

**RIMU**

Research and  
Evaluation Unit

**Climate Change  
Confronting a slow motion catastrophe:  
Principles and policies for a just transition**

**Professor Jonathan Boston, Victoria University of Wellington**

**6 March 2020**

# Climate change

## Confronting a slow-motion catastrophe: Principles and policies for a just transition

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March 2020

# Outline

1. The nature of the challenge – summary
2. Anticipatory governance
3. Principles for a just transition – both mitigation and adaptation
4. The challenge of rapid decarbonization
5. The challenge of adaptation – focus on sea level rise
6. Who should pay for what?
7. A proposed reform agenda for adaptation
8. Conclusions

# The challenges - summary

1. Climate change mitigation (decarbonisation) and adaptation both pose formidable challenges for humanity – some overlapping, others distinctive
2. The biggest challenges will be social and political, not technological or economic – e.g. how to ensure just transitions
3. Mitigation will have significant distributional, geographic and sectoral impacts
4. Adaptation to climate change will be much more difficult and protracted than mitigation (which is hard enough)
5. Large-scale climate change impacts are now unavoidable – and are becoming increasingly evident (e.g. droughts, floods, fires, storm damage, coastal erosion, etc.)
6. The impacts will continue to escalate, constituting a slow motion catastrophe and a classic 'creeping' problem – initially barely perceptible, but gradually growing in scope, scale, and duration, and in non-linear or abrupt ways

# The challenge - summary

7. The financial costs from damage to, and losses of, coastal properties and infrastructure will be immense, plus huge social and environmental costs (e.g. biodiversity loss, etc.)
8. The costs will fall unevenly, arbitrarily, and in a non-linear manner
9. The long-term costs will be (much) lower with effective adaptation – by reducing exposure and vulnerability, and mitigating risks
10. Effective adaptation requires sound anticipatory governance – foresight, pro-active planning, good coordination, climate proofing
11. Managed realignment and managed retreat ('decommissioning') (i.e. the relocation of human settlements away from hazard zones) will often be more cost-effective than protective structures ('holding the line') and the only technically viable option

# The challenge - summary

## 12. Funding issues:

- What are the ethical and other relevant principles?

### ➤ Mitigation

- Should there be public compensation for losses resulting from regulatory and other policy changes?
- How should the least advantaged be protected during the process of decarbonisation?

### ➤ Adaptation

- Who should bear the various costs of adaptation, including managed retreat?
- Should there be public compensation for the loss of private property, and, if so, on what basis?
- How should the additional infrastructure costs be funded?

# The challenge - summary

## 13. A proposed reform agenda for adaptation

- A comprehensive Climate Change Adaptation Act
  - A new planning process (for large-scale managed retreat)
  - New public institutions to facilitate and oversee adaptation, including planning, public insurance, infrastructure investment and compensation for loss and damage – an integrated regime
  - A dedicated climate change adaptation fund, with pre-funding and multiple funding streams
  - Statutory criteria for allocating public funding, including compensation

See Report of NZPC (2019) *Local Government Funding and Financing*

# The challenge - summary

## Selected references:

1. Jonathan Boston (2019) 'Funding Climate Change Adaptation: The case for public compensation in the context of pre-emptive managed retreat', a paper for the Ministry for the Environment, Wellington, 47pp
2. Jonathan Boston and Judy Lawrence (2018) 'Funding Climate Change Adaptation: the case for a new policy framework', *Policy Quarterly*, 14(2), 40-49
3. David Hall (ed.) (2019) *A Careful Revolution: Towards a Low-Emissions Future* (Wellington: Bridget Williams Books)
4. New Zealand Productivity Commission (2019) *Local Government Funding and Financing* (Wellington)
5. Greg Severinsen (2019) *Reform of the Resource Management System: A model for the future: Synthesis Report* (Auckland: EDS)

# Anticipatory governance

Leon Fuerth (2009)

*... a system of institutions, rules and norms that provide a way to use foresight for the purpose of reducing risk, and to increase capacity to respond to events at early rather than later stages of their development.*

Leon Fuerth and Evan Faber (2012)

*... a systems-based approach for enabling governance to cope with accelerating, complex forms of change.*

Distinctive approach to policy-making: systems thinking, foresight methods, integration with day-to-day decision-making, network modes of problem-solving, incremental adjustment, importance of monitoring and feedback, focus on emerging issues

# Attributes of Anticipatory Governance

1. An emphasis on foresight and related techniques
2. A precautionary approach
3. Proactive policy interventions
4. A systems approach – holistic
5. Adaptive management
6. Pursuit of resilience and sustainability
7. Support for participatory modes of decision-making
8. An emphasis on embedding long-term interests in day-to-day decision-making

