian



**WARMER OF CHANGE:** Changing temperatures in the western Indian Ocean has affected the monsoon pattern, says the study.

Ocean warm pool (which includes central-east Indian Ocean) witnessed an increase of 0.7 degree Celsius from 1901-2012, while the western Indian Ocean has experienced a warming of 1.2 degrees. This has the potential to change the Asian monsoon circulation and rainfall as well as alter the marine food web in this biologically productive region," said Roxy Mathew

larger picture that the western tropical Indian Ocean has been warming for more than a century at a rate faster than any other region of the tropical ocean and it is the largest contributor to the overall trend in the global mean sea surface temperature (SST).

He said that the data proved these regions have been experiencing mini El Ninos over the recent years. Normally, El Nino and La Nina are alternative cycles in the atmosphere with El Nino leading to warming and La Nina cooling the temperature. "But in this region, there is an imbalance and La Nina effect has been less when compared to El Nino occurrences. This leads to increase in temperature in ocean," he added.

"We have used observations and coupled global ocean-atmosphere model simulations to get the evidence that besides direct contribution from greenhouse warming, the long-term warming trend is highly dependent on El Nino," he said.



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# Physical Risk

*“The first-order risks which arise from weather-related events, such as floods and storms. They comprise impacts directly resulting from such events, such as damage to property, and also those that may arise indirectly through subsequent events, such as disruption of global supply chains or resource scarcity.”*

*- Prudential Regulation Authority, UK, 2015*

Examples:

**Droughts and Wildfires:** increase in the duration and intensity of droughts leading to increased crop damage, water scarcity (and social unrest), and wildfires.

**Heatwaves:** An increase in the frequency and severity of heatwaves causing damage to infrastructure and the associated business interruption.

**Heavy rainfall and flooding:** In a warmer world the atmosphere will hold more moisture, which will lead to an increase in the frequency of extreme precipitation events and associated flooding, causing damage to property and crops.



# Transition Risk

*“The financial risks which could arise for insurance firms from the transition to a lower-carbon economy. For insurance firms, this risk factor is mainly about the potential re-pricing of carbon-intensive financial assets, and the speed at which any such re-pricing might occur. To a lesser extent, insurers may also need to adapt to potential impacts on the liability side resulting from reductions in insurance premiums in carbon-intensive sectors.”*

*- Prudential Regulation Authority, UK, 2015*

Examples:

- Loss of market value and/or investment income within investment portfolios, where investments are exposed to the risk of stranded assets
- Changes in motor liability risks posed by a move away from fossil fuels
- Increased product liability as a result of technological changes supporting the transition to support lower-carbon economy e.g. overheating of energy storage batteries causing explosions.

*Transitioning to a lower-carbon economy is likely to entail extensive policy, legal, technology, and market changes. - TCFD recommendations*





# Liability Risk

*“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. Where such claims are successful, those parties against whom the claims are made may seek to pass on some or all of the cost to insurance firms under third-party liability contracts such as professional indemnity or directors’ and officers’ insurance.”*  
- Prudential Regulation Authority, UK, 2015

Examples:

The PRA identify the following reasons for such litigation:

- **Failure to mitigate:** Insured parties being held responsible for the physical impacts of climate change, such as through emissions of greenhouse gases.
- **Failure to adapt:** Insured parties have not sufficiently accounted for climate change risk factors in their acts, omissions or decision-making.
- **Failure to disclose or comply:** Insured parties (or insurers themselves) have not sufficiently disclosed information relevant to climate change, have done so in a manner that is misleading, or have otherwise not complied with climate change-related legislation or regulation.

