Climate change and coasts: impacts, vulnerability and the need for adaptation

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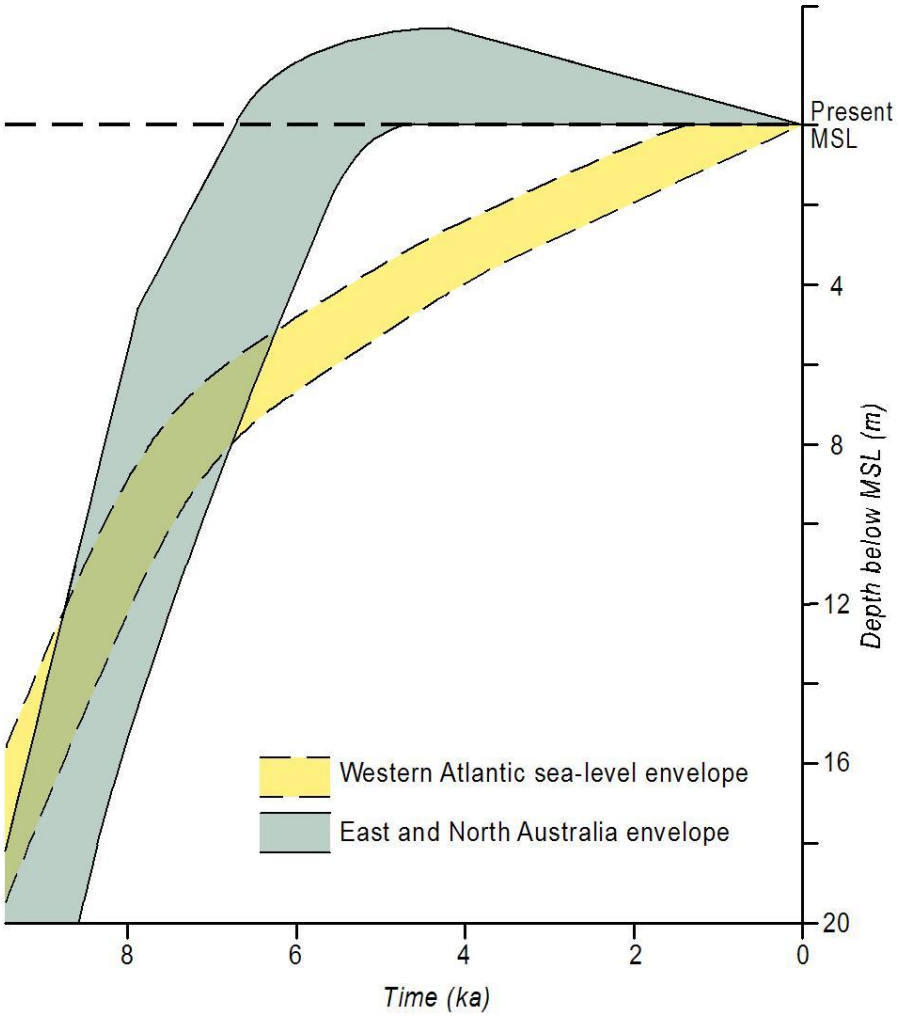
Valuing the Coast

- ***Environmental*** – geological constructs and habitat for fauna and flora
- Benefits to ***society*** in terms of amenity and the ***economic*** opportunities that arise
- Valued ***culturally*** by creating a sense of place or supporting traditional livelihoods