# Principles for a just transition – for both mitigation and adaptation

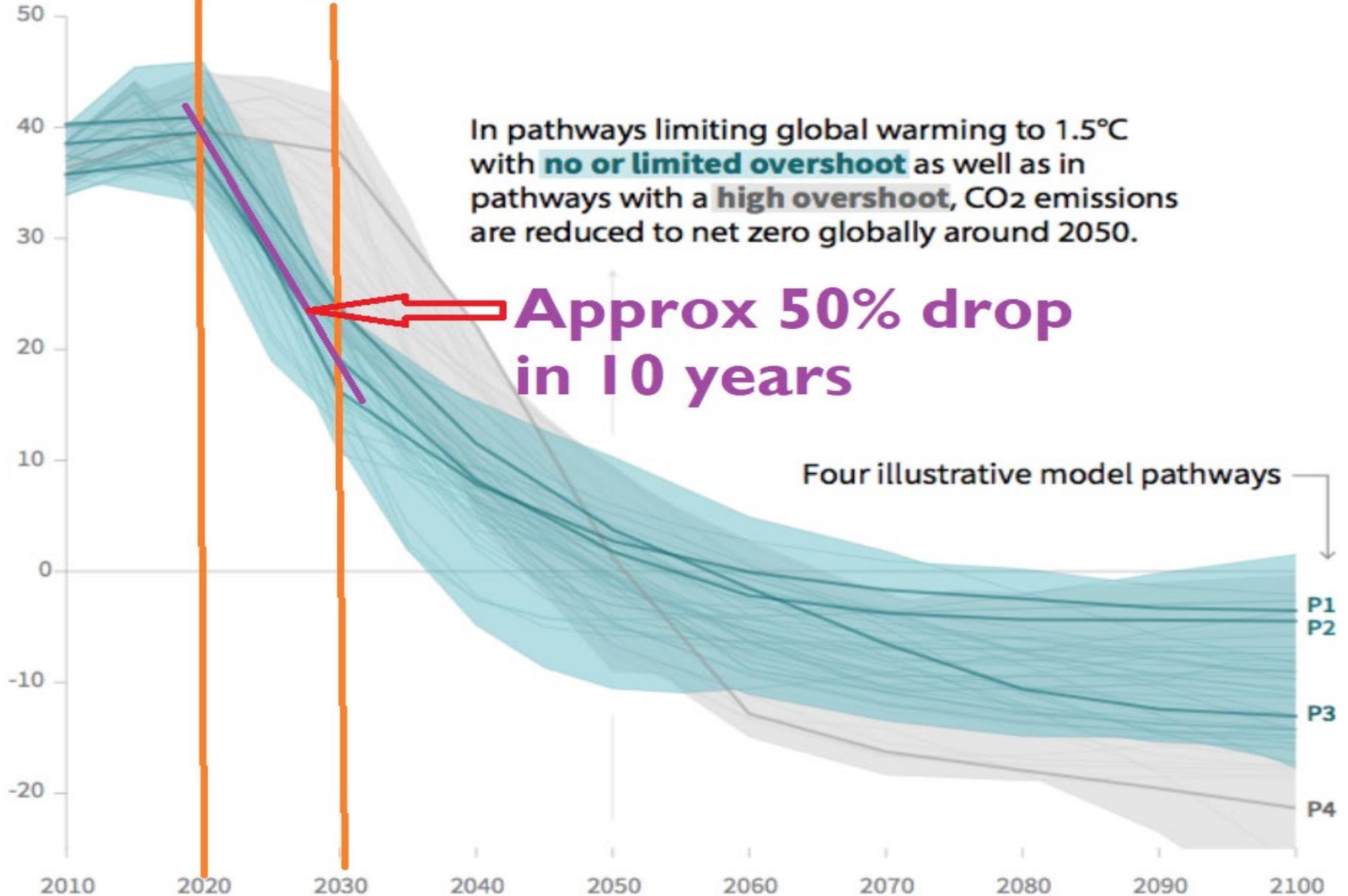
1. Collective responsibility for the whole society to act
2. Principle of remedial responsibility – only central government has the resources and mandate to protect the long-term national interest
3. Respect for the provisions and principles of the Treaty of Waitangi
4. An anticipatory focus – principles of precaution and pre-emption, and duty of care
5. Equitable sharing of the burden of adjustment (social contract)
  1. Polluter pays
  2. Protecting the least advantaged
  3. Enhancing the capability to adjust
  4. Enabling people to get on with their lives
  5. Tailored and targeted transitional assistance to meet basic needs
6. Collaboration, partnership and recognition
7. Policy certainty – quest for durable multiparty agreements
8. Fiscal responsibility

# The challenges of rapid decarbonization

1. Goal of avoiding warming of more than 1.5°C – requires a 50% (+/-) reduction in global CO<sub>2</sub> emissions by 2030 (even more if climate sensitivity is higher than 3°C)
2. A fair sharing of the global mitigation burden would imply an even greater reduction for NZ
3. Reducing domestic CO<sub>2</sub> emissions by 7-10% per annum for 10 years (plus cuts in N<sub>2</sub>O and aviation emissions) will require major policy/regulatory changes, with significant impacts on relative prices and important sectors of the economy
4. Little public understanding yet of the scale of the changes required
5. Need a careful and explicit alignment of tax/welfare policies and climate change policies to protect the least advantaged and facilitate rapid adjustment; not yet evident in government policy papers or decision-making
6. Cannot rely on COVID-19 to solve the problem!

# Global total net CO<sub>2</sub> emissions

Billion tonnes of CO<sub>2</sub>/yr



# Adaptation issues – climate change risks and impacts

1. Large and growing literature, summarized periodically by the IPCC; AR6 underway – Report on *Impacts, Adaptation and Vulnerability* due in October 2021
2. Impacts will depend on magnitude and speed of warming: IPCC *Special Report on 1.5C* (2018) highlights the differences between 1.5°C and 2.0°C
3. Currently on track for 3.0°C+, but more if climate sensitivity is higher than previously assumed
4. Risks of tipping points (e.g. Amazon, West Antarctic ice sheet, etc.)
5. Note cascading, cumulative, non-linear impacts

# What is at stake?



Flora and fauna and human habitats, mobility, infrastructure, economic activity, lost earnings, recovery costs, adjustment costs



# Scope and scale of risks

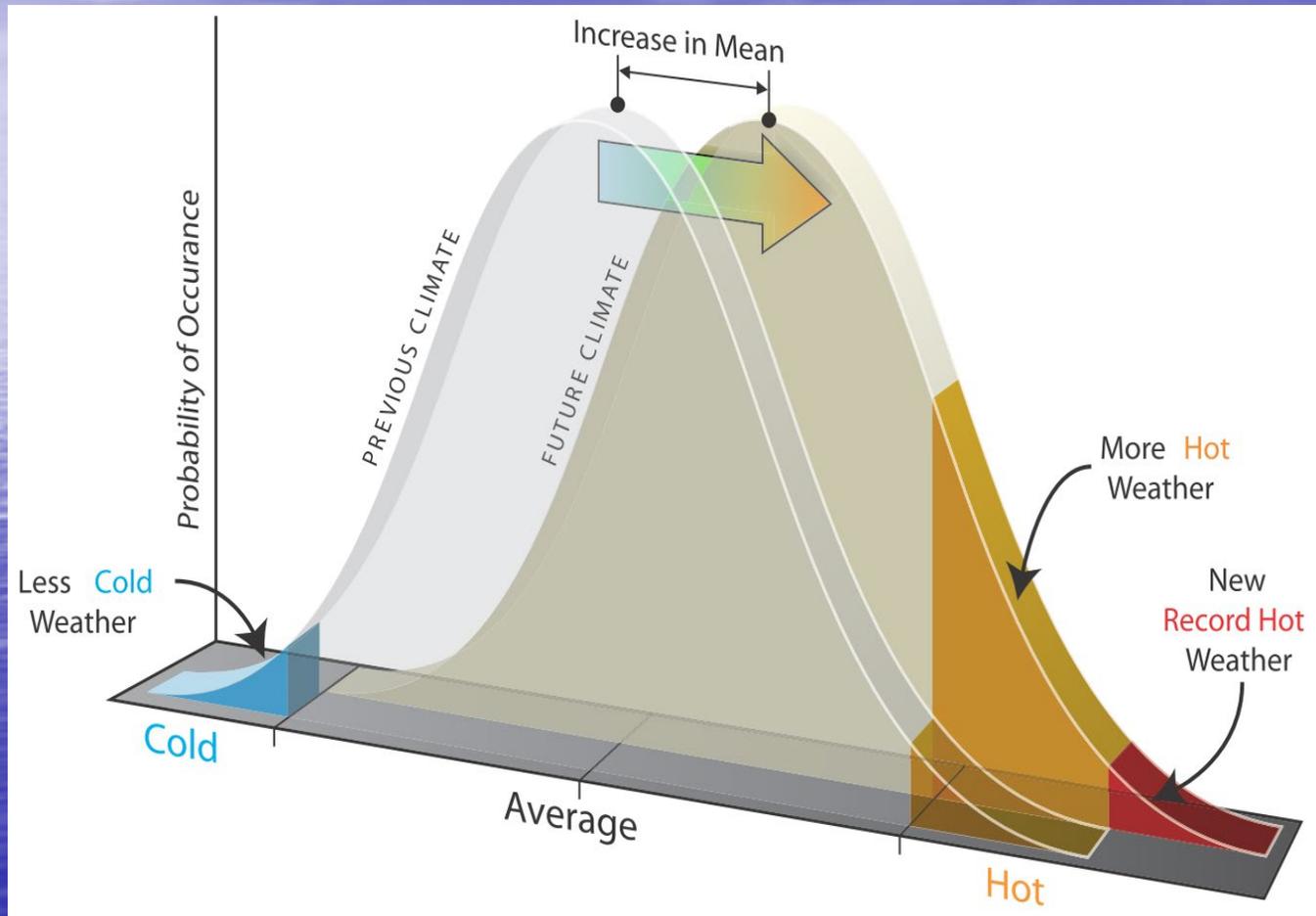
## From what?

