International Actuarial Association
Association Actuarielle Internationale

IAA Webinar

The Climate Change Adaptation Gap: An Actuarial Perspective

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Introduction and Overview

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Links

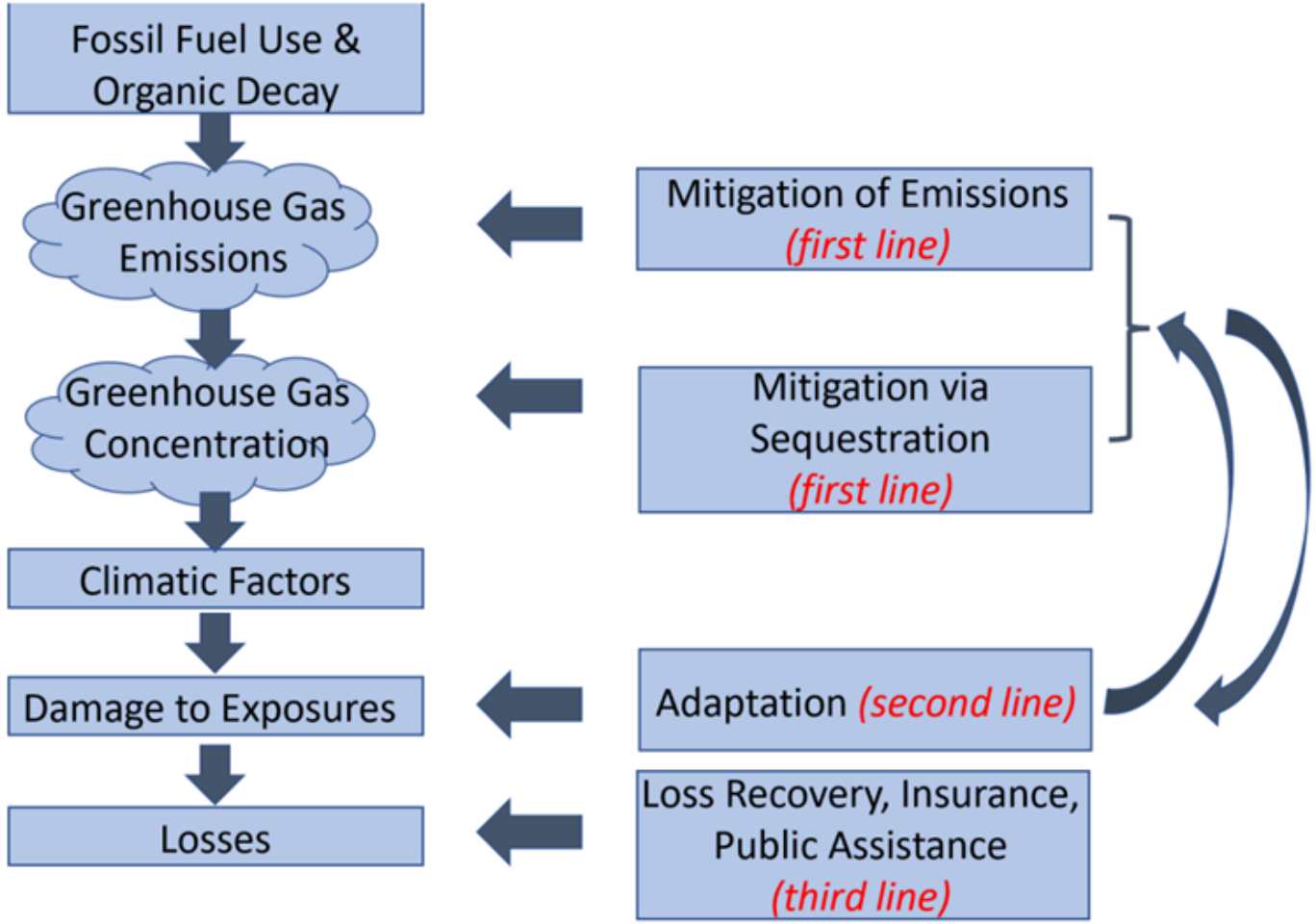
- Paper https://www.actuaries.org/IAA/Documents/Publications/Papers/IAA_CRTF_Paper6_AdaptationGap.pdf
- Glossary https://www.actuaries.org/IAA/Documents/Publications/Papers/CRTF_Glossary.pdf