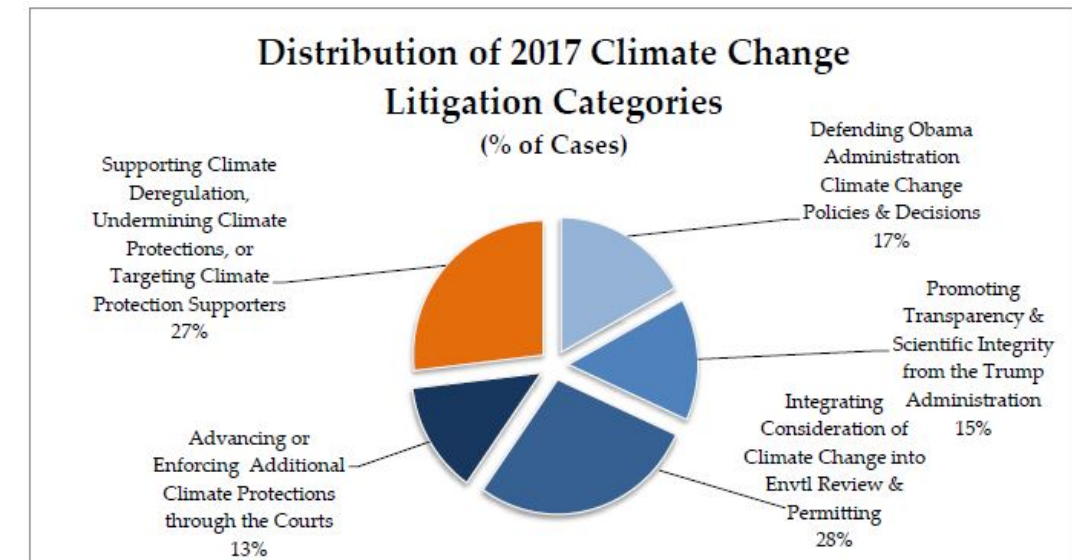


Figure 1: Cases were assigned to a single category. Blue indicates “pro” cases in favor of climate-related protections and orange indicates “con” cases opposing climate-related protections. See Part 4 for further description of the cases assigned to each category.



---

# *What is the relevance to General Insurance?*

# Pricing and Underwriting Examples

## Challenges

Insurers will need to understand the allowance for climate change within their models.

There may be relatively little historic data to base projections, or to discern a trend.

It may be necessary to look at alternative sources of data.

Pricing is only one lever to manage the climate risks coming onto an insurer's books.

## Examples

Catastrophe models may make some allowance for climate change, but insurers may want to recalibrate them to their own experience.

There may be relatively little history of climate related litigation and its outcomes. However, there is an increasing trend in cases being brought before the courts.

Sensitivities to climate change on "Weather Index Insurance" were highlighted by Daron & Stainforth, 2014.

As sea levels rise, some coastal areas may become uninsurable. Withdrawing cover from such areas will pose wider social and reputational issues

## Options

Consider the range of climate change risks and the degree to which they are considered within the calibration of those models.

Consider the range of possible outcomes and make suitable allowances.

Consider multiple sources of climate information, and acknowledgement their associated biases and errors.

Underwriting rules may need to be adapted for climate change.



# Reserving Examples

## Challenges

Most reserving techniques place some reliance on past experience.

Can we identify the climate-related drivers that might affect claims frequency or severity?

For emerging technologies, how can changes in the distribution of risk be anticipated in the reserving processes?

To what extent might the emergence of climate change impacts be spread over time and subject to greater uncertainty?

How might failure to mitigate, failure to adapt and failure to disclose impact on claims costs?

## Examples

Climate change may alter the mix and development of claims.

Will the incidence and extent of flooding events increase with changed weather patterns?

Will electric cars be slower and safer with more safety features, or silent and more dangerous with more risk of battery fires?

How might investors' propensity to sue under Directors & Officers policies change over time?

## Options

Consider whether climate uncertainties would affect future claims costs.

Practitioners are encouraged to present their impact analysis in the form of potential scenarios, from which deterministic "Actuarial Best Estimates" may be selected.

E.g. This Is Your Report Count Triangle

	12	24	36	48	60	72	84	96	108	120
2000	98	32	1	0	0	0	0	0	0	0
2001	93	30	1	0	0	0	0	0	0	0
2002	94	32	2	0	0	0	0	0	0	0
2003	92	36	1	0	0	0	0	0	0	0
2004	81	30	0	0	0	0	0	0	0	0
2005	69	18	2	0	0	0	0	0	0	0
2006	93	29	0	0	0	0	0	0	0	0
2007	77	39	2	0	0	0	0	0	0	0
2008	100	23	0	0	0	0	0	0	0	0
2009	97	0	0	0	0	0	0	0	0	0



# Across both Pricing and Reserving, could consider....

## Physical Risk:

- will the incidence and extent of flooding events increase with changed weather patterns?
- are there any leading indicators, based on physical rather than claims data, that could provide more insights?
- what changes in response to climate-change, such as changes in agriculture practices and investment in physical resilience, might impact future claims costs?