- Drought
- Fire
- Pests and diseases
- Sea-level rise – erosion and coastal inundation, rising groundwater, increased liquefaction risk
- Shift in rainfall patterns
- More frequent extreme events
- Increased rainfall intensity – storm water and ponding
- Increased flood risk – rivers and surface water
- Increased wind strength
- Decrease in snowfall accumulation

## What is exposed?

- Low-lying land-reclaimed land, ports, airports, cities, towns
- Transport networks
- Underground infrastructure
- Human activities
- Rural investments
- Tourism
- Water availability and quality
- Endangered habitats
- Health
- Forests
- Oceans
- Fisheries

# Increase in extremes events



**hot days** ↑

**cold days/frosts** ↓

**heavy rain** ↑

**drought** ↑

**fire risk** ↑

**severe storms** ± (↑)

# Focus on sea level rise



Sea level rise is happening now  
It will accelerate  
It will continue for centuries

**SEA LEVEL RISE IS FORESEEABLE**



Tamaki Drive, Auckland



# Sea level rise – projections

1. IPCC 5AR (2013): projected a rise of 0.26 to 0.98m in the global mean sea level by 2081-2100 (relative to 1985-2005), depending on the path of global GHG emissions
2. Rate of increase will accelerate from recent rate of 3-4cm per decade
3. Beyond 2100, the sea level will rise on all emissions scenarios for centuries (unless sustained negative net CO<sub>2</sub> emissions)
4. High GHG emissions scenario (e.g. CO<sub>2</sub> concentrations of 700ppm to 1,500ppm): IPCC projects 3.0m+ rise by 2300
5. Larger increases are possible (and earlier) if major ice sheets sustain more rapid ice losses
6. Realistic to assume up to 1.0m by 2100; prudent to prepare for more
7. Substantial regional variations likely due to ocean currents, land subsidence, seismic activity, etc.

# Increased frequency of 1:100 year events

**1:100yr event today becomes annual with modest sea level rise  
(by around 2050-60s): **low uncertainty****

**2.9m spring-tide range**

**1.4m spring-tide range**

SLR	Auckland	SLR	Wellington
0cm	Every 100 years	0cm	Every 100 years
10cm	Every 35 years	10cm	Every 20 years
20cm	Every 12 years	20cm	Every 4 years
30cm	Every 4 years	30cm	Once a year
40cm	Every 2 years	40cm	Every 2 months
50cm	Every 6 months	50cm	Twice a month
60cm	Every 2 months	60cm	3 times a week
70cm	Every month	70cm	Every tide
80cm	Every week	80cm	Every tide
90cm	Twice a week	90cm	Every tide
100cm	Every day	100cm	Every tide