Paper Outline

1. Adaptation, Adaptive Capacity and Adaptation Actions
2. An Actuarial Perspective
3. Climate-related Risk Management
4. Case Studies
5. Further Considerations
6. Conclusion & Next Steps

Adaptation vs Mitigation

Figure 1: The Climate Change Loss Process and Lines of Defense



Key Definitions

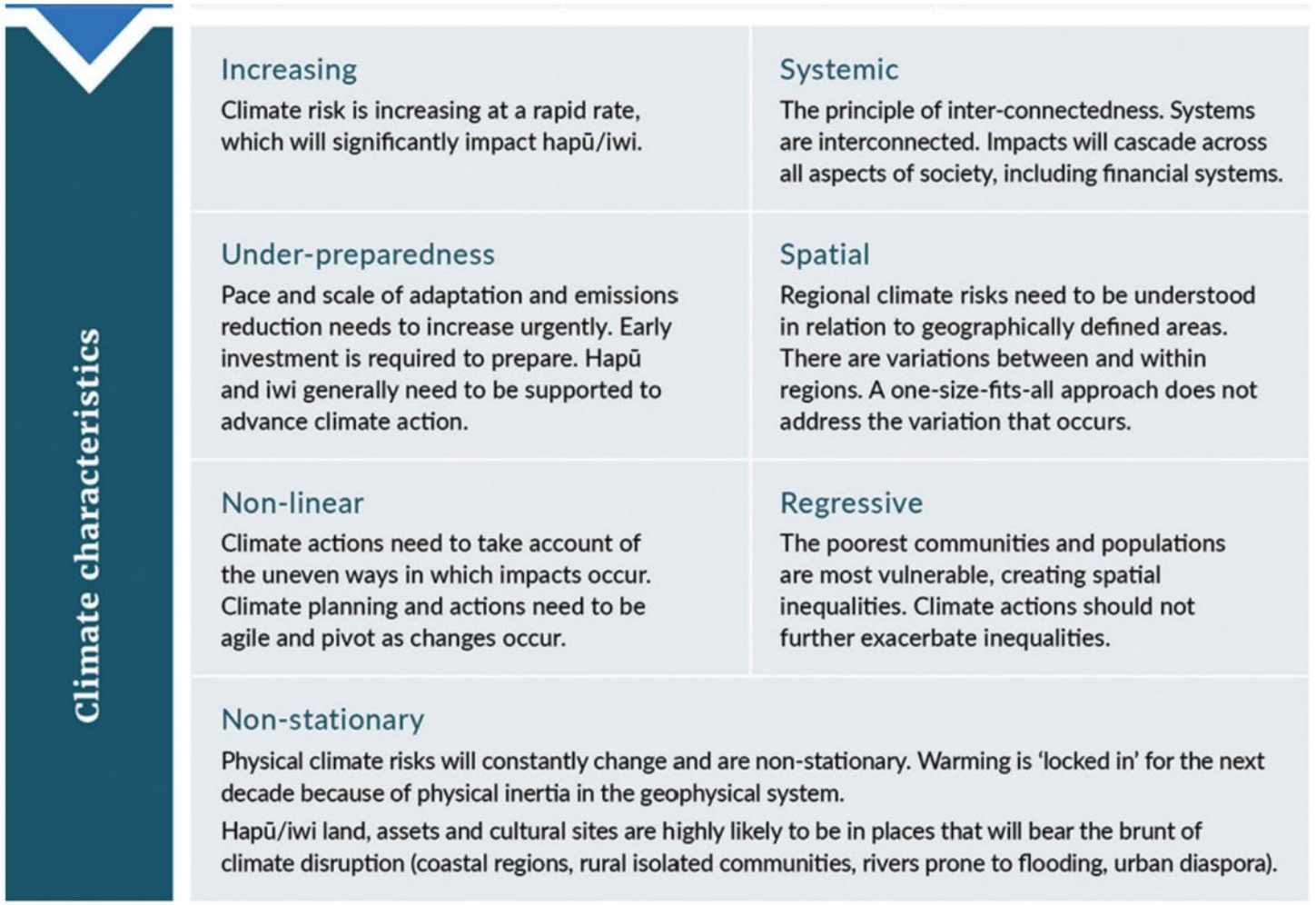
- **Resilience:** the capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation
- **Adaptive Capacity:** the ability of systems, institutions, humans and other organisms to adjust to potential damage, take advantage of opportunities or respond to consequences.
- **Maladaptation:** any changes in natural or human systems that inadvertently increase vulnerability to climatic stimuli; an adaptation that does not succeed in reducing vulnerability but increases it instead.