Context for change – our coastal environment

- Relatively stable sea levels for 6000 years but that is changing



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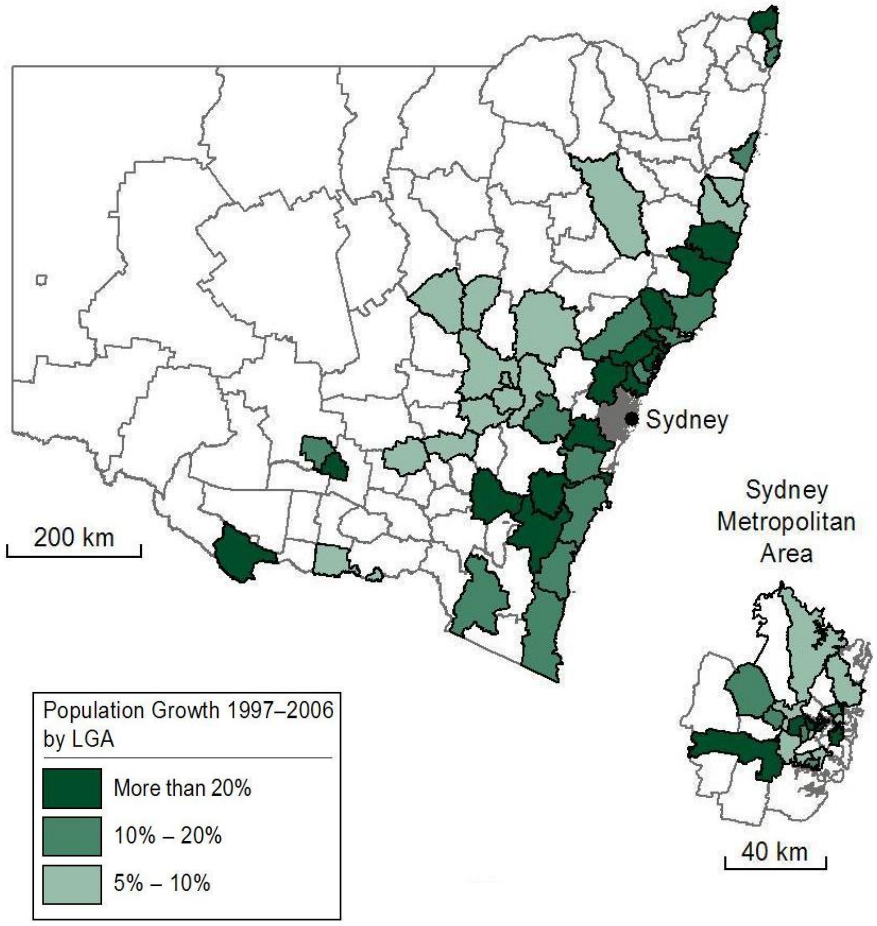
Context for change – our coastal environment

- Rapidly growing population in the coastal zone with 85% of Australians living within 50km of the coast



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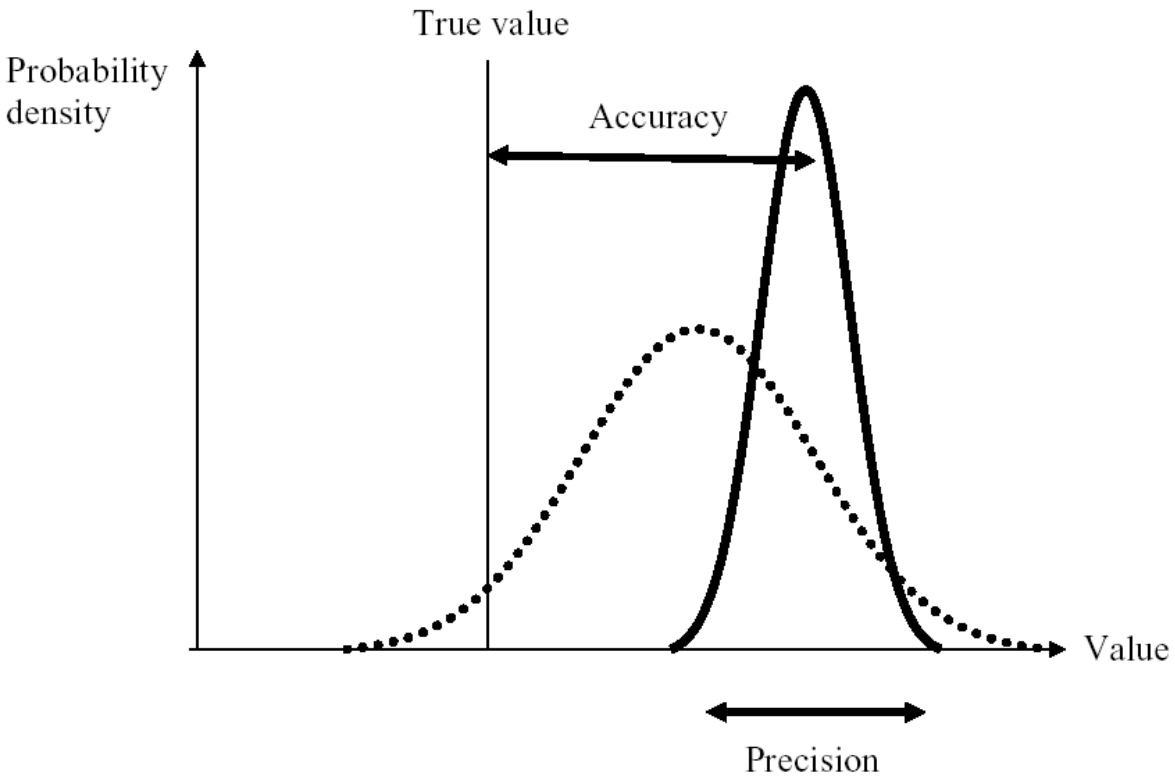
Context for change – our coastal environment