New Jersey Coast – Post Hurricane  
Sandy, October 2012



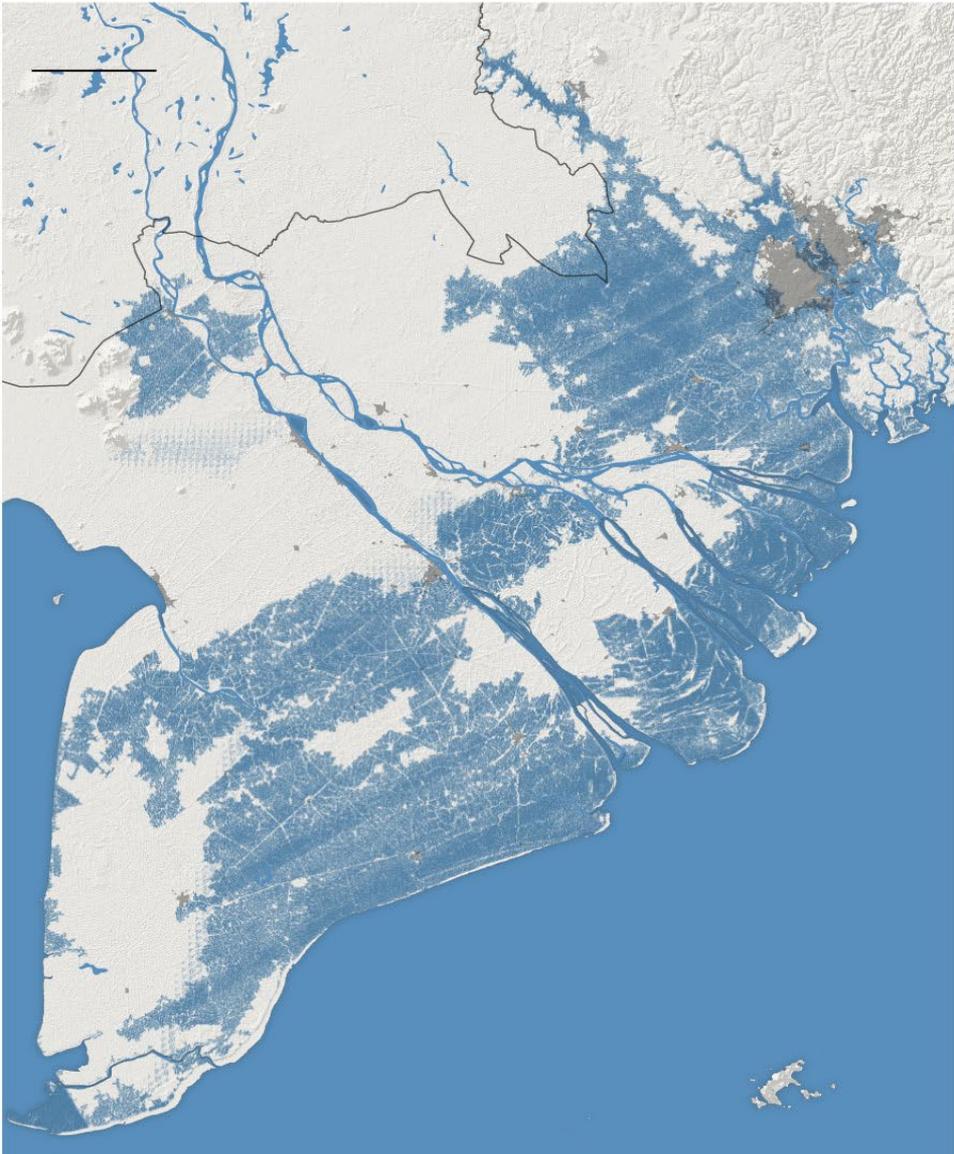


# What is at risk globally?

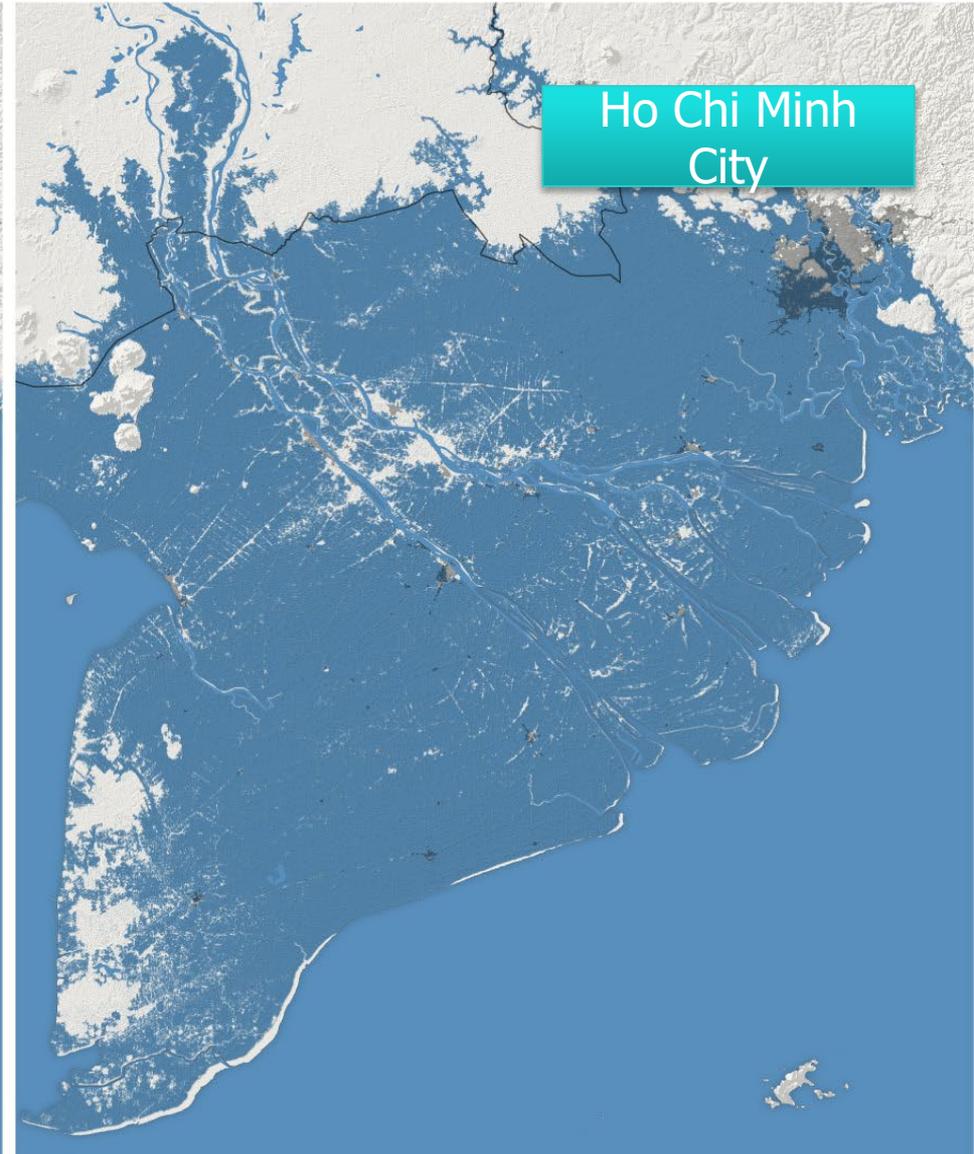
1. Assessing climate-related risks and costs is difficult – many uncertainties and methodological issues
2. In 1990 about 200 million people globally resided in a coastal flood plain (i.e. below the 1 in 1000-year surge-flood elevation); by 2080 could be 800 million, without sea level rise
3. Add sea level rise – far more vulnerable to extreme surge-flood events
4. By 2100, hundreds of millions of people will be displaced, especially around major river deltas
5. UNEP (2016): by 2100 the estimated annual costs for developing countries of adapting to climate change will be US\$280-\$500 billion
6. See article by Kulp and Strauss (2019)  
<https://www.nature.com/articles/s41467-019-12808-z>

# Sea level rise - Vietnam

Old Projection for 2050



New Projection for 2050



# What is at risk in NZ?

1. Most major cities are coastal, some with low-lying CBDs; 9<sup>th</sup> longest coastline in the world
2. At least 125,000 homes (250,000 people) and other buildings are within 1.0m of the current average high tide in spring (valued at around NZ\$40 billion)
3. Public infrastructure, including transport and energy systems, and water services will be significantly impacted. This includes ports, airports, roads, and railway lines, as well as hundreds of critical-facility buildings

# Estimating climate change costs

Relevant considerations include:

- the timeframes
- the path of global GHG emissions
- the projected impact of global warming on the main ice sheets and hence the pace and magnitude of sea level rise (especially later in the century)
- the projected impact of climate change on ocean currents and storms
- the assumptions made about the pattern and scale of future human development, especially in coastal areas and other vulnerable locations
- the nature and types of costs considered (e.g. direct and indirect, market and non-market)
- how losses of land, buildings and infrastructure are valued
- assumptions about the adaptation measures and protection strategies adopted and their estimated costs

# Types of costs of sea level rise, flooding, inundation, etc.

1. Disruption to normal business activity – output losses
2. Loss of private land and physical assets, both residential and commercial (e.g. due to coastal erosion and inundation)
3. Damage to, and replacement of, public infrastructure and other public assets
4. Loss of treasures, sense of place, amenities, community, etc.
5. Risk-reduction measures, including avoidance, mitigation by hard and soft structures, managed retreat, future-proofing infrastructure, etc.
6. Higher insurance costs, if and when insurance is available
7. Compensation for loss and damage

# Adaptation – goals and considerations

1. Need sound anticipatory governance: proactive, preventative, prudent, precautionary, participatory ...
2. Principle of remedial responsibility: only central governments have the resources and capability to manage, mitigate, and respond to the more serious impacts of climate change
3. Need an effective, fair, coordinated and flexible planning framework, based on durable, multiparty agreements
  - periodic national adaptation plans, subject to expert review
  - clear assignment of decision rights
  - adequate resources to achieve goals
  - tailored processes for public consultation and participate
  - mechanisms that are flexible to enable review and course correction as risk profiles change

