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Risk Management, Economic Sustainability and Actuarial Science Development in Indonesia

Actuarial Science and Climate Risks in Indonesia

9th May 2017

Yves Guérard, FSA, FICA, HFIA, PhD(hc)

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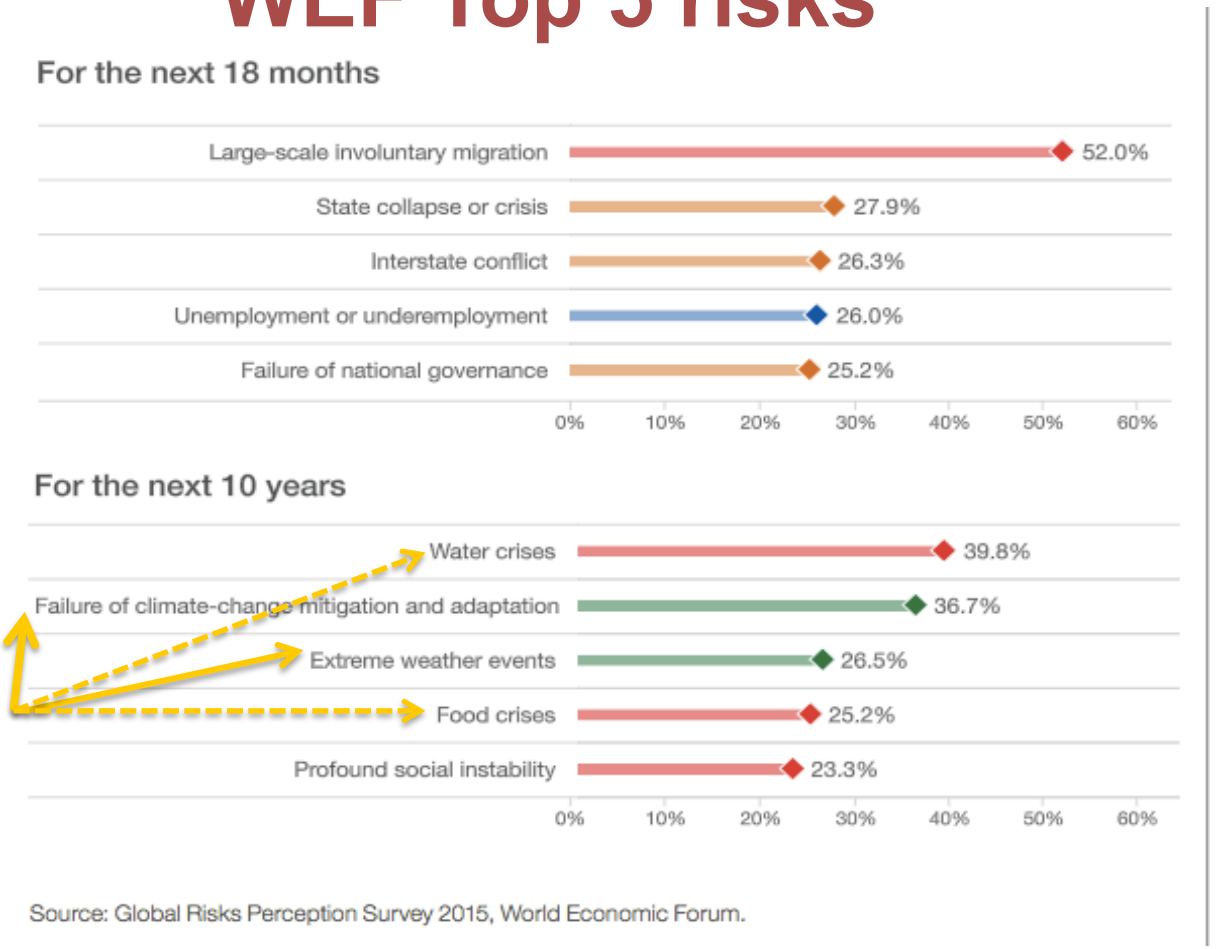
WEF Top 5 risks



Source: Global Risks Perception Survey 2015, World Economic Forum.

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AGENDA

1 The IPCC, a key source

2 Direct physical impacts

3 Migrating to a low carbon economy

4 The actuarial profession

5 Looking ahead, Moving forward

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Two strategic challenges

» **Keep the global warming below 2° Celsius**

- The NDCs are <u>not</u> legally enforceable but reporting is mandatory: enforcement is thus through more transparent reporting mobilizing peer pressure within the civil society
- Underlying objective is to divert investments towards an orderly migration to a low carbon economy
- Immediate impacts on values and returns of fossil fuel related assets

» **Adapt/mitigate the physical consequences of actual global warming**

- Already up by 1,1° Celsius but perceived impact still low and falsely presumed to be long term only, thus a low priority leading to inertia and higher risks

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1 - The Intergouvernemental Panel on Climate Change (IPCC)

Comprehensive source of information on climate risks

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AGENDA

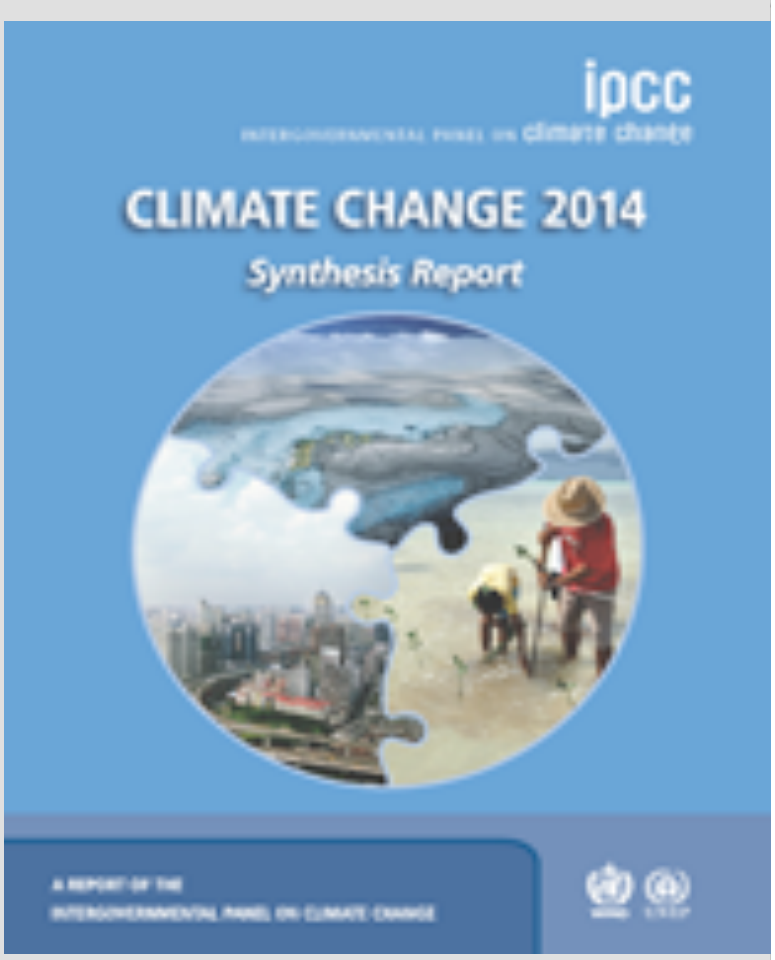
The 5th Assessment report (AR5) produced by hundreds of scientists comprises a

- **Synthesis report**

and 3 Working Group reports:

- **The Physical science basis**
- **Impact, adaptation and vulnerability**
- **Mitigation of climate change**

https://www.ipcc.ch/



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Critics and Skeptics

- Not everybody agrees with all IPCC conclusions, some believe IPCC scientists are too optimistic, others reject them as overly negative
- Dissent by some on the
  - reality of climate change or is it a hoax?
  - contribution of human activity VS natural causes
  - harm done by more or less than 2°C increase
  - gravity and timing of the risks
  - balancing of growth and sustainability
- Vested interests and conflicts of interests are at play as it was for smoking and lead in fuels in prior decades