## Transition Risk:

- will existing carbon-based industries receive lower investment and move to higher risk practices?
- for new and emergent technologies, how can changes in the distribution of risk be anticipated?

## Liability Risk:

- are these policies on a claims made or losses occurring basis, the latter being more exposed to latent claims?
- are there existing court cases that could indicate likely future trends?
- applying the three broad headings of "Failure to mitigate", "Failure to adapt" and "Failure to disclose", what claims might arise against these business classes?



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# Reinsurance Examples

## Challenges

Demand for reinsurance may increase.

Future climate impacts may be non-linear and increasingly correlated, which will make assessments of reinsurance requirements a more complicated task.

Reinsurance cover may become less accessible as reinsurers review their underwriting practices.

## Examples

Increases in frequency and severity of catastrophic events could increase demand for higher vertical limits and more reinstatements.

## Options

There may be opportunities for reinsurers to expand their operations by introducing new products or expanding existing ones.



# Investment Examples

## Challenges

Individual investments may each be exposed to varying amounts of climate change vulnerability.

Analysis of climate risk vulnerabilities may lead to changes in demand (and market value) of individual investments.



## Examples

Citigroup estimate that, even if the rise in global temperatures is to be constrained to two degrees above pre-industrial levels, the total value of stranded assets could be over \$US100 trillion based on 2015 market prices.

As “Environmental, Social and Governance” (ESG) investment strategies become more widespread, investors in may disinvest from securities issued by carbon-intensive companies.

## Options

Practitioners could:

- Set out formally their approach to climate change-related risks within the investment policy ,
- Arranging for a “carbon audit” of your investment portfolio to determine ,
- Discuss with investment managers the steps they are taking to deal with climate change.

There may also be investment opportunities arising, for example, for investment in new technologies such as “green energy” , new infrastructure or electric cars.



# Risk and Capital Management

## Challenges

Climate risk is likely to be a material emerging risk to many general insurers.

Stress testing and scenario analysis can help identify climate change impacts.

Disclosures in annual reporting may need to describe climate change as an emerging risk.

Climate change may feature as a concern within the risk appetite of the insurer or its stakeholders and investors.

Within capital models, the uncertainty around the modelled risk types may change.

## Examples

TCFD make specific recommendations about the use of scenario analyses to support strategic decisions.

ClientEarth recently made complaints to the FCA about a lack of disclosure by some insurers.

Regulators may require capital allocation choices more aligned with future needs of a low carbon economy.

## Options

Assess the specific climate related issues each for short, medium and long-term horizon and their impact on capital.

Consider climate change scenarios within stress and scenario plans.

Consider making TCFD compliant disclosures.

Consider climate change within risk appetite discussions.



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# *What is the relevance to Life Insurance?*

# Climate Change and Life Actuaries: Who?

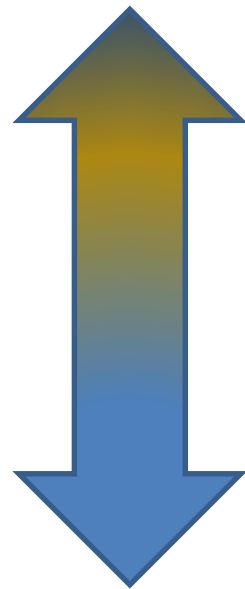
Impact Area	Actuarial Impacts / Areas of Work
Changes to investment performance from <ul style="list-style-type: none"> <li>• direct climate impacts on specific assets,</li> <li>• regulation or restrictions leading to 'stranded assets',</li> <li>• investment opportunities in capital intensive climate change mitigation or transitions</li> </ul>	Investment advice Asset liability matching Product design e.g. investment fund choices and disclosure
Changes and uncertainty around mortality and morbidity	Product design Product pricing Reserving Capital Management
Changes to regulation	Risk governance Risk reporting Corporate level disclosures Customer / distributor disclosures
Overall uncertainty around timing, magnitude and response to climate change	Risk governance Strategic planning



We can think about financial effects by product type and the type of modelling we do...