Cascading and Compounding Risks

- Multiple climate hazards can occur simultaneously and interact with other non-climate-related risks
- **Cascading risk:** when a primary event (trigger), such as heavy rainfall or rapid snowmelt, is followed by a chain of one or more other events, such as consequential flooding or landslides.
- **Compounding risk:** represents a combination of events that occur at the same time
  - e.g. the concurrence of heatwaves and severe droughts in Europe in recent years
- Climate-related risk drivers may also exacerbate non-climatic risk drivers.

Adaptation Plans

Figure 2: New Zealand's National Adaptation Plan – Features of Climate-Related Risks



Note: iwi means tribe while hapū refers to sub-groups within those tribes

Adaptation Actions

- Building codes
- Heat health action plans
- Agricultural practices
- Responses to sea level rise and other water-related risks
- Supply chain management strategies
- Managed relocation

Further Considerations

- **Time horizons:** Short and long-term perspectives needed
- **Vulnerable populations:** Socially marginalized groups often experience disproportionate exposure to risk and affordability problems
- **Coordinated action:** Interdependencies between actions need be recognized
- **Role for governments and supervisors:** Incentives for adaptation can be provided by government rules or programs
- **Role of disclosure:** Adequate focus on adaptation measures

An Actuarial Perspective Climate-Related Risk Management

Sam Gutterman

Why is Adaptation a Concern to Actuaries

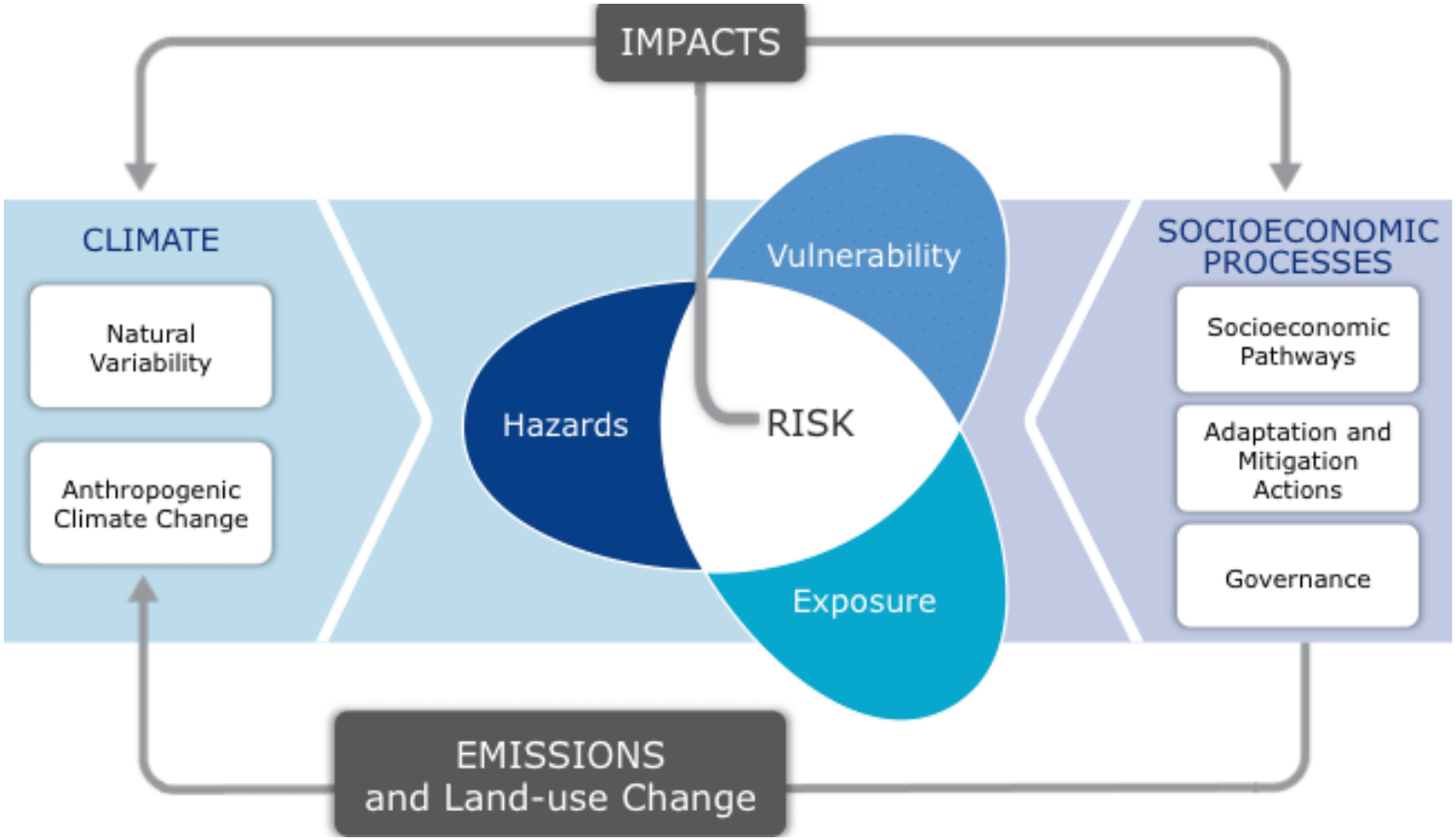
- Can affect insurance experience
- Actuaries can
  - Recognize its practicality and importance
  - Leverage their experience in risk management practice
  - Manage uncertainty over long time horizons
- In inter-disciplinary work
  - Impact on insurance systems, protection gaps, vulnerabilities, insurability, and resilience
  - Anticipate its effect on insurance costs
  - Recognize its role in developing realistic scenarios
- Can expand the influence and work of actuaries