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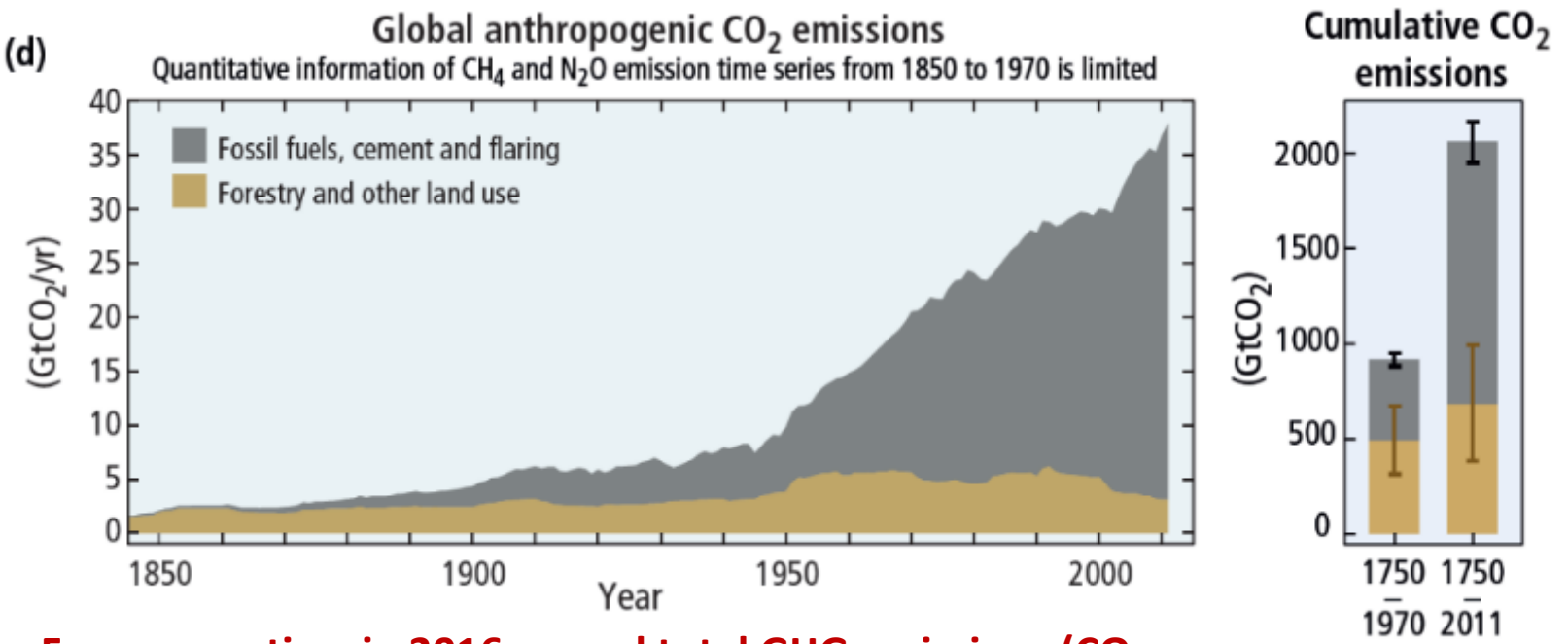
What is causing global warming?



For perspective, in 2016 annual total GHG emissions (CO_2 equivalent) were about 54,3 Gt CO_2e versus 50 Gt CO_2e in 2010

Source: https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf

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International consensus

- United Nations Framewok Convention on Climate Change (UNFCCC) objective adopted by 192 parties in 1992 is to "stabilize" greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system"
- The IPCC Fifth Assessment Report included a global carbon budget
  - Given cumulative CO_2 emissions from anthropogenic sources from 1870 to 2011 were about 1,900 Gt CO_2 the remaining CO_2 budget for given probabilities of staying below the 2C relative to pre-industrial levels is:

Probability of staying below $2^{o}C$	Gt CO_2
66%	1,000
50%	1,100
33%	1,400

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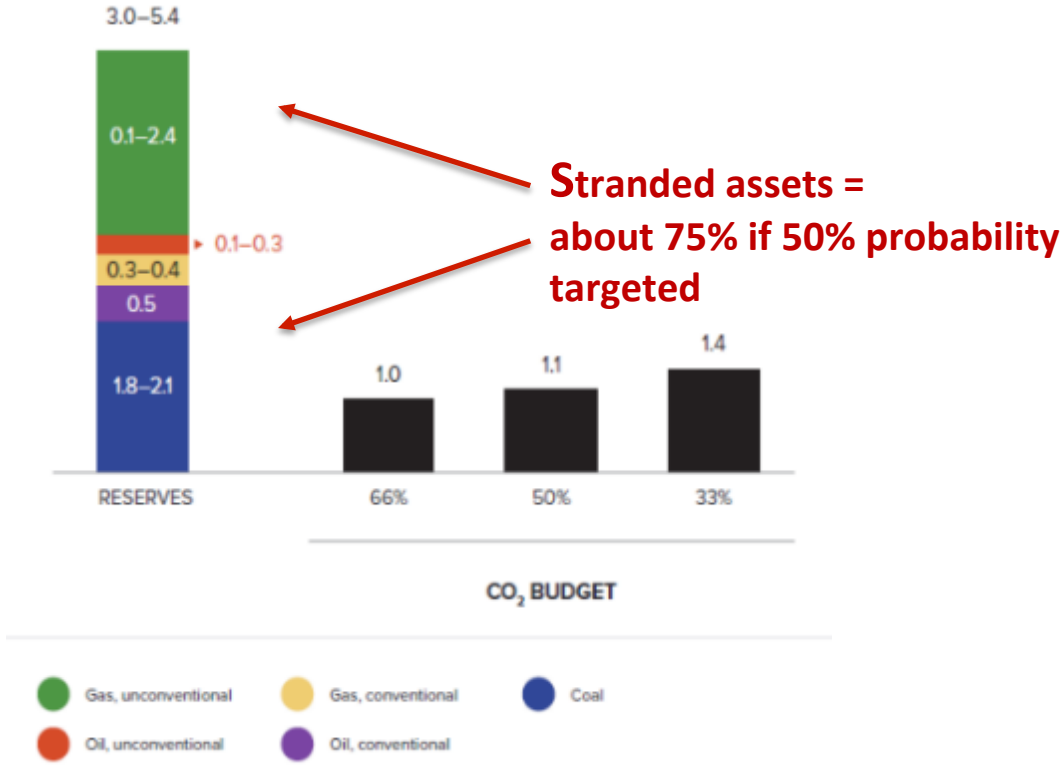
The Carbon Budget vs Fossil Fuel Reserves



Stranded assets = about 75% if 50% probability targeted

Source: http://newclimateeconomy.report/wp-content/uploads/2014/08/NCE_GlobalReport.pdf

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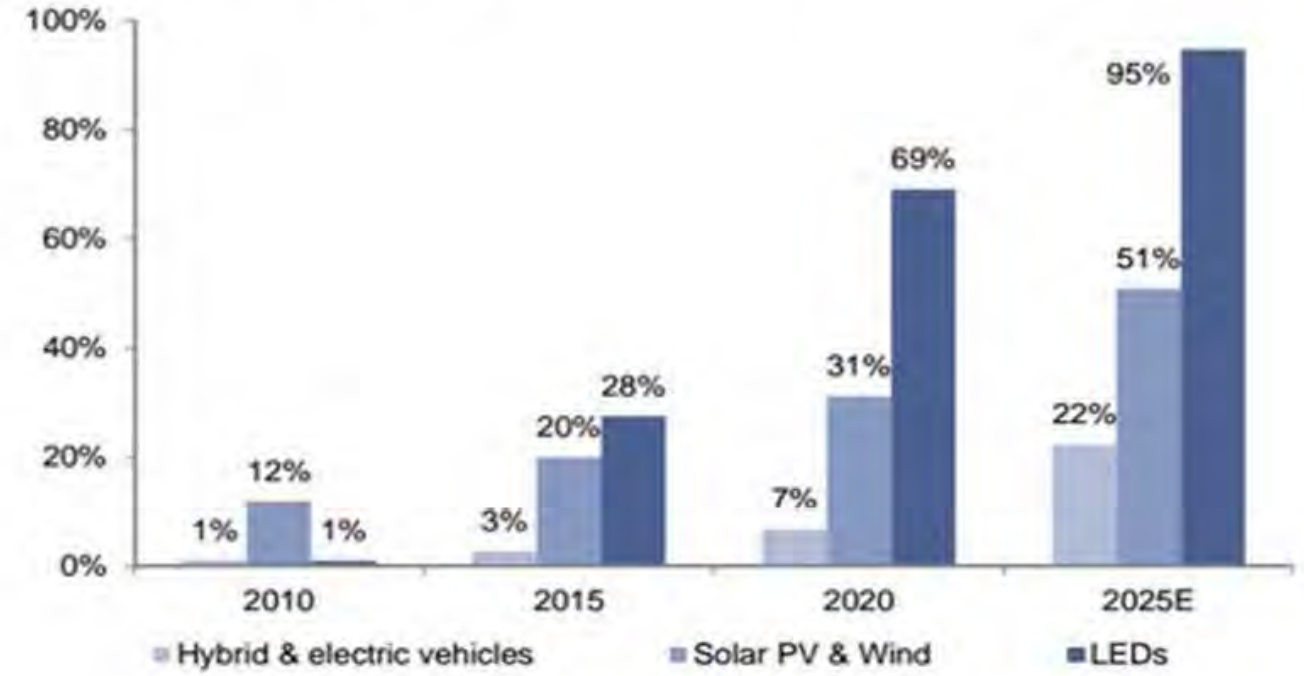
The growth of low carbon energy sources