# Goals and principles for adaptation funding

1. Minimize long-term adaptation costs through policy decisions that reduce climate change risk exposure (which, in turn, lower future damages, insurance costs, moral hazard, etc.)
2. Define and fulfil the 'social contract':
  1. share burdens equitably, both inter- and intra-generationally, including fair compensation for losses
  2. enable people to get on with their lives
  3. ensure that people can meet their basic needs, including adequate housing
3. Define and fulfil the 'global contract'

# Goals and principles for adaptation funding

## Supplementary goals

1. Minimize moral hazard
2. Ensure a durable, consistent and predictable approach – minimize uncertainty, delays and transaction costs
3. Ensure transparency and accountability for the use of public funds
4. Ensure fiscal prudence and sustainability
5. Complement, and where necessary replace, insurance mechanisms
6. Ensure proper coordination of public funding of protective structures, resilient infrastructure, and managed retreat

# Goals for funding 'red-zone' properties in Christchurch – after 2010-11 earthquakes

Involved 8,000+ properties; most fully compensated, based on most recent authoritative property valuations:

1. Certainty of outcome for property owners as soon as practicable
2. Create confidence for property owners to move forward
3. Create confidence in decision-making processes – for home-owners, business owners, insurers and investors
4. Use the best available information to inform decisions
5. Have a simple process to provide clarity and support those affected (avoid lengthy negotiations)
6. Fairness for all parties
7. Minimize moral hazard (e.g. incentives for people not to insure their properties in the future)

# The issue of compensation for private property losses and public acquisition

1. Idea of compensation: well understood – involves financial equivalent for what has been lost/deprived
2. Compensation raises fundamental legal, moral, and political issues
3. Societies vary in their expectations and traditions
4. Legally, the principle of (fair) compensation for 'taking' or acquisition of private property by the state (e.g. for public works) is long-established (roots in the Magna Carta 1215)
5. Constitutional protections for private property are common (e.g. Australia, US, etc.)
6. Sea level rise and increased flood risk makes compulsory acquisition highly likely (e.g. to protect the public interest)
7. Voluntary property buyouts are already common in some countries – US over 40,000 via FEMA since 1989; US\$4 billion+; post-disaster
8. Many regulatory measures to reduce climate-related risks will not require public compensation

# The issue of compensation for private property losses and public acquisition

1. Compensation in a climate change context is controversial – politicians and officials in many countries prefer euphemisms – ‘adjustment assistance’, ‘transitional assistance’, etc.
  - Fear of raising public expectations and generate massive fiscal liabilities (and it might, but these may be unavoidable)
  - Fear of setting precedents – but many already set across the OECD
  - Risk of moral hazard
  - Raises difficult questions of what might get compensated – loss of private dwellings/land, loss of commercial buildings/land, business discontinuity, etc.
2. Legislatures could conceivably enact legislation enabling private land to be acquired without compensation, but political constraints

# Arguments for public compensation

- 1. Collective responsibility for climate change:* most of those facing significant property losses have not contributed disproportionately to the problem; the impacts are mostly beyond their control, unintended, and often arbitrary and unforeseeable
- 2. Traditions of equitable risk pooling and solidarity:* collective action is the norm for serious, large-scale, if not existential, threats (e.g. natural disasters, war, terrorism, etc.). Local communities vary in their resources, resilience and coping capacities; a national policy framework will be essential for adequate and equitable funding
- 3. Compulsory relocation:* legally-mandated relocations will sometimes be necessary in the public interest (e.g. to protect life or achieve other public purposes); traditionally, fair compensation is provided where compulsory acquisition and relocation occurs (e.g. public works)

# Arguments for public compensation

- 4. Long-term cost minimisation:* publicly funding protective structures but not managed retreat creates a policy bias favouring (expensive) protection; some communities will be (unfairly) protected at great public expense
- 5. Coordination of funding of public infrastructure with decisions on human settlement:* public funding of climate-resilient infrastructure will be essential; but decisions must be coordinated with those on the location/relocation of vulnerable communities
- 6. Minimise protracted legal action:* without a settled policy framework that includes fair public compensation for climate-induced property losses, protracted court cases are likely; democratically-determined decisions are preferable to judicial ones
- 7. Private insurance will not address the problem:* insurers will withdraw; large numbers of property owners will lack insurance; implications for mortgages, the financial system, etc.

# Arguments against compensation

1. Excessive fiscal risk; risk of compensatory 'creep' – but costs/losses will occur anyway, so the question is how to share the burden
2. Wrong to compensate those who have knowingly taken a risk – yes, but many climate-related risks are unforeseeable
3. Equity issues: many coastal property owners are wealthy – yes, but many are not; wealth is irrelevant if acquisitions are compulsory
4. Rely on existing social safety nets – but rarely adequate for such complex and major problems
5. Risk of moral hazard (e.g. building in hazard zones) – yes; strong planning frameworks are needed

# Compensation issues

## 1. Types and range of losses covered

- Private dwellings, commercial property, business disruption, agricultural losses

## 2. Eligibility criteria

- Level of risk (as assessed by authoritative processes)
- Level of compulsion
- Principal place of residence (taxation analogy)

## 3. Level of compensation

- Property value (assessment criteria)
- Knowledge of risk
- Ability to pay (absorb losses)
- Discretionary rules
- Minimum and maximum thresholds
- Co-payments
- Supplementary payments

## 4. Forms of compensation

- Cash v equivalent land/property

# Funding managed retreat: arrangements and sources

1. Pre-funding v pay-as-you-go
2. Full funding v partial funding of costs
3. Co-funding arrangements – note US experience
4. Source of funds (some mix of):
  - a carbon/emissions tax
  - an insurance levy
  - an additional rating levy
  - an dedicated tax
  - general tax revenue
5. Crown/central government guarantee

# Climate Change Adaptation Fund

## A possible model:

1. A statutory body under its own Act, arms-length from central and sub-national government, with a board containing representative from each tier of government
2. A mix of funding sources, including polluter-pays (e.g. a dedicated carbon tax), and a Crown guarantee
3. Funding for both private and public purposes (i.e. loss of private assets and future-proofing infrastructure)
4. Statutory principles and criteria for allocating funds – for compensation and protective structures
5. A period of pre-funding to create a pool of funds – consistent with intergenerational equity
6. Post-disaster funding continues via private insurance (where available)

# Conclusion

1. Mitigation and adaptation both require just transitions, informed by a range of well-established principles
2. Both pose formidable political challenges, but adaptation will be more difficult
3. The financial and non-financial costs of adaptation can be reduced significantly via sound anticipatory governance
4. New well-designed planning and funding mechanisms will be essential
5. Some compensation for private property losses is justified and politically inevitable