Role of Insurance in Adaptation Decision-Making

- Property & Casualty (General) Insurance is a key friction that makes many economies function
  - Helps adaptation objectives to be achieved, including incentives to minimize exposure to climate-related risks through the selection of risks, pricing, or product design
    - Examples – prices or coverages to incent building construction or redesign to meet minimum standards to reduce damage from floods or wildfires
  - In some cases, the short-term nature of these contracts may be incompatible with the long-term risks involved
    - Recent experience suggests that these risks can be significant now
- Health Insurance
  - Incentives to enhance health care and emergency response infrastructures

Relation between Hazards, Exposure, and Vulnerability

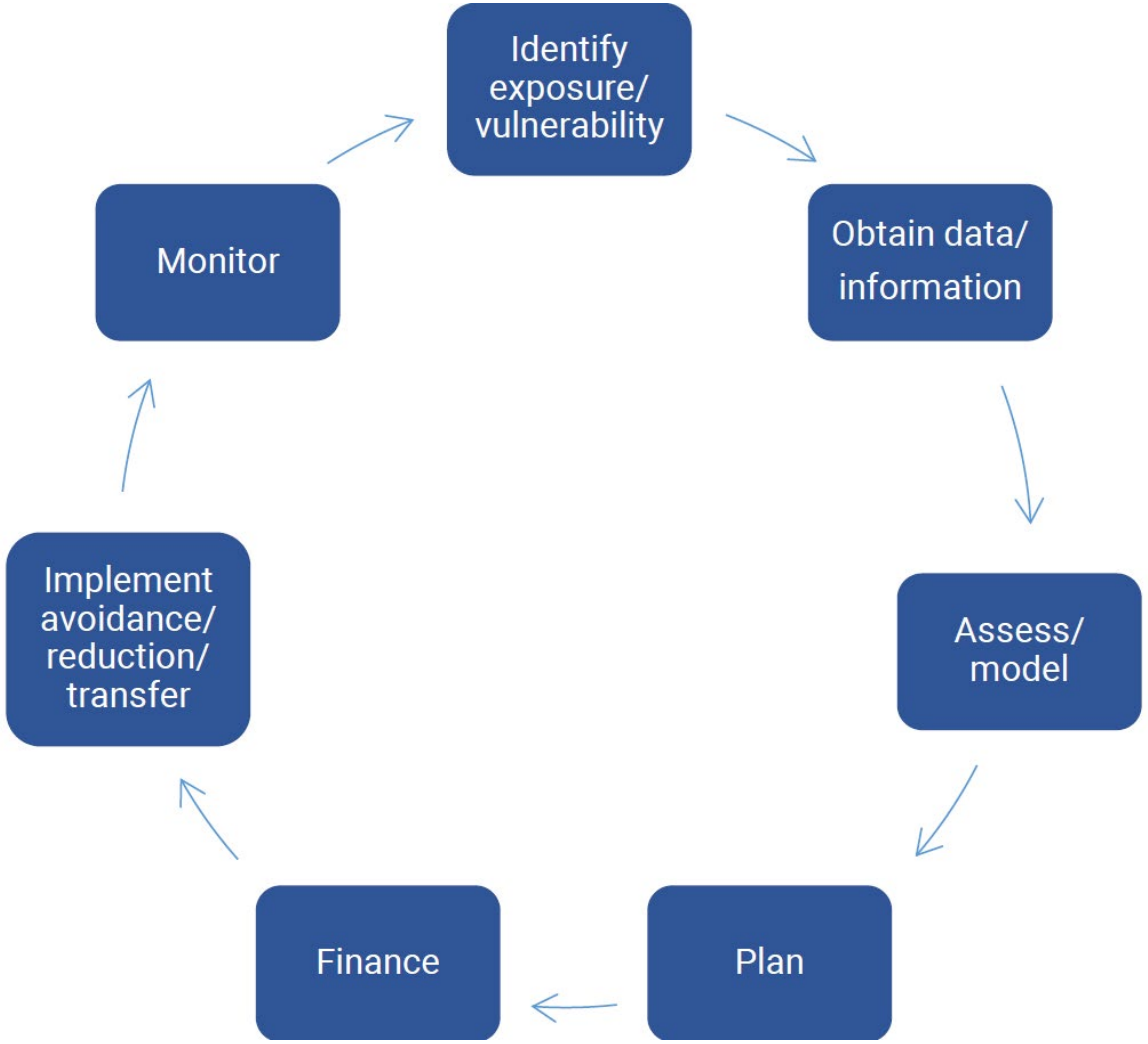
- Risk arises when those who are vulnerable are exposed to climate hazards
- Goal of adaptation is to eliminate or reduce the impact of adverse climate-related (and other) hazards