Exhibit 9: Low carbon technologies are making rapid inroads across lighting, power, and autos…
Market shares of low carbon technologies in autos, power generation and lighting



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2 - Direct physical impacts

Speed at which warming occurs is a key issue

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Serving the public interest

» Recognizing their responsibility to promote the well being of the society as a whole, the four largest North American actuarial associations joined forces in 2008 to publish an Actuaries Climate Index (ACI) and an Actuaries Climate Risks Index (ACRI)

- In 2011, Solterra Solutions, a Canadian environmental consulting firm was commissioned to prepare an analysis of the impacts of climate change (published in November 2012)
- The ACI website has been launched on November 30th 2016 and the ACRI will be launched later in 2017
- Access to the website is free for all at **www.ActuariesClimateIndex.org**. A Guided tour Power Point is available to first time visitors

Canadian Institute of Actuaries / Institut canadien des actuaires

American Academy of Actuaries

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Society of Actuaries

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Actuaries Climate Index (ACI)
Actuaries Climate Risk Index (ACRI)

- ACI: impact of extreme climate events
- ACRI: impact on mortality and economic losses
- "Extreme" means with a frequency outside the 10th to 90th percentile interval for the 1961–1990 reference period
- The ACI combines six variables:
  - 1. High temperature
  - 2. Heavy rainfalls
  - 3. Violent winds
  - 4. Low temperature
  - 5. Long drought
  - 6. Sea level
- Demonstrates that climate change
  - Affects our daily lives in myriad ways
  - Means more the than global warming by 2° Celsius popular in the media
  - Is evolving in ways that might seem random in the short term
  - But cumulatively makes our planet more at risk

ACTUARIES CLIMATE INDEX
INDICE ACTUARIEL CLIMATIQUE

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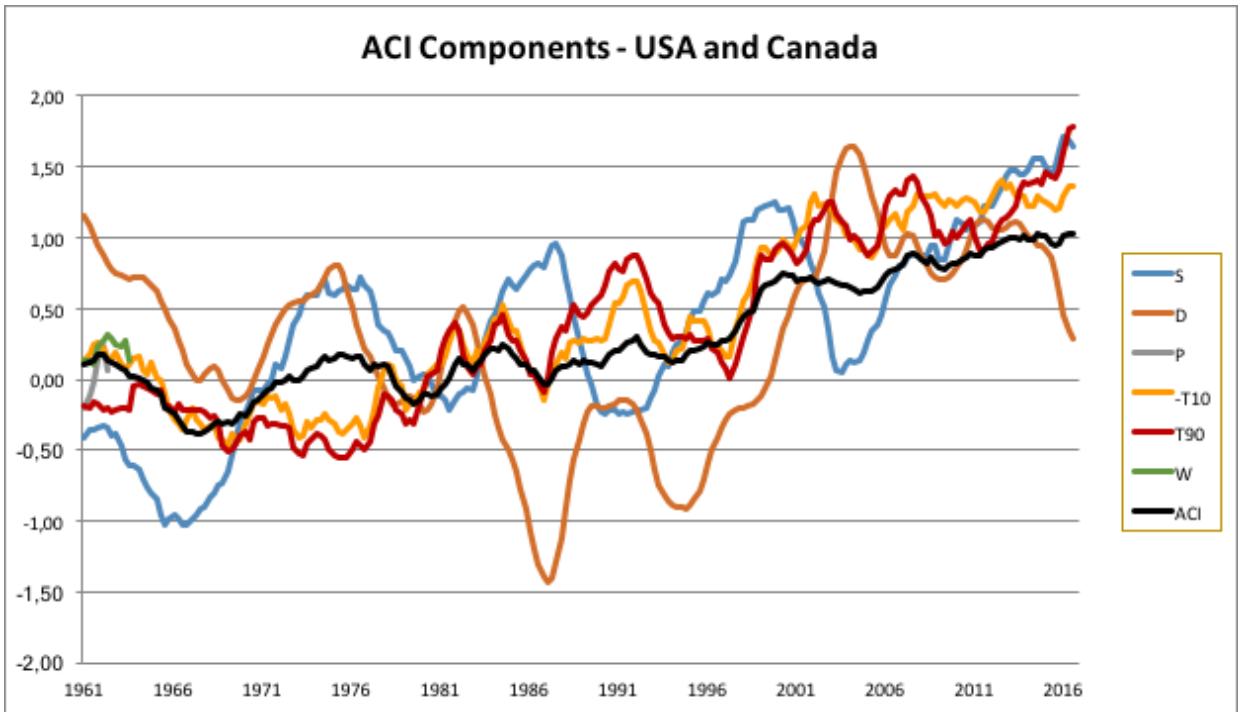
6 seasonal components & 5-year average ACI

(mean = zero; components' standard deviation = 1)



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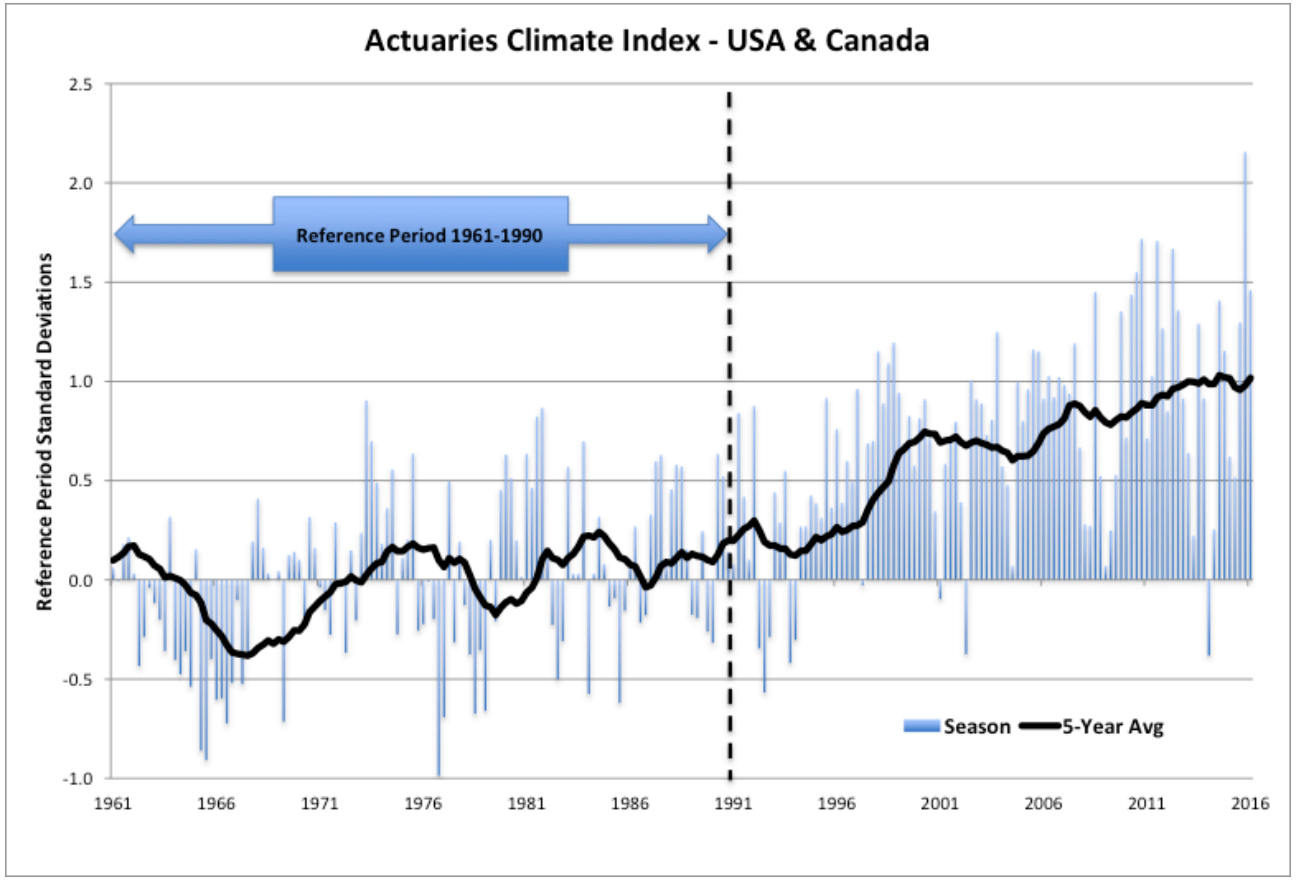
Actuarial Climate Index (ACI)
Actuarial Climate Risk Index (ACRI)