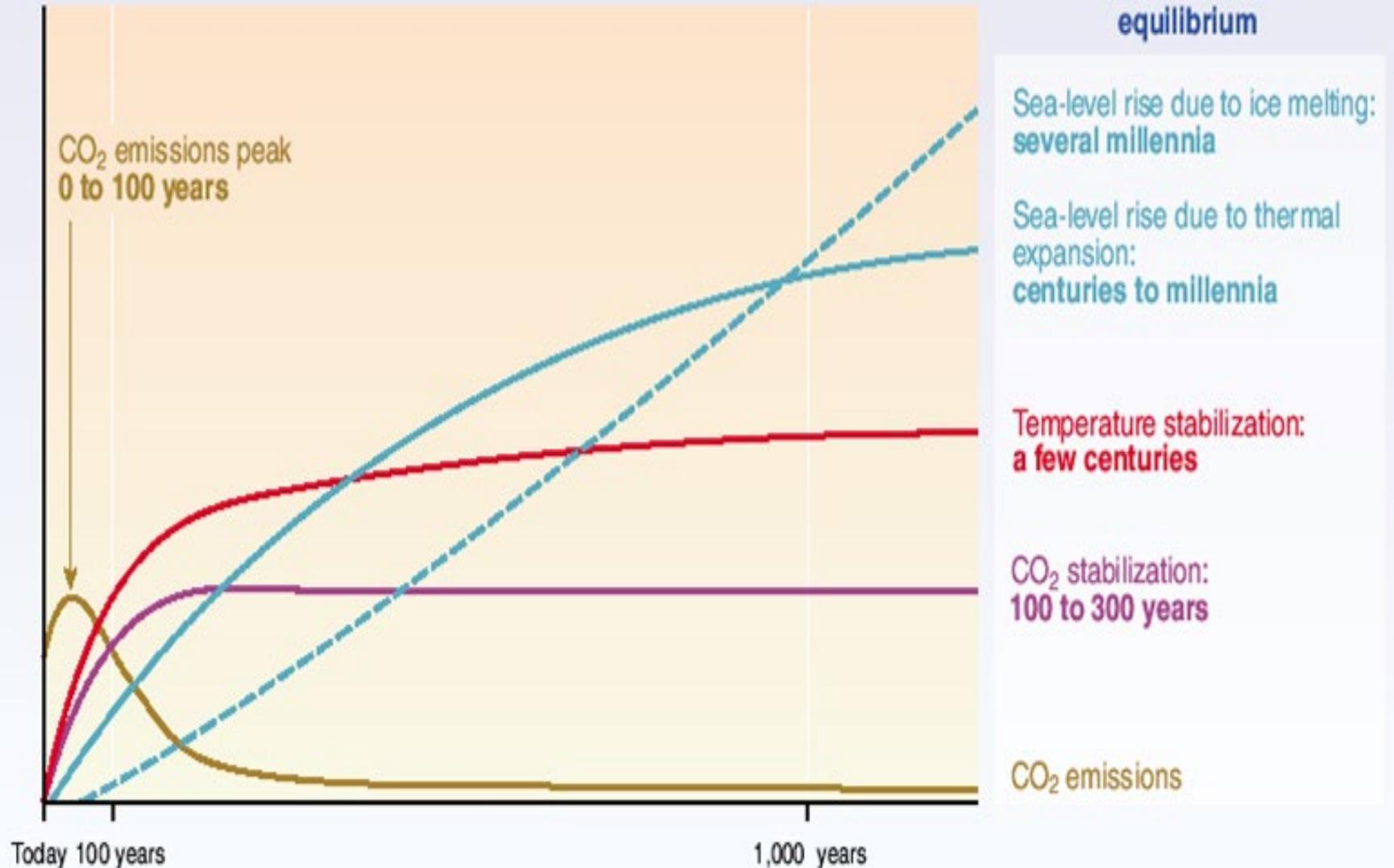
# Acknowledgements

1. IPCC Reports
2. CCC Reports
3. Parliamentary Commissioner for the Environment (NZ)
4. New Zealand Productivity Commission
5. Dr Judy Lawrence (NZ Climate Change Research Institute)