Source: IPCC, 2014

Climate Risk-Related Risk Management Process

- These are general steps
- Order applied may differ by project
- May involve feedback loops



“Identify Exposure/Vulnerability” Step

- Identify and assess
  - Climate hazards
    - Level, variability, and severity
    - Trends
  - Exposure and vulnerability of property and lives
- Identify
  - Risks of concern, objectives, and policies for users
  - Process most relevant to risk management
  - Any co-benefits and opportunities

“Obtain Data and Information” Step

- Recognize types climate change risks, including relevant regulations/laws, vulnerabilities, protection gaps and possible adaptation actions
- Obtain relevant data
  - May present difficulties, especially because future climate/weather conditions may differ from those in the past
  - Unlike mitigation, exposures and vulnerability, depending on the hazard, can differ
- Existing vulnerabilities and adaptation
- Gaps and inconsistencies in available data limit the ability of stakeholders to hold public and private actors accountable and to support needed adaptation investments
- Two data initiatives of the UN Office for Disaster Risk (UNDRR)
  - Global Resilience Index Initiative (GRII) and Risk Information Exchange (RiX)

“Assess/Model” Step

- Assess exposures and vulnerabilities
- Cost-benefit analysis
  - Quantifies the financial costs and benefits of adaptation
  - Requires credible, useful, and timely climate risk-related data, information and tools, including models where relevant
  - Demonstrates the value of investments or rules
    - Such as relating to services provided by natural infrastructure, such as the restoration of wetlands to control floods
- Actuarial modeling
  - Considers likely behavior in response to incentives
  - Depends on data, information, and judgment

“Monitor” Step

- Regular evaluation of the effectiveness of existing adaptation processes
- Establish goals
  - Implementation process
  - Effectiveness
- If current situation does not satisfy needs, identify revisions
- Measuring adaptation success (e.g., avoidance of extensive wildfire damages) can be more difficult than mitigation success
  - Estimate what the losses and damages would have been without adaptation
  - Develop relevant, reliable, and consistent data and observable criteria, either from the local area or areas exposed to similar risks

Uncertainties

- Can relate to climate change, climatic factors, their inter-relations, and adaptation effectiveness
- Risk/loss preferences of insurer and insureds can differ and be significant
- Impact
  - Consider alternative approaches
  - Most commonly modeled through scenario analysis*
- Contingency planning is becoming more important
  - Examples: what happens if electric power grid fails, New Mexico's attorney general has launched a readiness task force to prepare for 'worst-case scenarios'