- Greatly modified coastal shoreline and marine environment

Assessing the impacts of climate change

- Local government, planners and industry are increasingly calling for more accurate climate projections at finer scales of resolution



The challenge of irreducible uncertainties

- Yet the accuracy of climate projections is limited by fundamental, irreducible uncertainties (Dessai et al 2008)
  - Climate system knowledge, chaotic processes
  - Uncertainty about future greenhouse gas emissions
- This uncertainty in climate projections cascades when conducting impacts assessments

Making decisions in the face of uncertainty

- Decisions can be made (and are made) without accurate predictions of the future
- Better to use a range of plausible scenarios combining climate projections and other factors to explore outcomes and risks
- Scenarios can be used to explore vulnerability and adaptation

Scenarios for the future – sea level rise and the NCVA

Year	Scenario 1 (B1)	Scenario 2 (A1FI)	Scenario 3 (High end)
2030	0.132	0.146	0.200
2070	0.333	0.471	0.700
2100	0.496	0.819	1.100

Climate change impacts - inundation risk

- Major risk is combined effect of storm events + sea level rise
- 2030 - One in 100 year events will occur every twenty years
- 2070 – One in 100 year events closer to an annual frequency

Climate change impacts - inundation risk

King tides + sea level rise: impacts are now

Torres Strait – January 2009

Torres Strait – January 2010

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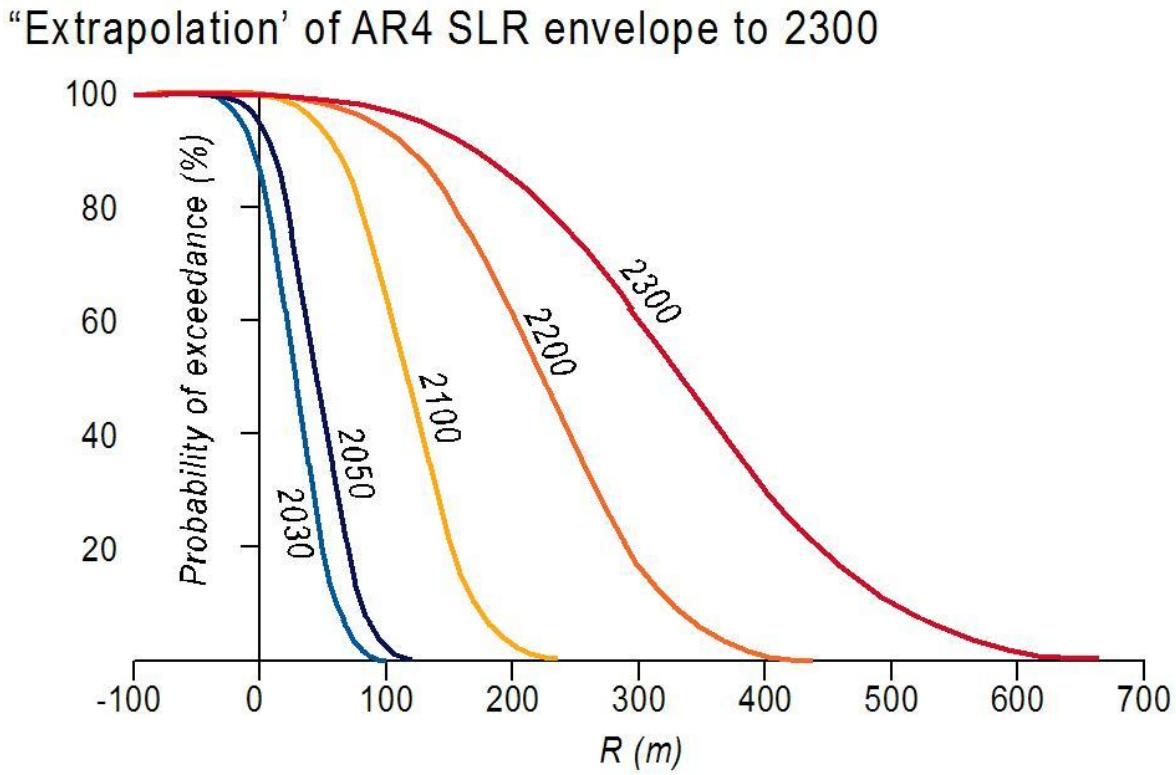
Climate change impacts - shoreline recession