Longer Duration/ higher investment component

Shorter Duration/ lower investment component



Traditional Savings  
Annuity Products  
Unit Linked Savings  
Traditional Guaranteed Risk  
Reviewable Risk

Modelling is often based on or includes risk neutral financial models with stress test based risk assessment

# Risk management stages

The maturity of the risk management of Climate Change risks

General Awareness / Identification

Scenario Testing

Strategic / Business Planning

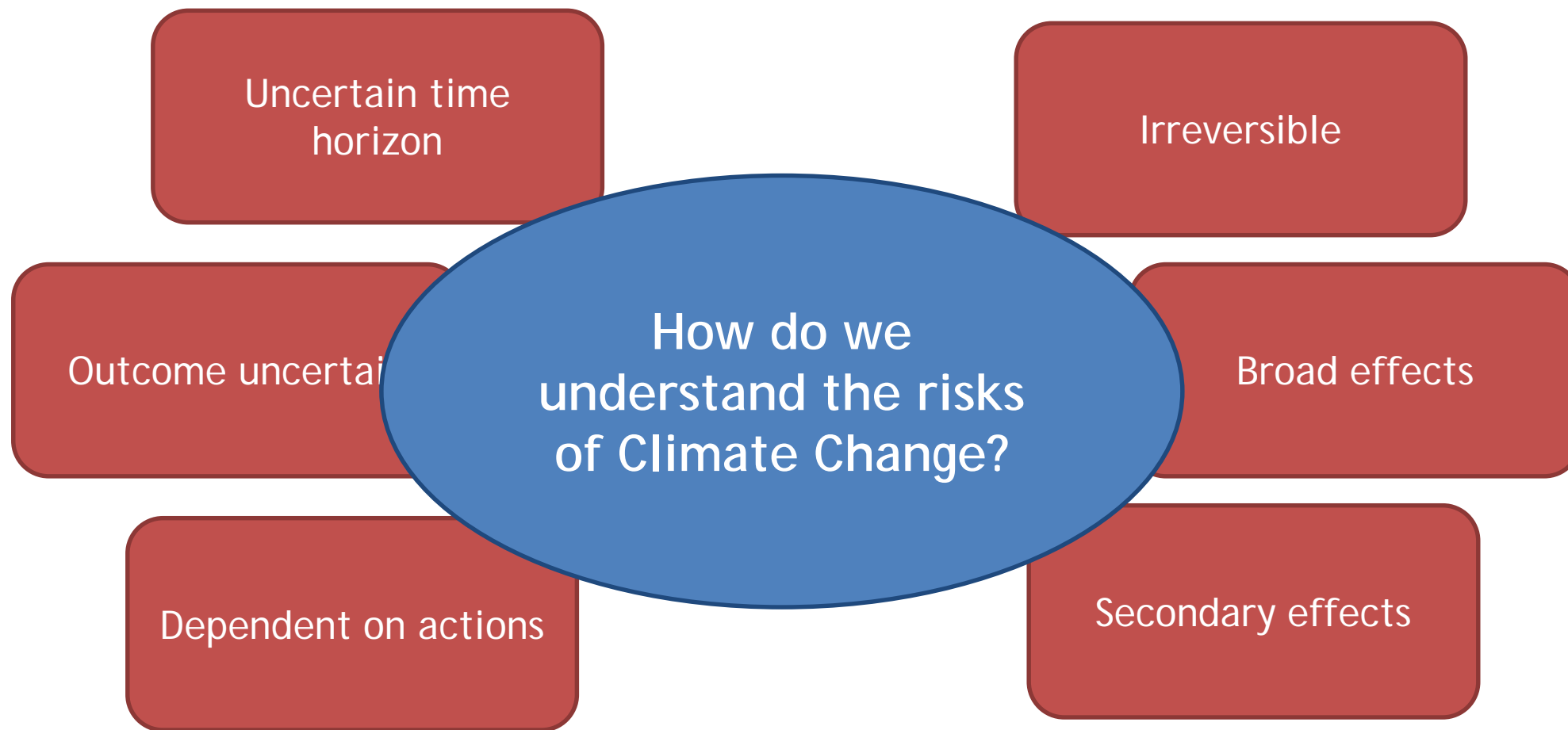
ORSA

Capital Models and Pricing

Modelling progression



# Risk identification and awareness



# Risk identification

Example: A simple risk framework to combine climate risk factors with common insurance framework risks