*See IAA papers: 2 - *Introduction to Climate-Related Scenarios*, 3 - *Climate-Related Scenarios Applied to Insurers and Other Financial Institutions*, 4 - *Application of Climate-Related Risk Scenarios to Asset Portfolios*

Decision making

- Considerations that may affect the quantitative and qualitative findings of a cost-benefit analysis
  - Availability, reliability, and relevance of data and information
  - Expected frequency, severity, and timing of the risk
  - Whether strategic, tactical, or operational
  - Decision-makers and stakeholders
    - Views and risk preferences
  - Global, national or local considerations
  - Types and level of uncertainty
  - Time available to make and implement the decision

Case studies and conclusion

Stuart Wason

Case Study – Barbados Coast

- Coastal zone is main economic asset
- Tourism 39% of GDP
- Beaches subject to erosion and storms
- Climate change effects – reef deterioration; storm severity; sea level rise

Example of Headlands

Photo courtesy of Antonio Rowe, Deputy Director of CZMU

Case Study - Barbados Coast

- Near to medium term solution to construct a series of 5 headlands 20-25 m into the sea
- Construction costs of U$11.7 mill funded by IADB
- Longer term adaptation will require investments in waste-water treatment and relocation of structures further back from the sea
- Project considered a success

Barbados Case Study – Actuarial Implications

- Importance of considering the effects of climate change and possible adaptation measures for Barbados and its land, beaches, people, structures and economy.
- Addressing these issues requires their inclusion in risk management and scenario analysis.
- Requires cooperation and partnership among all stakeholders to minimize protection gaps.
- Actuaries have strong roles in providing advice on risk-related matters to governments and other stakeholders.

Case Study - Cauvery River, India

- Cauvery is rain-fed and heavily dependent on both the southwest and northeast monsoons.
- 800 km in length; falls 1341 m; drains 81,155 sq km
- Water used for irrigation, household consumption and generation of electricity.

Path of Cauvery River in India

Case Study - Cauvery River, India

- Cauvery and its interdependent natural and human systems are facing severe challenges, both human and climate change
- **Water sharing**: Conflicts between peoples and interests have required Supreme Court rulings
- **Rainfall**: Variability of the monsoons (both SW and NE); change in nature of rainfall

Dry Venar River, a Tributary of Cauvery

Former Public Works and Irrigation employee A. Deivasihamani showing the dry Venar river, a tributary of the Cauvery in Thiruchirapalli district

Case Study – Cauvery River, India

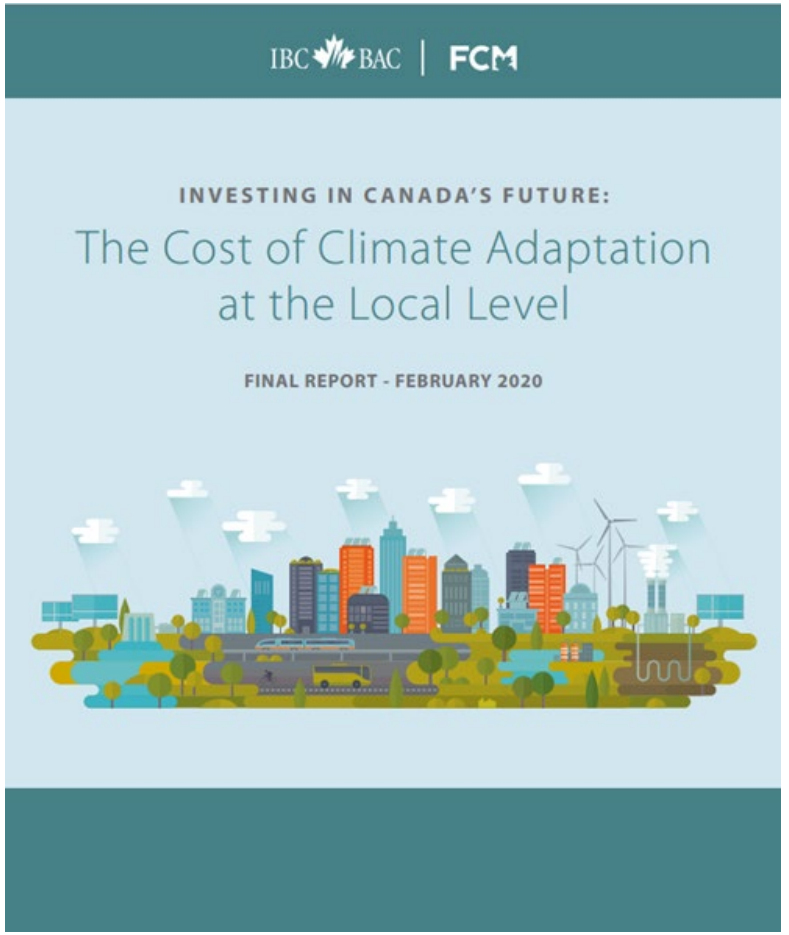
- **Water retention**: Intensification of farming, forest reduction, urbanization
- **Result**: Insufficient water for all stakeholders; river runs dry before it reaches the sea
- **Adaptation project**: A partial solution is a re-forestation project along the banks of the river; begun in 2019, billions of tree saplings are to be planted along the banks of the river; cost of saplings is crowd-funded – local farmers do the planting; benefits include soil/water retention, improved resilience to weather extremes etc.