- One metre of sea level rise can lead to 50-100m of recession
- Coastal erosion



Lake Macquarie Beach

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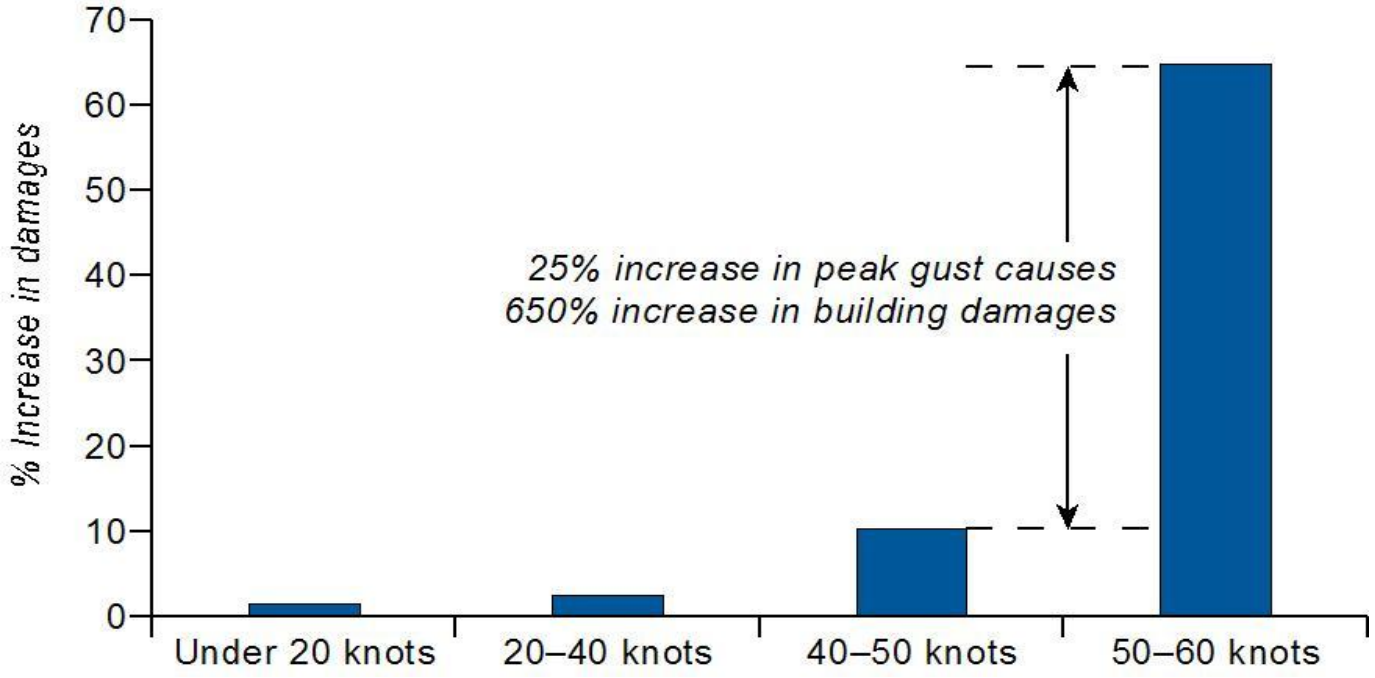
Climate change impacts – wind events



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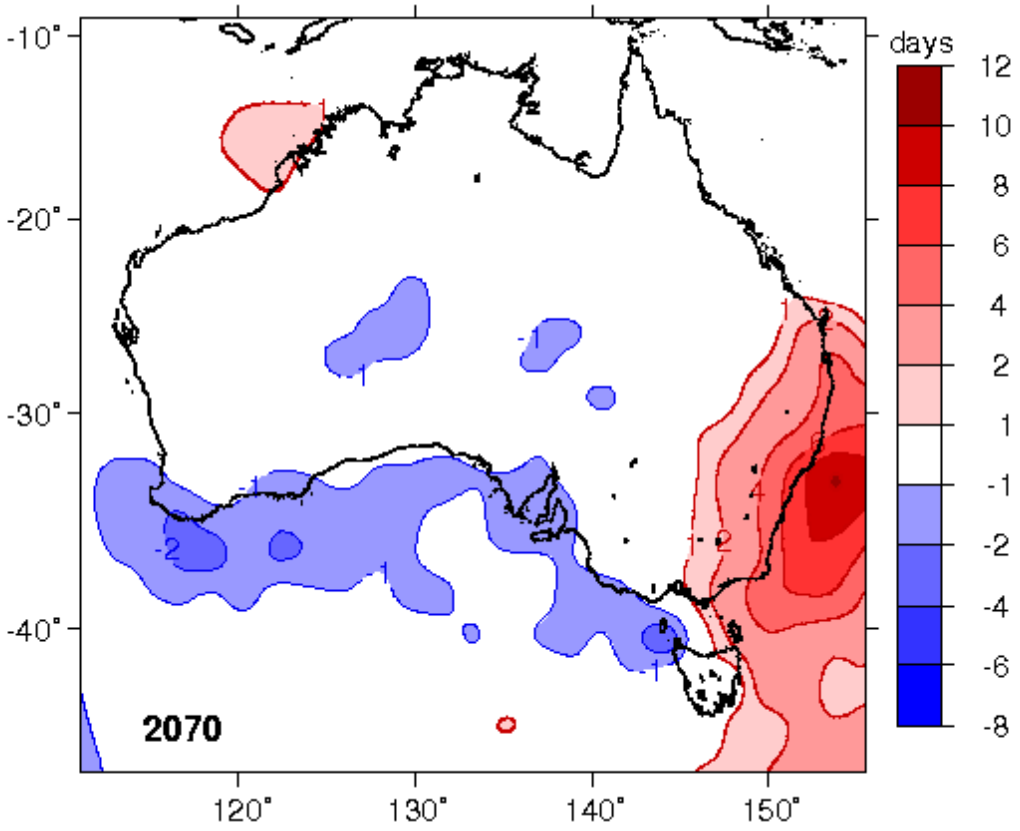
Climate change impacts – hail