# CO<sub>2</sub> concentration, temperature, and sea level continue to rise long after emissions are reduced

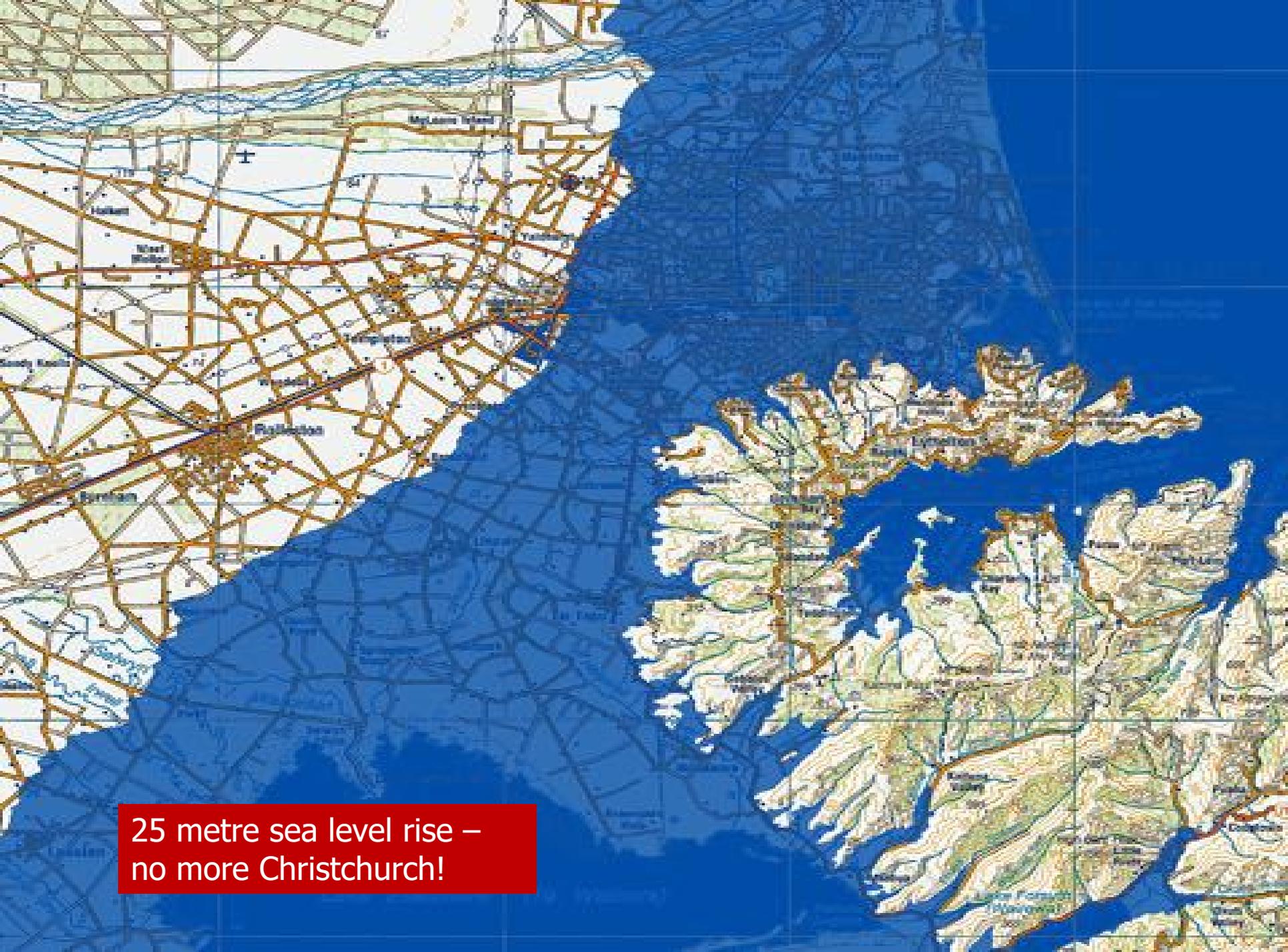
Magnitude of response

Time taken to reach equilibrium



Christchurch – 10 metre sea level rise





25 metre sea level rise –  
no more Christchurch!

# What is at risk in Dunedin?

Low-lying homes, businesses & roads in Dunedin  
- relative to spring high tide mark

	0-50 cm	50-100 cm	100-150 cm	Total 0-150 cm
Homes	2,683	604	317	3,604
Businesses	116	29	40	185
Roads (kms)	35	17	20	72

(Source: Parliamentary Commissioner for the Environment, *Preparing NZ for Rising Seas*, 2015, p. 54)

Note: Of the nearly 2,700 homes that lie less than 50 centimetres above the spring high tide mark, over 70% (close to 2,000) are lower than half that elevation

# What is at risk in UK?

Committee on Climate Change, *Managing the Coast in a Changing Climate* (October 2018)

1. By 2080s, up to 1.5m properties (including 1.2m homes) may be in areas with a 0.5% or greater flood risk (EAD value over £360b); plus 1,600kms of major roads, 650kms of railway lines, etc., plus 100,000 properties may be at risk from coastal erosion
2. Implementing current Shoreline Management Plans to protect the coast will cost £18-30b, depending on the rate of climate change
3. For 149-185 kms of England's coastline (20% of the total) – not cost-beneficial to protect or adapt as currently planned by England's authorities
4. The Thames barrier will need replacement by 2070; currently protects £200b in property and 1.25m people

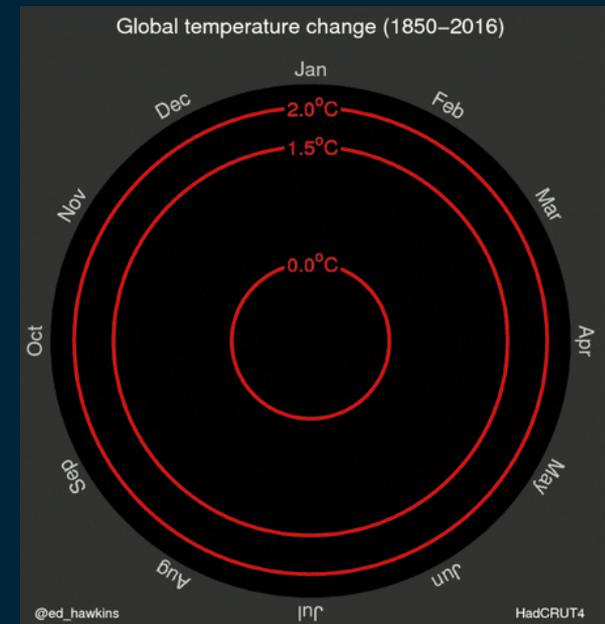
# Managed retreat

## Definition

“the application of coastal zone management and mitigation tools designed to move existing and planned development out of the path of eroding coastlines and coastal hazards” (quoted in Hino, et al., 2017)

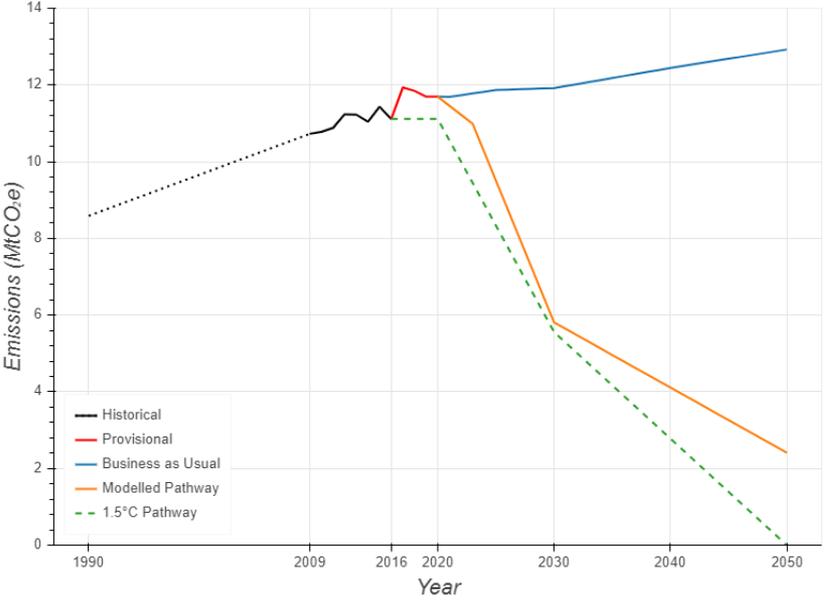
- deliberate, intentional, coordinated and planned
- designed to reduce natural hazard risk permanently rather than temporarily
- since the 1980s approximately 1.3 million people in 22 countries have been relocated through managed retreat – both in pre- and post-disaster contexts and both voluntarily and involuntarily

# Te Tāruke-ā-Tāwhiri: Our response to climate change



Dr Sarah Anderson, Chief Sustainability Office

Auckland Annual Gross Emissions



- Meeting our climate goals will require halving our emissions by 2030 and reaching net zero by 2050

- But we also need to take a precautionary approach to planning for change



# The right decision at the right time



- Our current emissions trajectory is likely to lead to a 3.5 degree warmer world by 2120



- We are taking a precautionary approach, embedding climate impact statements in every report



- There is uncertainty in how our climate will change, but we must plan for the best information we have



