Adaptation of forest management to climate change in the Asia Pacific region

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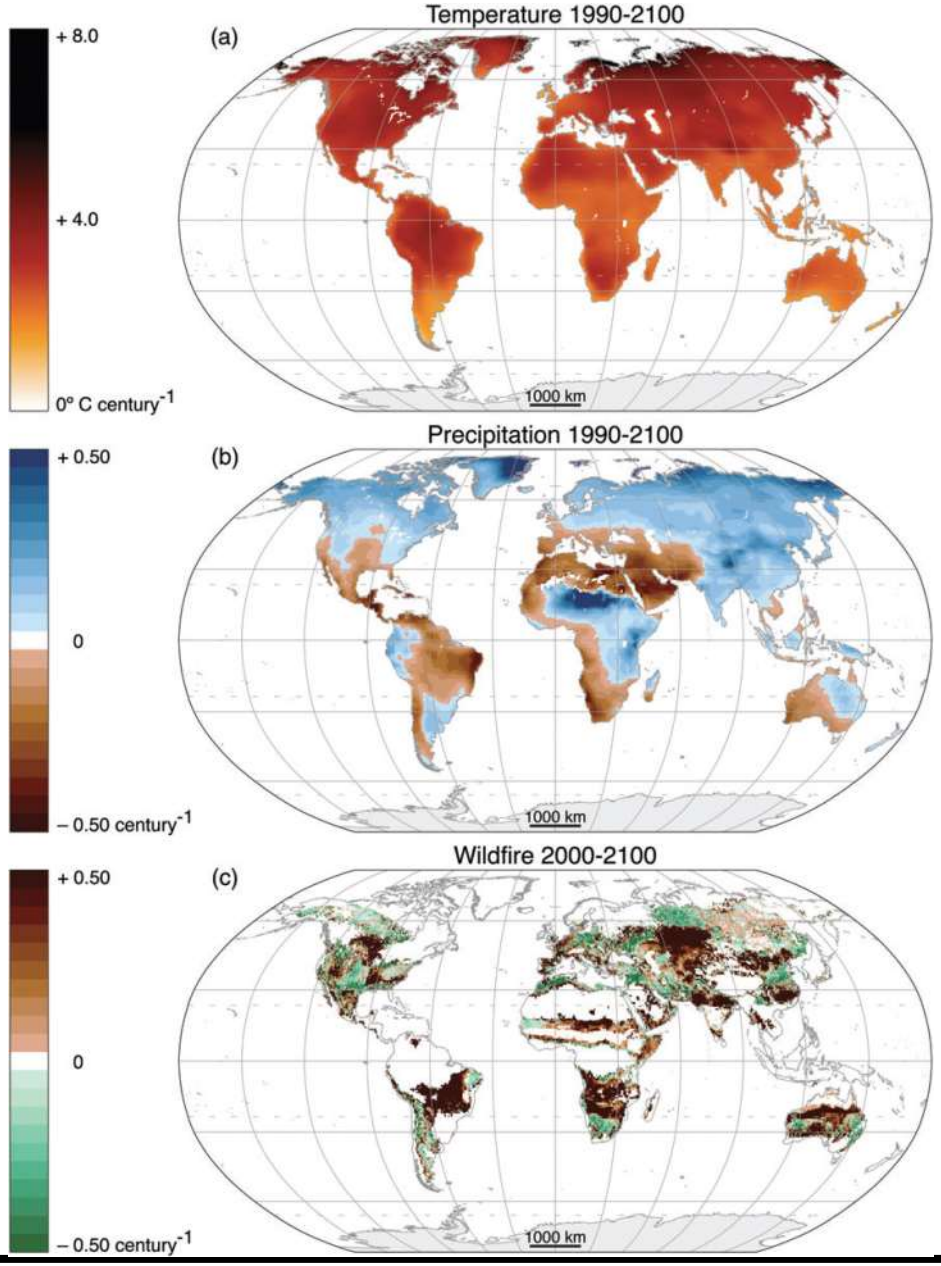
Outline

- Key vulnerabilities to climate change for forests and people in the Asia Pacific region
- Adaptation principles and issues
- Adaptation options

Future climates



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Gonzalez et al 2010 Global Ecology and Biogeography