2070 - A2 Scenario

- 8 extra hail days per year
- Return period of large hail (>6 cm) reduces from 8 years to 5 years



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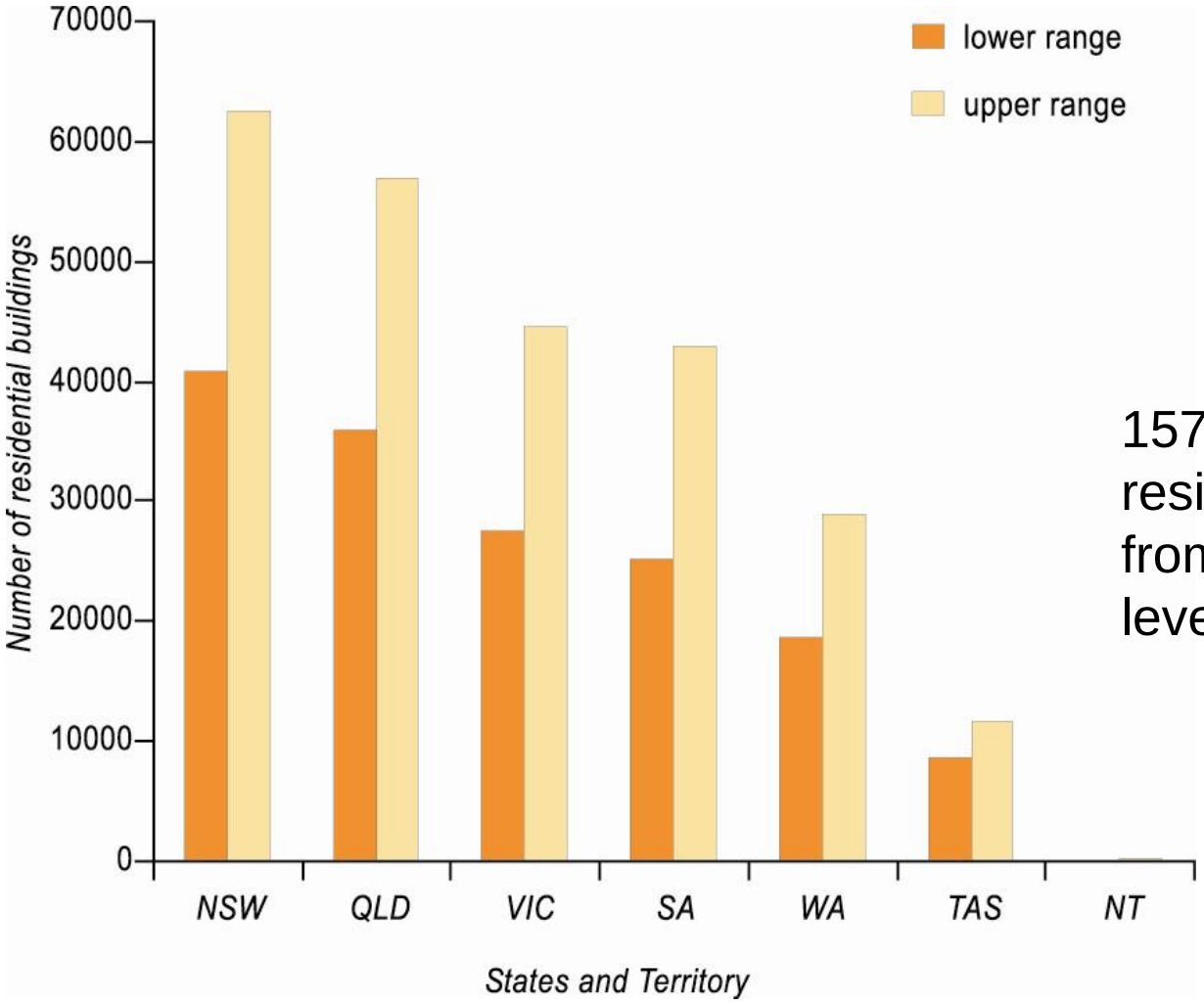
Climate change impacts – extreme heat