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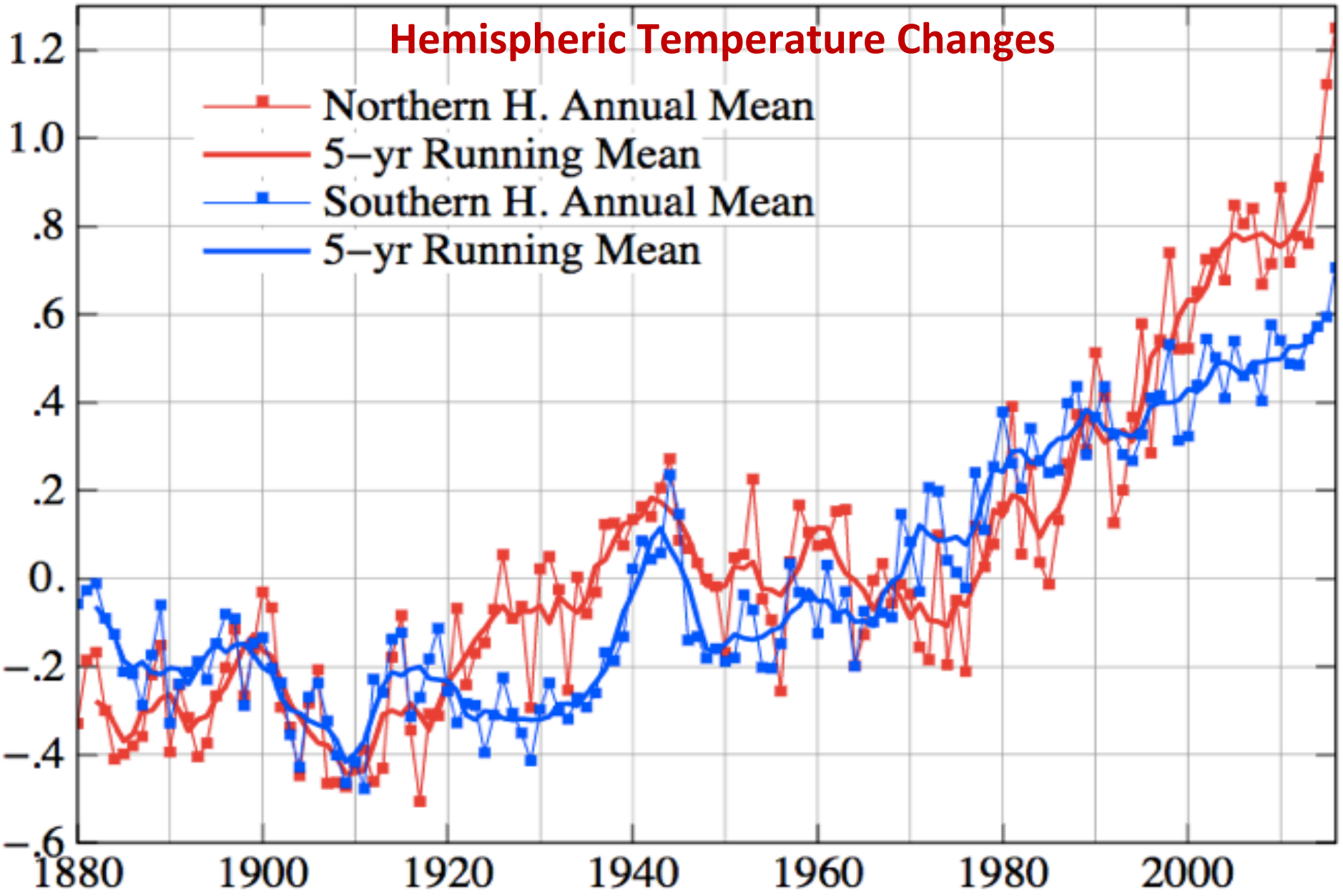
Hemispheric Temperature Changes



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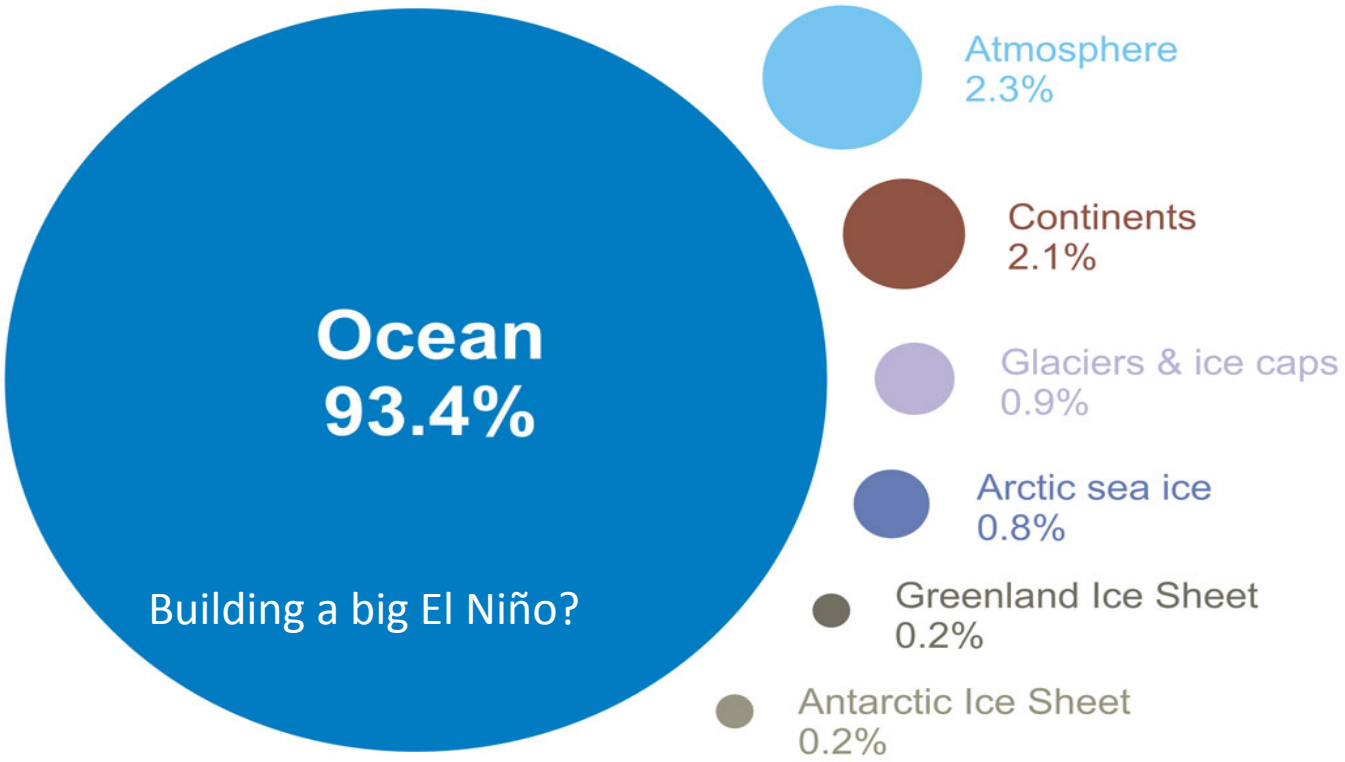
Where is global warming going?



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Catastrophic risk potential

- The Antarctic and Greenland ice sheets contain more than 99% of the freshwater ice on Earth
  - Antarctic Ice Sheet: 14 million km^2, sea level rise about 60 meters if totally melted
  - Greenland Ice Sheet: 1.7 million km^2, sea level rise about 6 meters if totally melted
- Ice sheets are slowly flowing downhill under their own weigh. To remain stable, an ice sheet must accumulate the same mass of snow as it loses to the sea.
- The catastrophic risk that a large chunk of ice breaks suddenly is not known but monitoring is in place

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Mortality and Health Risks

» Injures, disease and deaths due to more intense heat waves and fires	Very High Confidence
» Under-nutrition resulting from diminished food production	High Confidence
» Food and water-borne diseases	Very High Confidence
» Vector-borne diseases	Medium Confidence
» Modest improvements in cold-related mortality and morbidity in some areas	Low Confidence

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3 - impacts from human responses to global warming

Transition to a low carbon economy and regulatory initiatives

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Early warning from the Governor of Bank of England, Mark Carney

- Three broad channels through which climate change can affect financial stability[1, 2]:
  - **Physical risks** (e.g. extreme weather)
  - **Liability risks** (e.g. litigation, damages)
  - **Transition risks** (e.g. stranded assets)
- On Nov 9th 2015 the Financial Stability Board proposed to the G20 for the creation of an industry-led disclosure task force on climate-related risks[3].
- One objective is to overcome the short horizon problem in reporting

The impact of climate change on the UK insurance sector

A Climate Change Adaptation Report by the Prudential Regulation Authority

September 2015

[1] http://www.bankofengland.co.uk/publications/Pages/speeches/2015/844.aspx
[2] http://www.bankofengland.co.uk/pra/Documents/supervision/activities/pradefra0915.pdf
[3] http://www.financialstabilityboard.org/wp-content/uploads/20151106-Climate-change-Press-Release.pdf

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Financial assessment of climate risks

The Economist Intelligence Unit

"The asset management industry—and thus the wider community of investors of all sizes—is facing the prospect of significant losses from the effects of climate change."