Cauvery River Case Study – Actuarial Implications

- Adaptation can make a difference especially if acted on at a sufficient scale and in combination with other activities.
- Actuaries can advise stakeholders (governments) on collective issues, favourable effect of adaptation and the risks of inaction.
- Actuaries apply their skills in risk management, health care, losses, damages, economics, scenario analysis, insurance.
- As a result, vulnerable populations are protected, and the costs of climate change are shared among a variety of public–private partnerships.

Case Study - Canada

- IBC/FCM 2020 report provides credible estimate of the investment in municipal infrastructure and local adaptation measures needed to reduce the impacts of climate change in Canada



Case Study - Canada

- Municipalities, are owners and operators of 60% of public infrastructure in Canada; on front lines of impacts of climate change and solutions to protect Canadians
- Municipalities can’t shoulder cost of adapting to climate change alone - is shared responsibility among all levels of government.
- Avoiding worst impacts of climate change at municipal level will cost an estimated C$5.3 billion per year (0.26% of GDP).
- Studies have shown that investments in resilient infrastructure have a return on investment of $6 in future averted losses for every $1 spent proactively.

Case Study - Canada

- 37% of cumulative nature related losses are not covered by insurance
- Potential burden on the various levels of government and taxpayers generally

Cumulative Losses, DFAA and Insurance Payments (2005–2014) ($millions)

	FLOODS		CONVECTION STORMS		HURRICANES		WINTER STORMS		TOTAL	
	LOSSES	% OF TOTAL	LOSSES	% OF TOTAL	LOSSES	% OF TOTAL	LOSSES	% OF TOTAL	LOSSES	% OF TOTAL
Total loss	$12,505	100%	$7,314	100%	$718	100%	$10,452	100%	**$30,989**	**100%**
DFAA	$3,465	28%	$20	0%	$138	19%	$1,267	12%	**$4,890**	**16%**
Insurance	$4,982	40%	$5,726	78%	$436	61%	$3,552	34%	**$14,696**	**47%**
Outstanding	$4,058	32%	$1,568	21%	$144	20%	$5,633	54%	**$11,403**	**37%**

Source: Parliamentary Budget Officer of Canada 2016

Canadian Case Study – Actuarial Implications

- Foster greater use of public/private partnerships to reduce protection gaps, make effective use of insurance mechanisms and reduce the fiscalization of climate costs;
- Gather data/research on costs/benefits of adaptation;
- Ensure clients' risk management incorporates climate-related risk expertise, including the benefits of adaptation measures;
- Assist stakeholders in understanding the uncertainties involved in modelling climate-related risks, including adaptation responses.

Conclusions

- Best defense against future climate-related risks and damages is build resilience and reduce exposure, vulnerability and inequality that drive disasters and their damages
- Long-term planning and accelerated implementation, particularly in the next decade, is important to close adaptation gaps (IPCC AR6 WGII)
- If adaptation is invested in now, many of the ultimate costs of climate change can be halved (Canadian Climate Institute)
- Effective adaptation-related data and information will enable better risk management planning

Conclusions

- Actuaries can contribute to adaptation, not only in the usual areas of actuarial practice, but through broader application in risk management, scenario analysis and cost-benefit analysis
- Uncertainty of future outcomes is at heart of climate change discussion. Understanding/communicating these uncertainties is a key role for actuaries
- Actuaries can contribute to inter-disciplinary assessment and discussion of adaptation and its impact on financial systems including advising on protection gaps, vulnerabilities, insurability and resilience.

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