SE Australia heatwave, 28-30th Jan 2009

- >200 premature deaths in SE Australia + much morbidity
- Power blackouts to >500k buildings
- Transport disruptions (24% of Melbourne trains cancelled; $5m in fines) and damage to transport infrastructure
- Damage to fruit and vegetable growers est. $tens of millions
- Victorian electricity demand hit record high 2000MW>normal Feb

The frequency of such events is likely to at least triple in southern Australia by 2070

Implications for Infrastructure and Settlements



157,000 – 248,000 residences at risk from a 1.1m sea level rise

Critical Infrastructure

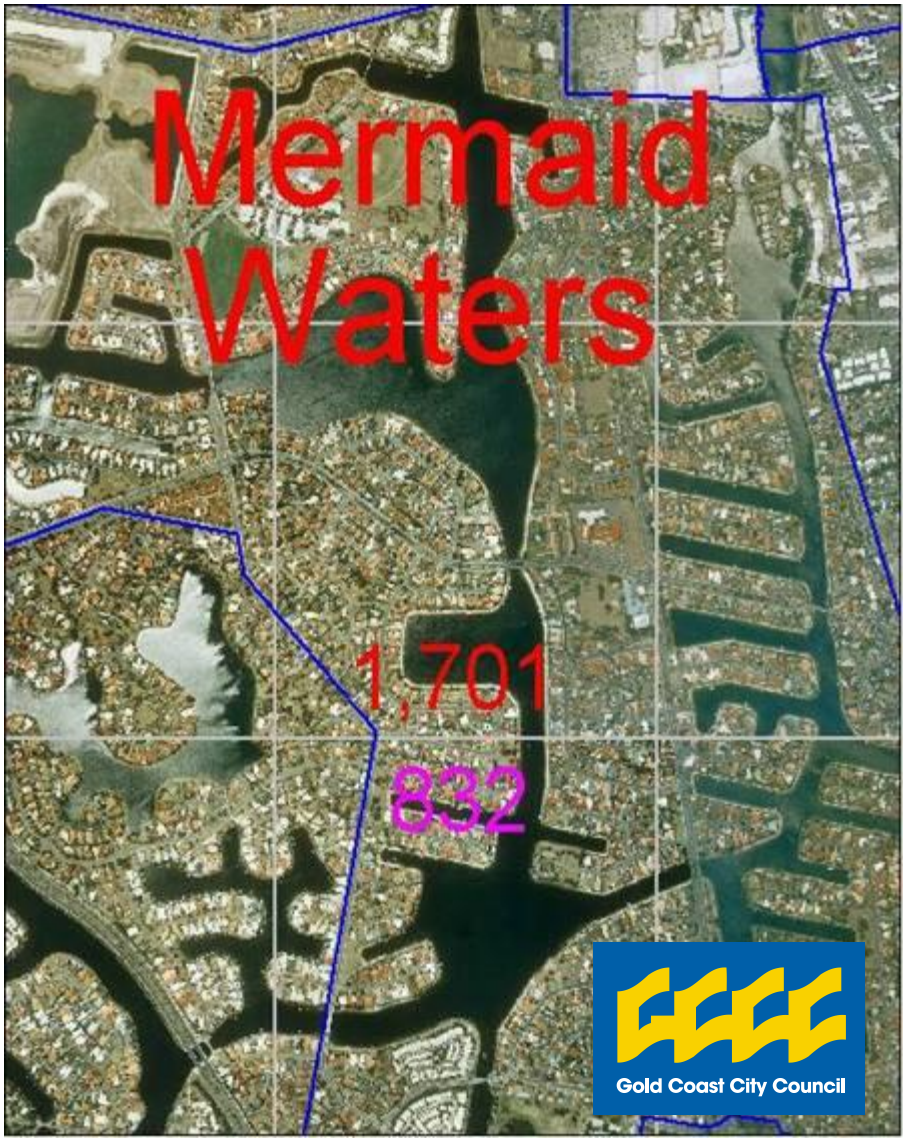
	Within 200m of the coastl
Regional infrastructure	120 ports 5 power stations/substations 3 water treatment plants 170 unidentified industrial zone 1,800 bridges