- The Cost of Inaction: recognising the value at risk from climate change (The Economist Intelligence Unit, commissioned by Aviva)[1]

"Overall, we find that the incremental costs of action are limited (and indeed ultimately lead to savings), offer reasonable returns on investment, and should not have too detrimental an effect on global growth."

- Energy Darwinism: Why a Low Carbon Future Doesn't Have to Cost the Earth (Citi Group)[2]

citi

AXA

"A 2°C World Might Be Insurable, A 4°C World Certainly Would Not Be"

- Axa CEO, Henri de Castries[3]

1. https://www.eiuperspectives.economist.com/sites/default/files/The%20cost%20of%20inaction.pdf (July 2015)
2. https://www.citivelocity.com/citigps/ReportSeries.action?recordId=41 (Aug 2015)
3. https://group.axa.com/en/newsroom/news/about-whether-about-when (May 2015)

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TCFD created at the request of G20 to mobilize market forces

The Financial Stability Board (FSB) established the Task Force on Climate-related Financial Disclosures (TCFD) on December 4, 2015 to develop recommendations for more efficient and effective climate-related disclosures that:

- could "**promote more informed investment, credit, and insurance underwriting decisions**" and,
- in turn, "would enable stakeholders to **understand better** the concentrations of **carbon-related assets in the financial sector** and the financial system's **exposures to climate-related risks**."

Report published 14th December 2016

Actuarial inputs Frebuary 2017

Final Report June 2017

Going to G'20 summit July 7th & 8th 2017

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Financial Stability Board TCFD Extract from Recommendations

- **Financial institutions – including pension plans and asset managers**
  - should be able to describe the main climate-related risks and opportunities they face,
  - including scenario planning for limiting global temperature rise to 2 degrees Celsius, and
  - publishing their carbon footprint amid the transition to a low-carbon economy.

(As summarized by BMO Global Assets Management)

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Focusing on 'orderly'

- The G20 and the Financial Stability Board are of the opinion that
  - "Warming of the planet caused by greenhouse gas emissions poses serious risks to the global economy and will have an impact across many economic sectors.
- The key hurdle is achieving the orderly transition to a low carbon economy that would deliver a prosperous future and a good standard of living but:
  - Without effective disclosure of these risks, the financial impacts of climate change may not be correctly priced.
  - As the costs eventually become clearer, the potential for rapid adjustments could have destabilizing effects on markets."

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Targets Banking and NBFI sectors

Industries		Governance		Strategy			Risk Management			Metrics and Targets		
		A	B	A	B	C	A	B	C	A	B	C
Financial	Banks			■			■			■		
	Insurance Companies				■	■	■	■		■		
	Asset Owners	Includes Pension Funds			■	■	■	■		■	■	
	Asset Managers				■		■	■		■	■	

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4 - The actuarial profession

A pool of uniquely qualified resources for climate financial risks reporting, management and control

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Actuaries: a global profession

- Role in coordinating institutional initiatives
  - At the local level
  - At the regional level
  - At the international level
- Role as individuals:
  - Normative: integrity, compliance
  - Dynamic: creativity, innovation
- Climate change: a global phenomenon with local impacts
  - Adaptation to increasing longevity was gradual but climate change is requiring a more rapid pace

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International Actuarial Association

- PAI is a full member of the International Actuarial Association (IAA), which brings together 69 local associations comprising 70,000 actuaries in 110 countries
  - The IAA is a supporting institution of the Principles for Sustainable Insurance of the UN Environment Program's Finance Initiative
- PAI is a voting member of the AAI, can participate in its activities at multiple levels: Council, Committees, Work Groups and International Congresses of Actuaries.
- The IAA publicly supported the work of the Conference of Parties (COP) 21 in Paris in 2015 and called for increased transparency in emissions disclosure to enable investors and society to better manage the risks caused by climate change
- Its Resources and Environment Work Group supports the Warsaw International Mechanism in the areas of actuarial expertise listed in Article 8(4) of the Paris Agreement

AAI IAA

PERSATUAN AKTUARIS INDONESIA
(THE SOCIETY OF ACTUARIES OF INDONESIA)

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Actuarial profession responsibility

- Make a critical analysis of available climate information
  - extract the relevant financial data from the extensive available scientific literature
  - work with climatologists and other professionals to serve the public interest by providing factual user-friendly information as to the financial impact of climate risks
  - develop financial risks management models adaptable to changing emerging trends
  - ensure actuaries have the appropriate data, tools, and methodologies at hand for providing high-quality professional services
- Respond to the need for efficient instruments to mitigate, transfer, and share climate risks, including insurance and other management tools, innovate in the development of new programs, markets, products, strategies
- Support disclosure of climate risks, explain the degree of uncertainty, in the short and long term and the need to plan over a longer horizon than quarters, even decades.

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Individual actuaries responsibility

- Make a critical review of available climate information (IPCC) and grasp the implications on actuarial methodologies and assumptions
- Remain responsible for protecting the sustainability of programs and products based on sound actuarial principles as well as the equity between end users and payers while taking account new risks arising from climate change, planet's limited resources, their pervasive impacts on pricing, liabilities and counterpart assets (valuation and returns) and the challenge of the transition to a low carbon economy
  - disclose in any reports or opinions whether or not they have (already) taken these risks into account, and to what degree
- Actuaries can focus on climate risks and for climate changes rely on conclusions generally accepted by the scientific community but
  - disclose any departure from that consensus that was deemed necessary
  - refrain from rendering professional services for which they are not adequately qualified as required by standards of practice

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A New Frontier for Actuaries

- As specialists in risk management and in the use of long-range models combining financial impact scenarios and probabilities, actuaries can help with pricing, asset valuation and assist as preparers for climate financial disclosure as required by the Financial Stability Board
  - discounting a stream of uncertain climate financial impacts over a long period is akin to valuing pension cash flows, a familiar actuarial tasks.
  - comparability needed to facilitate analysis by the FSB can be achieved, despite the variability of financing strategies of various entities, by using the model of AISB 19(PSAK 24) for pension expenses
- Actuaries can assess and compare costs of adaptation or mitigation options, design financial packages to fund these costs and maximize the value added of fact based policy decisions through predictive data analysis
- More importantly by promoting the awareness of climate risks and making information available to stakeholders in the civil society, actuaries can **increase the probability of success** in the implementation of the Paris Agreement

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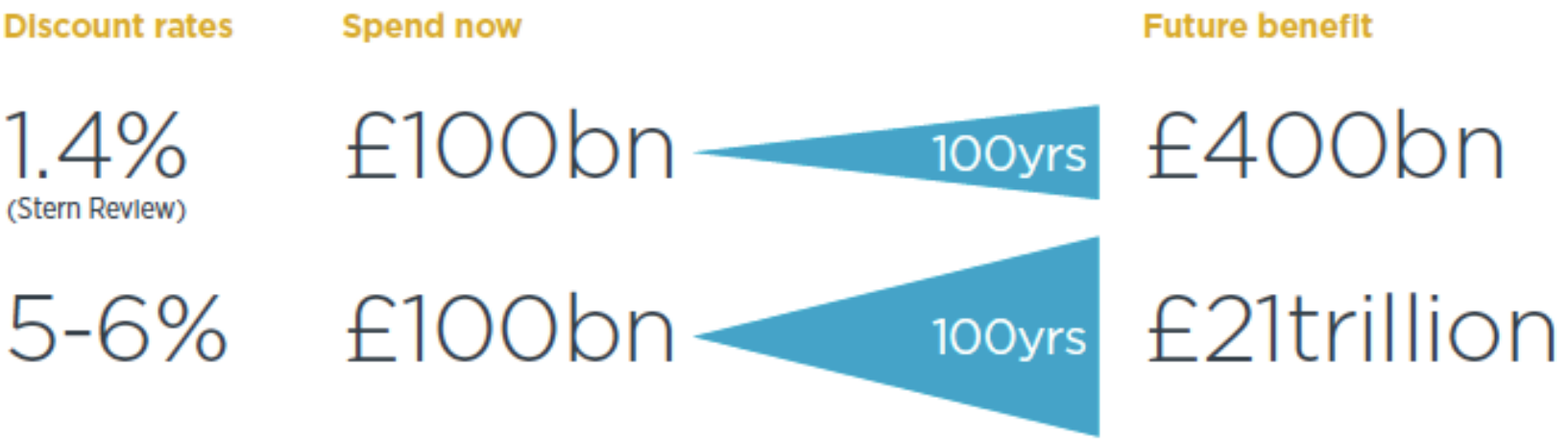
Sensitivity to discount rates