Climate impacts in AP region

- AP region will warm faster than the global average and experience some of the most severe climate change impacts
- Future changes are highly variable within the region: diversity of biomes, topography and local weather and the influence of large-scale drivers such as the ENSO and the Indian Ocean Dipole
- Major climate systems and seasonal events are expected to shift, including changes in the arrival time and intensity of the Asian monsoon, and an increase in frequency and/or intensity of extreme weather events
- Changes in climate have already occurred in some areas: increased temperature, decreases overall rainfall, altered seasonal patterns
- More drought, intense flooding, landslides, soil erosion, and risk and severity of forest fires with detrimental effects on forest ecosystems

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Wang et al 2015 J. Geograph. Research

Impacts on people

- Poor and marginalized societies are often the most vulnerable to climate change
- AP region has over half the worlds poor who are highly dependent on climate sensitive production systems
- Climate change will impact on est. 450 million people in the region who directly depend on forests for their livelihood
- Many others in established and emerging industries depending on forests

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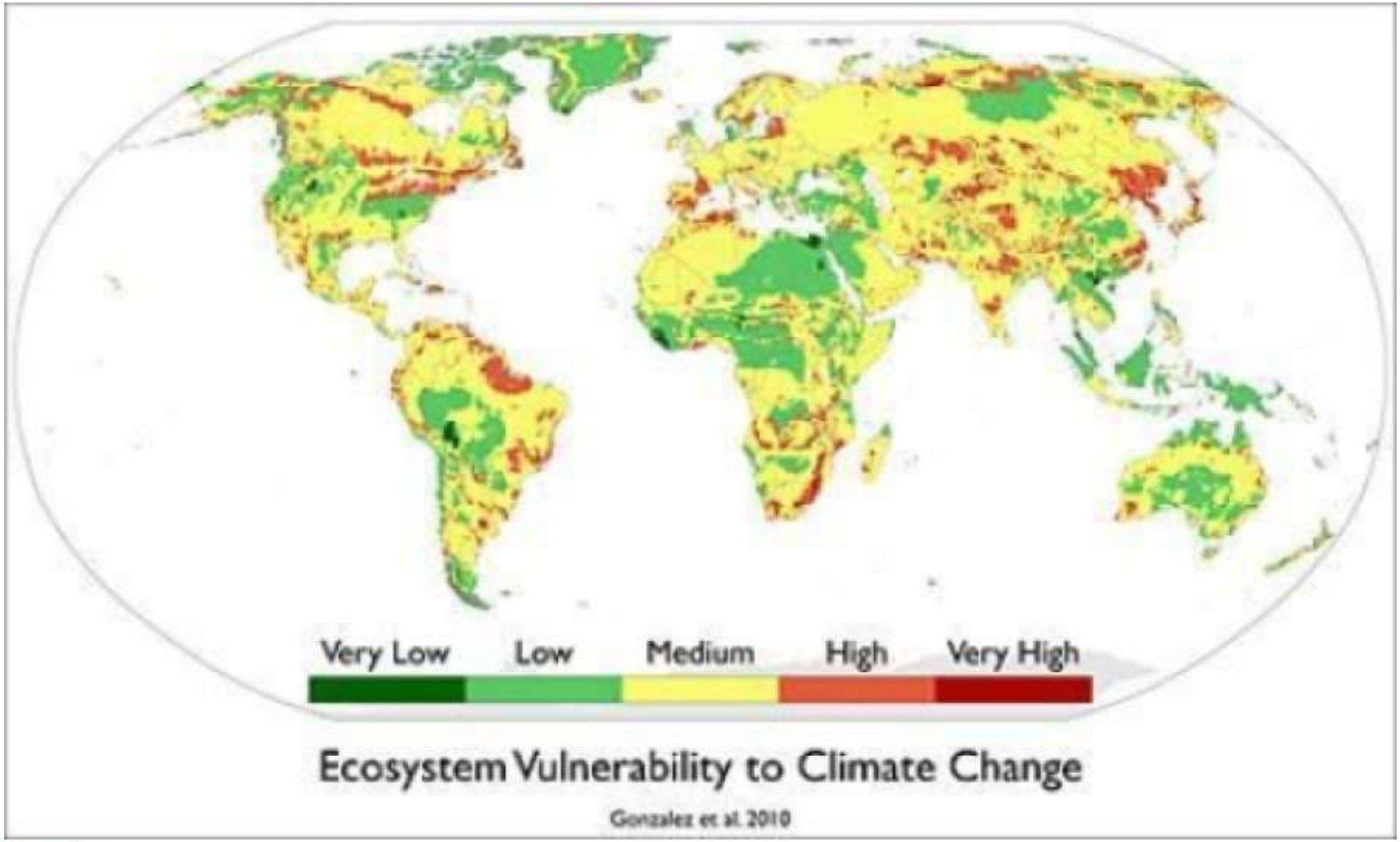
Forest responses to climate change