Other infrastructure and industry impacts

- Energy management – demand and supply
- Industry
  - Tourism
  - Oil & Gas
  - Fishing and aquaculture

Economic Impacts of Climate Change

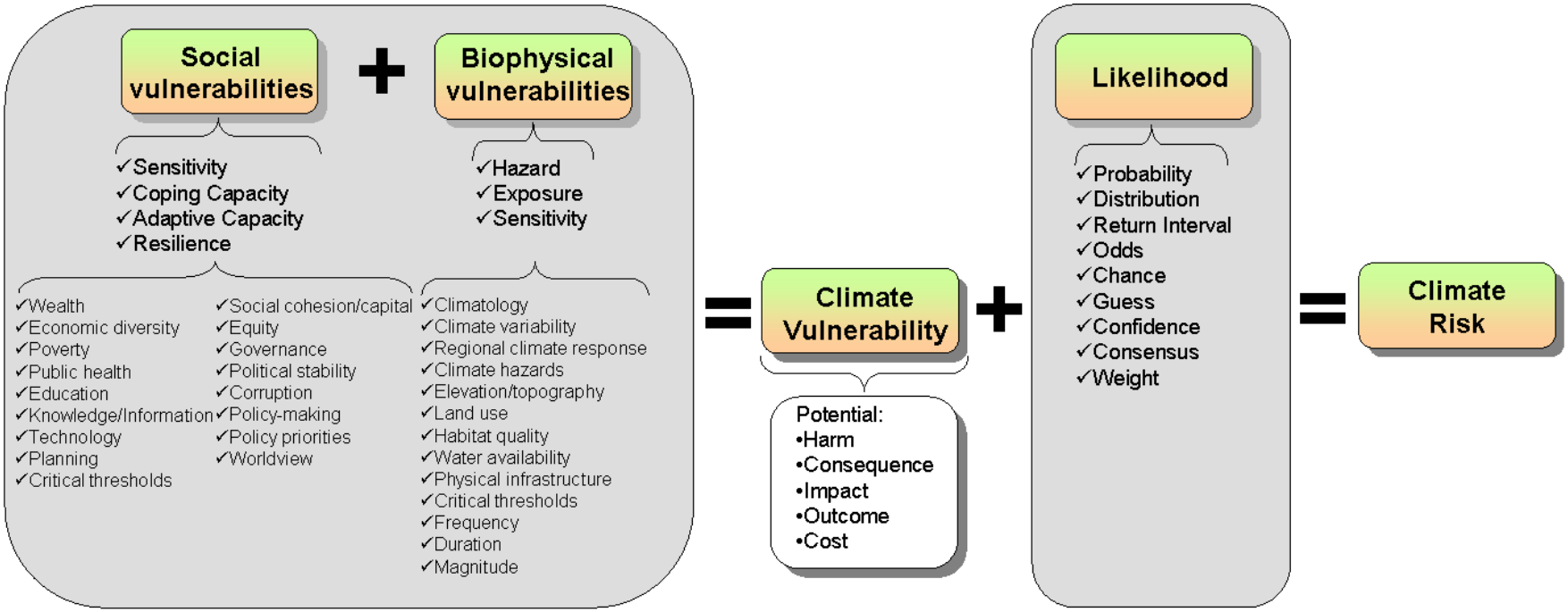
- Currently 4500 properties are flood prone - $140M damages
- 20% increase in rainfall from extreme events → 7000 properties - $235M



Ecosystem impacts

- Coastal landforms
  - wave action and erosion
- Estuaries and associated wetlands
- Coral reefs
- Constrained tidal flats and coastal squeeze
- Thresholds and non-equilibrium systems