See IFoA:
Intergenerational Fairness Bulletin Issue 1, January 2017
Chapter 2. Climate change: The past, present and future

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The discount factor, an optimizing tool

- Actuaries can help optimize facts based decisions by providing credible financial comparisons over a long horizon
- Given the high uncertainty of long term climate risks and the practical impossibility of pricing survival, discounting is a tool to arbitrage between alternative tactical choices, not to justify « **go, no go** » strategic decisions
- But it can also inform discussions about intergenerational equity and equity between past and future emitters of GHG

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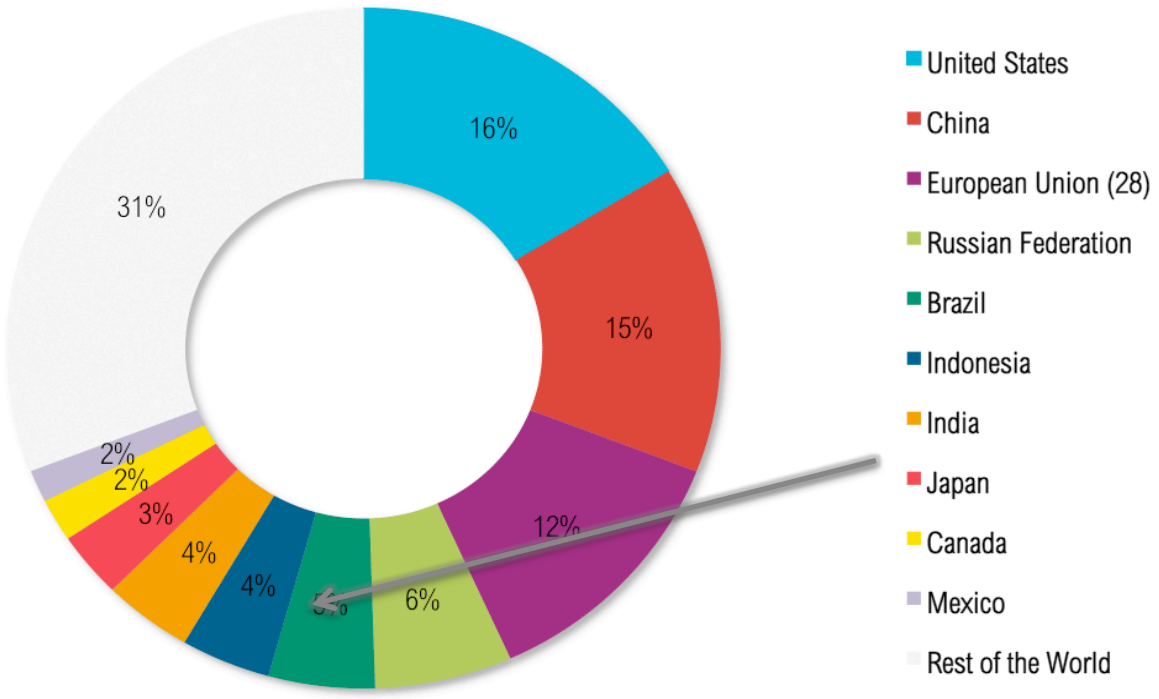
Cumulative GHG emission 1990-2011



http://bit.ly/11SMpjA

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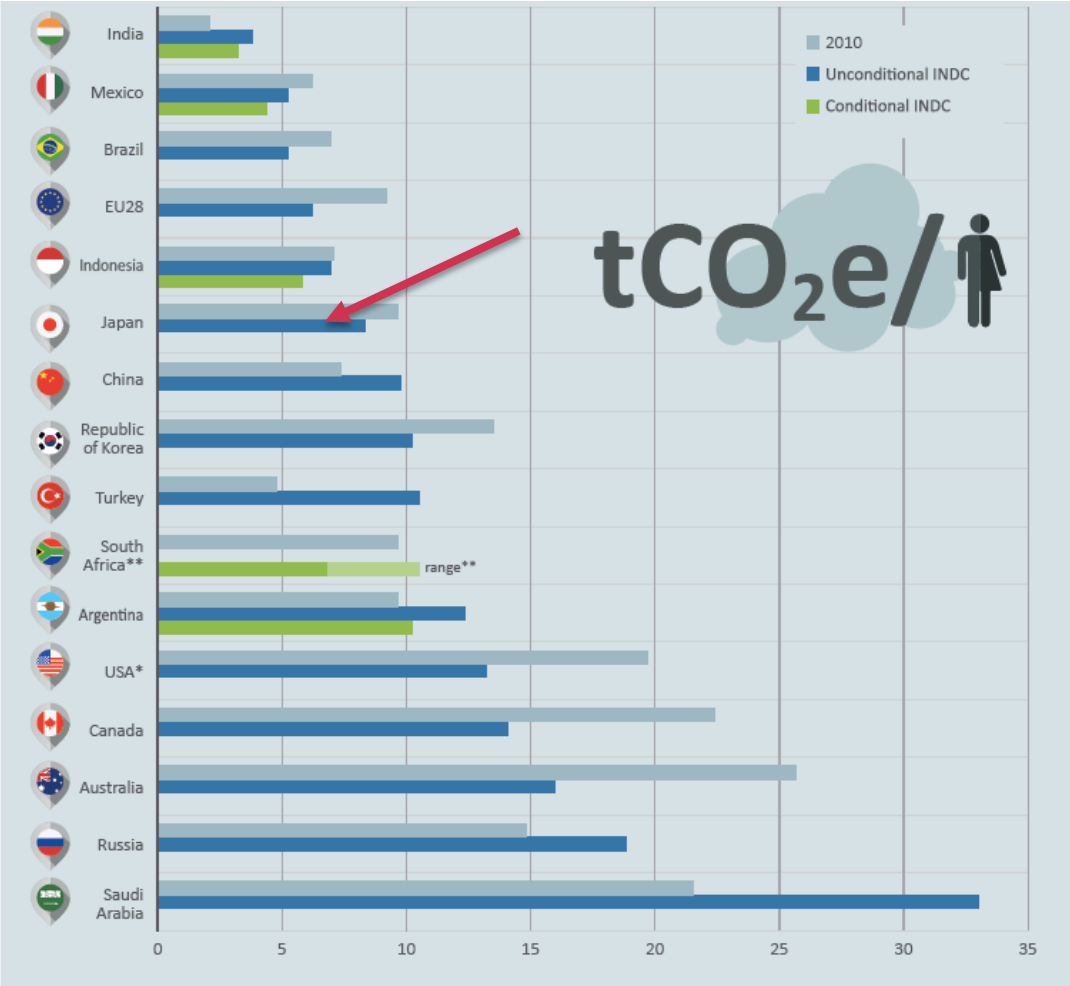
Emissions of G20 countries under NDC 2030



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5 - Looking ahead

Low probability of keeping warming below the COP 2009 international consensus of +2° Celsius

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What is the urgency?