Risk grouping	Physical	Transition
Market		
Longevity		
Mortality / Morbidity		
Lapse		
Counterparty		
Operational		
Strategic		
Reputational		



# Risk identification

Example: Possible risks arising in our framework

Risk grouping	Physical	Transition
Market		
Longevity		
Mortality / Morbidity		
Lapse		
Counterparty		
Operational		
Strategic		
Reputational		



# Scenario analysis

What are the key components (and considerations) of scenario planning?

Multiple scenarios

Physical and Transition

Time horizons

Shocks and Trends

Internal and External  
sources

Management Actions

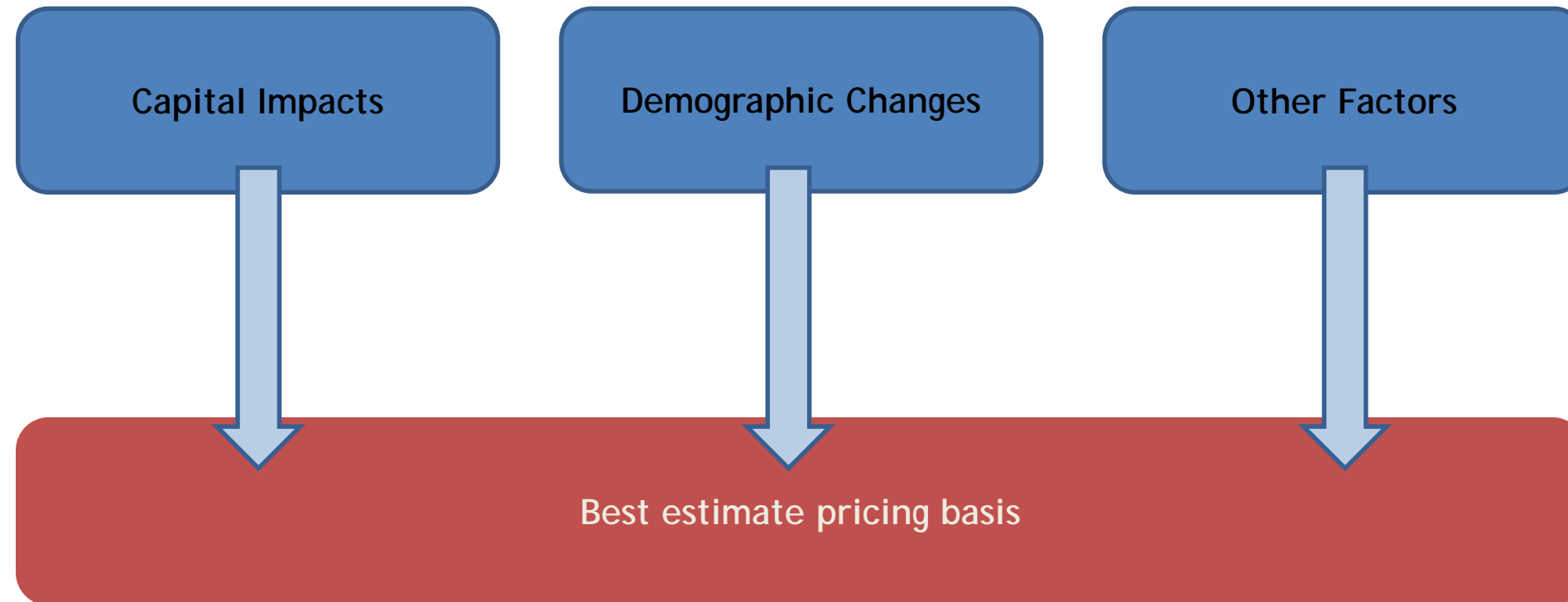
Limitations

Links to risk factors

Narratives not numbers



# Capital, Demographics, and Pricing



# Opportunities

Investment strategy and  
capital projects

New products and  
“Green Finance”

Corporate Social  
Responsibility



# Next Steps

Re-read the IFoA risk alert

<https://www.actuaries.org.uk/news-and-insights/media-centre/media-releases-and-statements/ifo-warns-climate-change-financial-risks>

Read the "Practical Guide to Climate Change for General Insurance Practitioners" out soon!