Assessing risk and vulnerability



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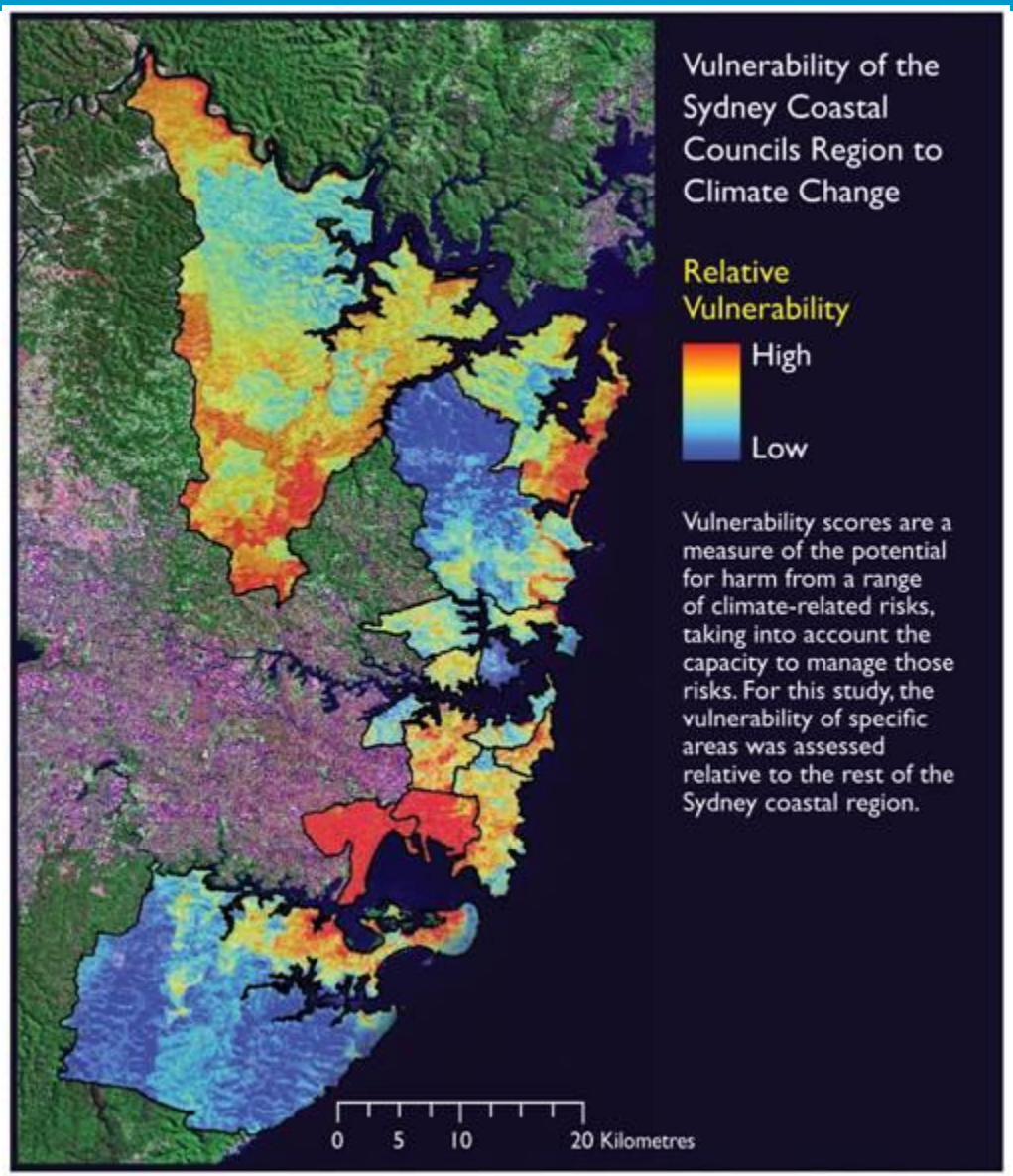
Assessing risk and vulnerability



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Assessing risk and vulnerability

- Current focus in coastal councils on sea level rise
- Getting too fixated on a single “number”; need a scenario approach, e.g. 50, 80, 110 cm and also consider sea level rise in the context of other drivers
- Need to assess risk for different planning decisions

- Vulnerability assessments need to be informed by adaptation responses

Adaptation is an increasing priority

- The science is clear – coastal impacts are unavoidable
- Increased focus on adaptation is required to support
  - Planning
  - Engineering
  - Critical infrastructure design
  - Ecosystem management

Adaptation - top-down, bottom-up

- Adaptation is largely local and regional

  BUT

- We need the right top-down policy approaches,
- Consistency,
- Co-operative governance model

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Diversity of adaptation responses is required

- Event protection
  - Soft e.g. sand pumping
  - Hard e.g. sea walls, barrages
  - Natural barriers
- Damage protection
  - Harm minimisation e.g. cyclone building codes, flood barriers

Diversity of adaptation responses is required

- Planned avoidance
  - Planning and building codes
- Loss distribution
  - Insurance
  - Government support for losses
  - Disaster relief
- Acceptance
  - Planned retreat

Conclusions

- The coastal zone is highly vulnerable to climate change
- Impacts are likely to accelerate in coming decades
- While there are many uncertainties in the impacts this should not be a reason to delay action in adaptation
- Planned, integrated adaptation response needed which includes no regrets, investment now for the future, and responses that can wait until changes become more evident