- The **Holocene,** the long period during which agriculture and human societies began to flourish, began 10,000 years ago. During that period, the atmospheric CO_2 remained below 300 ppm.
- As the CO_2 now exceeds 400 ppm and is still rising, Nobel laureate Paul Crutzen suggested that we are entering a new geological epoch, the **Anthropocene**, dominated by the impact of human activity on ecosystems and biodiversity.
- Climatologists "*estimate"* we can survive +2^{o}C but going up quickly to +3^{o}C or +4^{o}C entails high risks and great uncertainty .
  - Our ecosystems cannot reach a new equilibrium quickly enough and we don't know if humans could adapt to it

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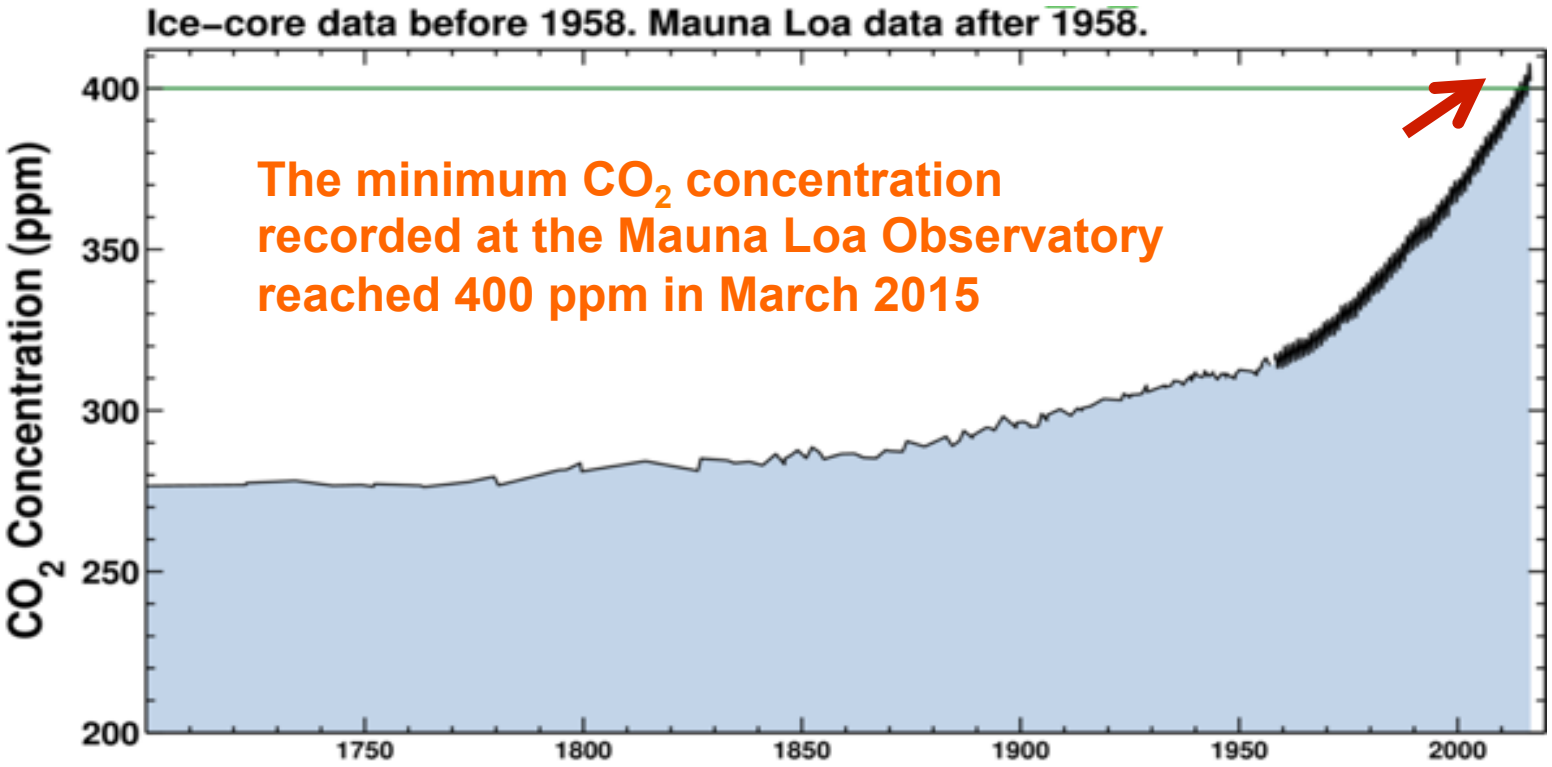
Last 300 years of CO_2 accumulation



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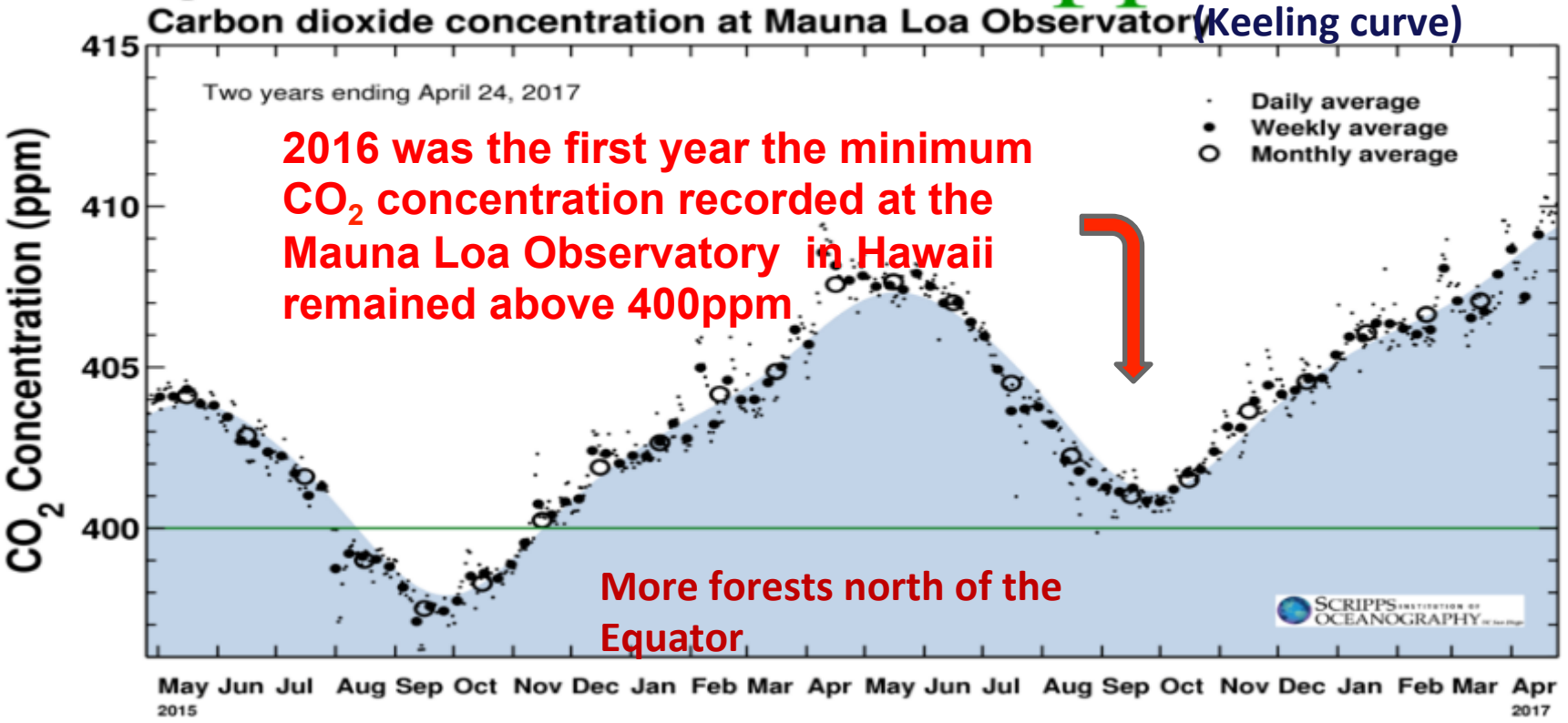
Latest CO_2 reading
April 24, 2017

410.07 ppm



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Moving forward

- Low likelihood of limiting global warming to 2ºC; higher risks associated with +3ºC or + 4ºC remain uncharted environments.
- Assuming money is deployed efficiently and a low carbon economy made **financially attractive**, research breakthroughs may allow humanity to thrive within a lower carbon budget and stabilize CO_2 at levels below 450 or at most 500 ppm
- To keep warming below 2ºC above historical levels, emissions need to reduce asymptotically for a soft landing at the level that can be naturally absorbed before CO_2 concentration reaches about ±475 ppm
- The gap being about 75ppm, zero net emissions should be achieved much closer to 2050 than to 2100.