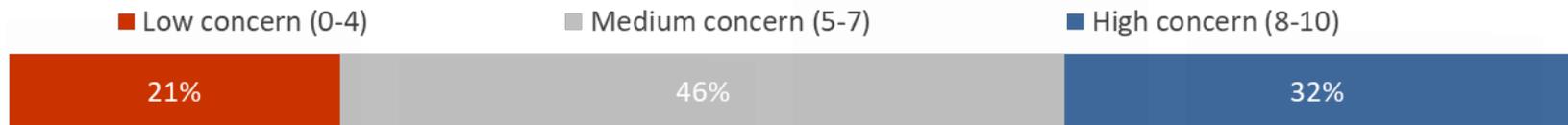
- This doesn't mean we need to make every decision **today**



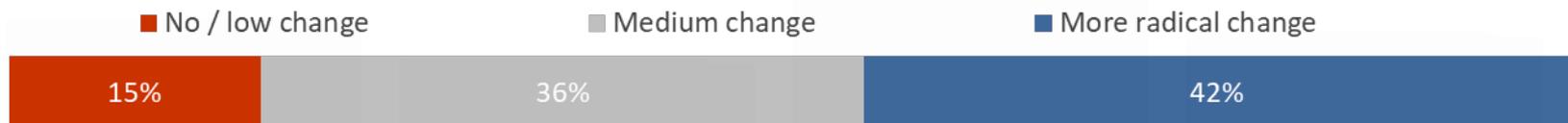
Three in four Aucklanders (75%) believe that human activity is changing the climate.



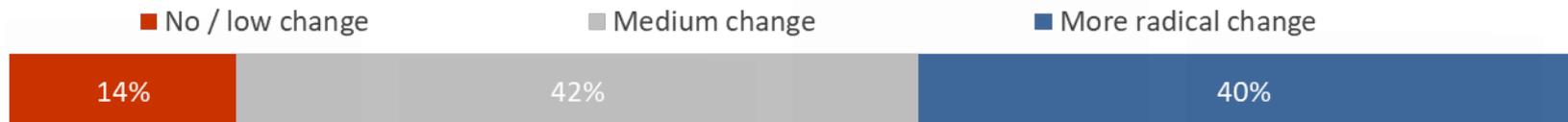
One in three Aucklanders express a high level of concern about the impact of climate change on Auckland, whereas 46% express moderate concern.



There is widespread recognition that Auckland must make changes to meet our climate commitments, with 42% seeing a need for more radical change.



Most Aucklanders are willing to change their lifestyle to ensure we meet our climate commitments, with two in five willing to make radical change.



## THREE PILLARS

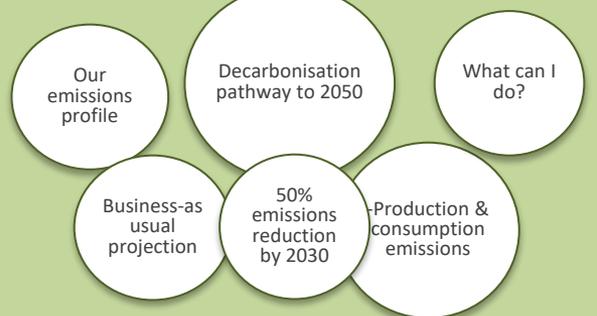
A Tāmaki response  
*Our story*

What are we talking about?



Reducing our emissions  
*Mitigation*

What are we talking about?



Preparing for change  
*Adaptation*

What are we talking about?



## EIGHT PRIORITIES



# Sarah Sinclair, Chief Engineer, Infrastructure and Environmental Services

# Climate Change Mitigation

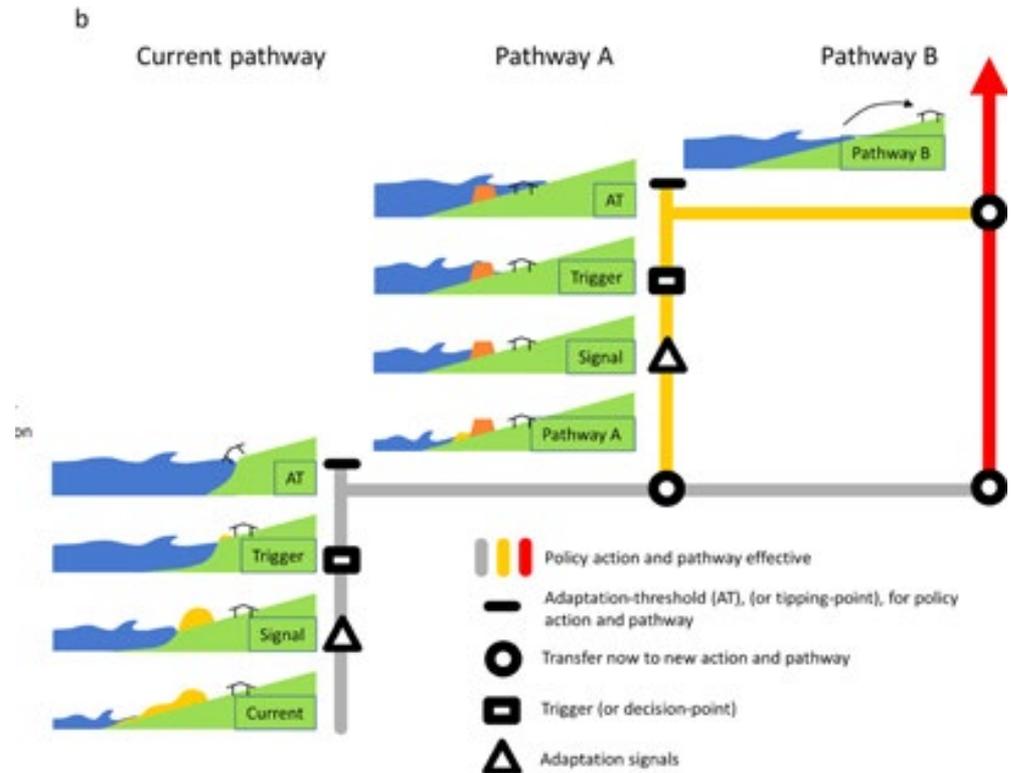
“incrementalism is the enemy of everything we are trying to achieve”

Sir Jonathan Porritt, last week in Auckland

Adaptation is the right decision at the right time

### Dynamic Adaptive Policy Pathways (DAPP)

- Keeping options open for the future
- Avoidance of lock-in
- Identification of clear triggers
- Transparency on how and when decisions are made



# Wicked Problems take broad approaches

All of Council delivery framework



Governance and leadership



Emergency response and planning



Strategy, policy and planning



Knowledge and research



Regulations and consents



Communication, education and community resilience building



Asset management



Partnerships

# We are acting now

- Data and knowledge
- Policy setting
- Infrastructure delivery
- Infrastructure planning
- Partnership opportunities
- Stakeholder engagement

# RIMU

Research and  
Evaluation Unit

Thank you for your interest.

[www.knowledgeauckland.org.nz](http://www.knowledgeauckland.org.nz)

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