Read the "Climate Change: A Practical Guide for Life Insurance Actuaries" out soon!

Join the Resource and Environment Practice Area LinkedIn Group

<https://www.linkedin.com/groups/13593694>

Volunteer to be part of the R&E Member Interest Group

<https://www.actuaries.org.uk/practice-areas/resource-and-environment/current-resource-and-environment-member-interest-group-mig>

Chat with members of the working party

*GI: Mark Rothwell (Chair), Martin Earle, Choong Hern Ooi, James Orr, Jianhua Siew, Shradha Shroff*

*Life: David Ford (Chair), Yvonne McLintock, Kyle Audley, Kurt Yuan, Bradley Ashton, Marjan Qazvini*

Apply your new-found knowledge



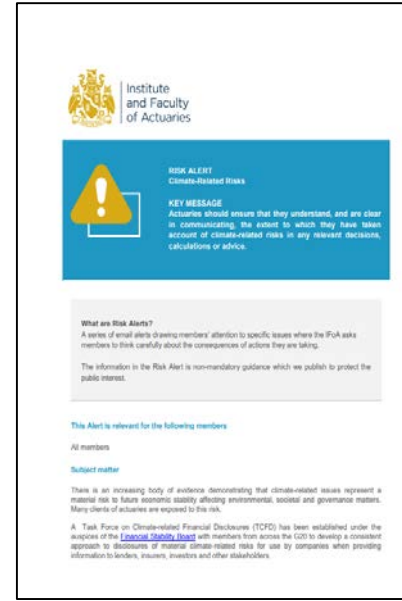
# Further reading



FCA



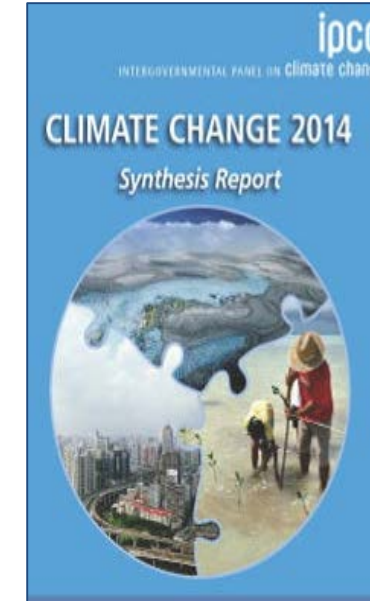
PRA



IFoA



TCFD

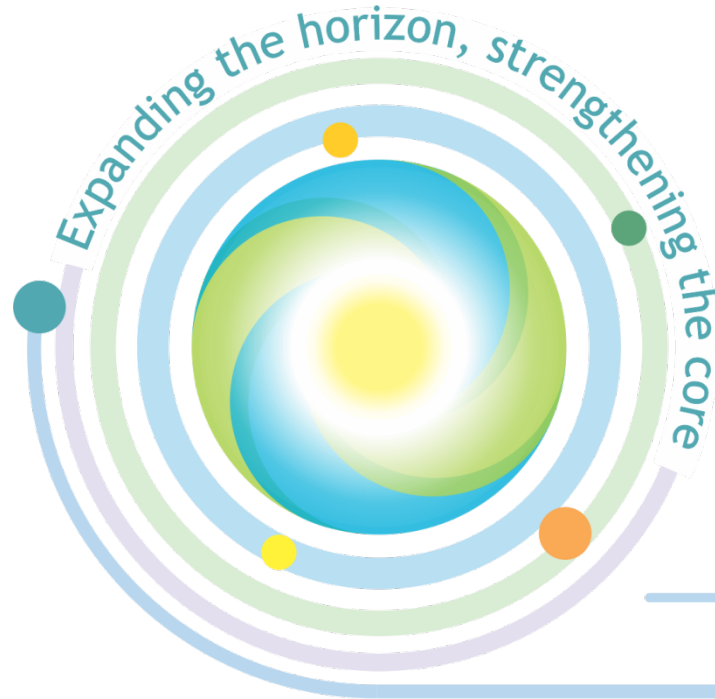


IPCC





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THANK YOU

Date or any extra text highlight