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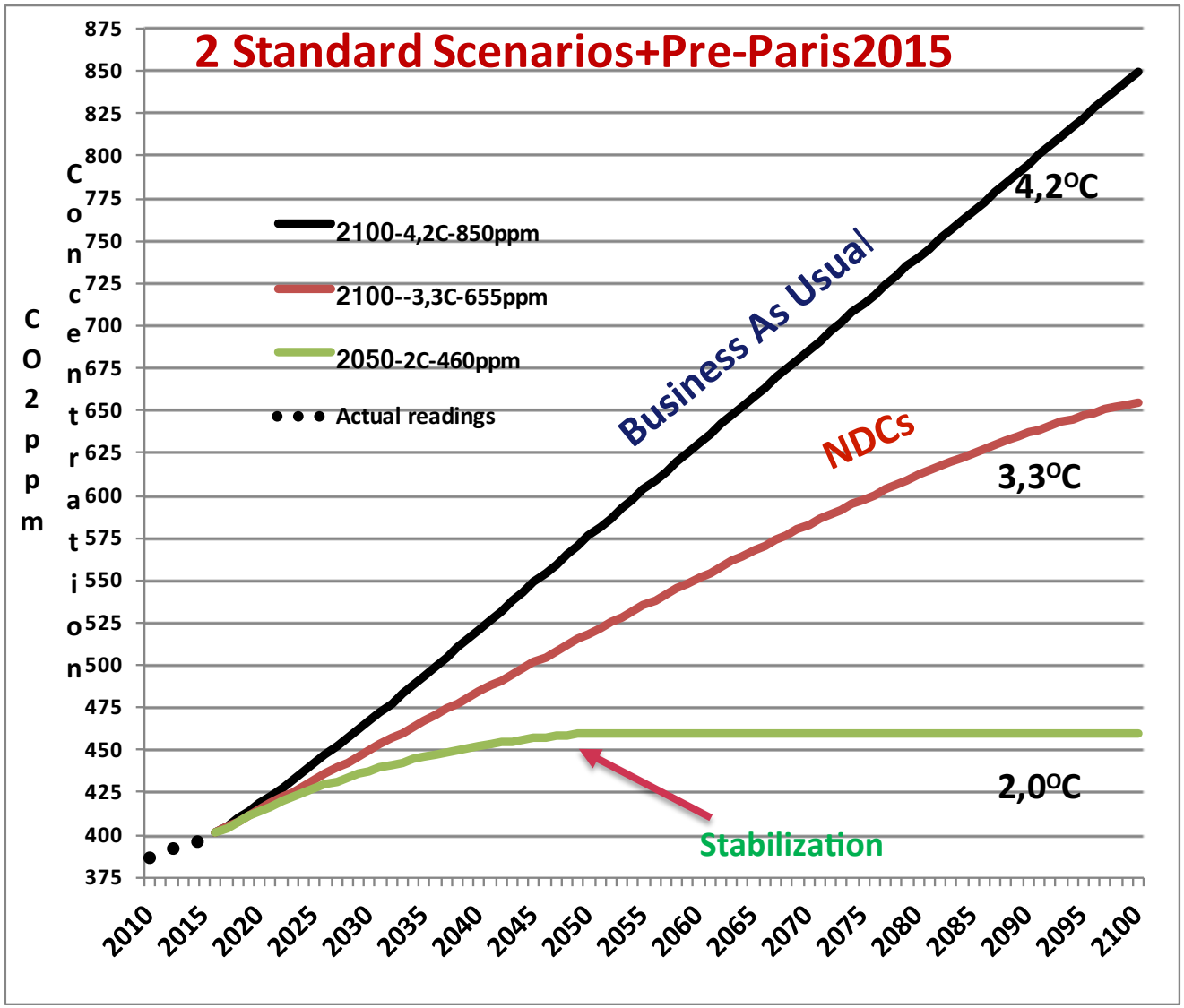

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Sustainability goes beyond Climate

- Climate change is only a component of the environment that our planet offers
- In 1970, the Club of Rome pointed out that limited planet resources cannot support unlimited exponential growth. Even renewable resources will be depleted if they cannot be renewed fast enough.
- Global warming is exacerbating the sustainability challenge as it may reduce agricultural production and will result in physical damage to infrastructures from extreme weather events, sea-level rise, etc.

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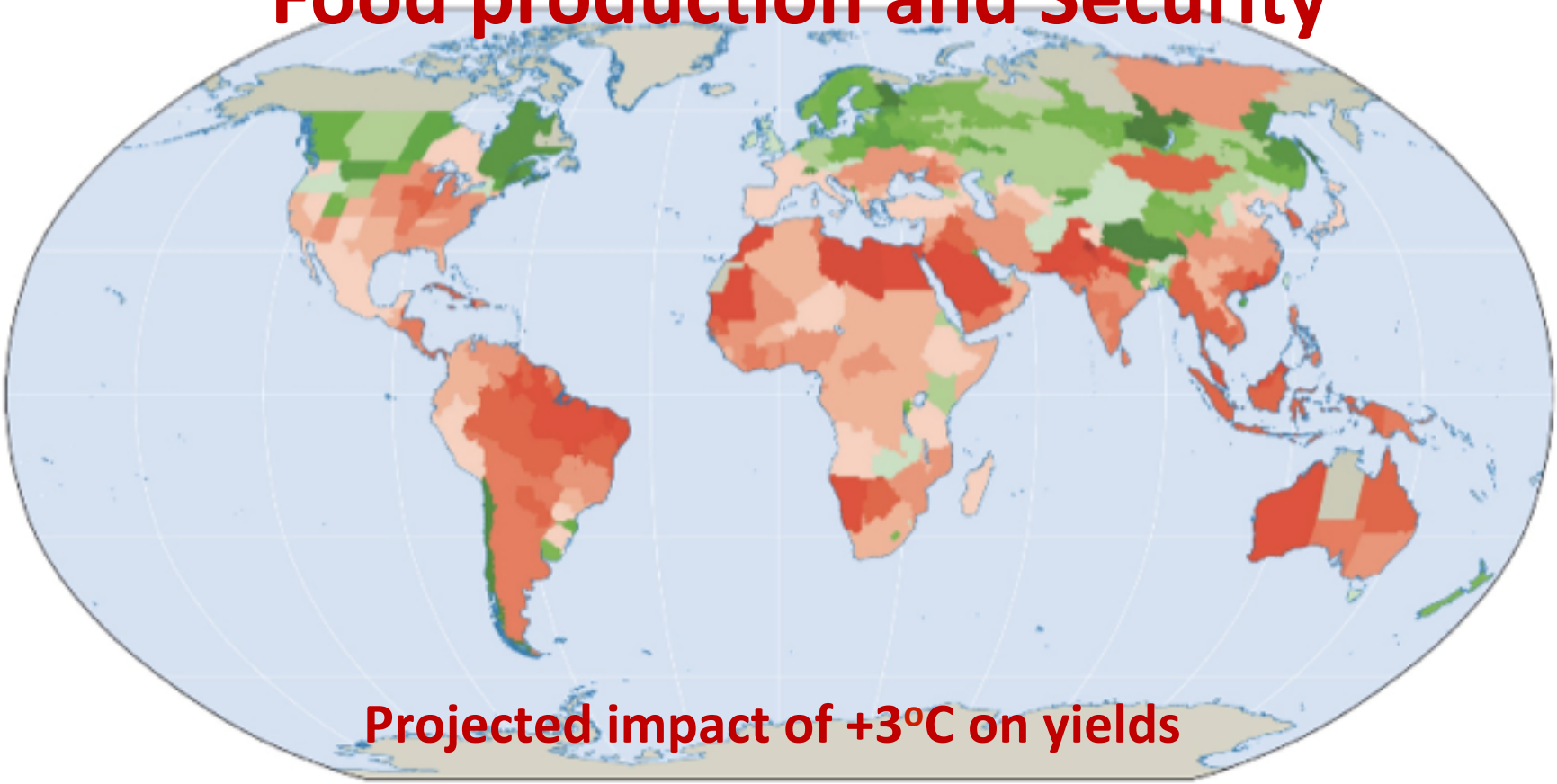
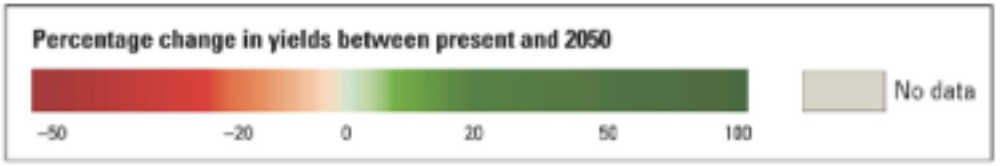
Food production and Security



Projected impact of +3°C on yields



Source: WRI 2013.

Indirect impact on Population

Note: −50% change = half as productive in 2050 as in 2015; +100% change = twice as productive in 2050 as in 2015.

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You, and all of us, can contribute

- The 8 billion population projected by 2030 is twice the 4 billion the earth had to feed as recently as 1974
- By some estimates, we are now using 50% more resources than the sustainable level. The pursuit of economic growth is compounding the growth in demand.
- Obtaining our calories from grass fed livestock meat generates more GHG and consumes up to 10 times the resources of a vegetarian source
  - Individuals and society must adapt to new constraints and serve the public interest by sharing in the GHG reduction required for the common good

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Looking forward

- The risk implications of climate change will continue to grow if current trends continue: actuaries are eager to work with other professionals to help controlling the challenge
- Entities that incorporate climate considerations into their strategic planning will have a competitive edge.
- They will also be better able to answer demands for climate disclosures and provide convincing information to regulators, shareholders, lenders and all stakeholders demonstrating that they are effectively and prudently managing risks.

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