- Increased CO2, inc. temperature, rainfall variability

	FAST	SLOW
INDIRECT	Fire frequency/intensity More disease More insect pests More invasives Water quality	Habitat composition and structure Wood supply Erosion Water yield
DIRECT	Photosynthesis Water use/transp. Flowering/phenology Regeneration Wood density/quality Growth and mortality Frost/storm damage	Decomposition Tree nutrient status Genetic change Species distribution/ local extinction

Ecosystem goods and services

Vulnerability assessment



Gonzalez et al 2010 Global Ecology and Biogeography 19, 755–768

ADAPTATION

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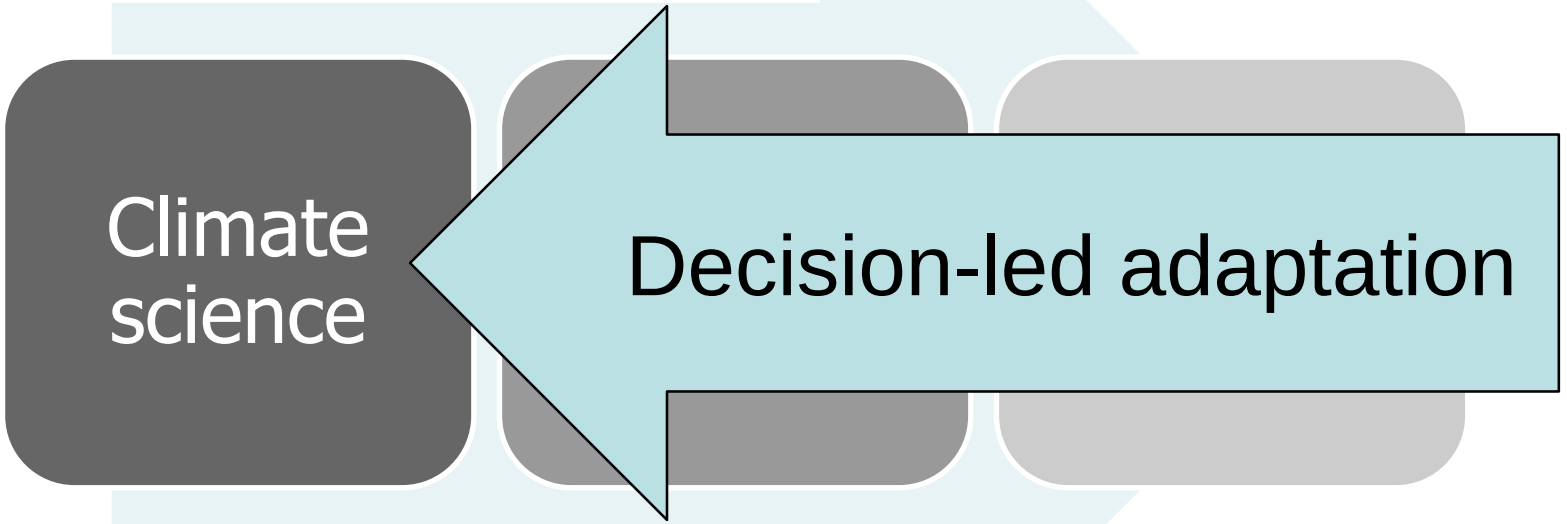
Wheaton E., D.C.MacIver. 1999. A Framework and Key Questions for Adapting to Climate Variability and Change. Mitigation and Adaptation Strategies for Global Change 4: 215-225.

Principles for adaptation in forest management

- **Emphasis on maintaining ecological function, rather than forest structure or composition**
- **Multiple options can meet future goals**
  1. **Build <u>resistance</u> to change**
     1. **eg. rare, high value species or older plantation forest**
  2. **Promote <u>resilience</u> to allow recovery of functions**
  3. **Enable forests to <u>respond</u> to climate change**
- **Avoid unnecessary, insufficient, misguided, or mal-adaptive options**

Millar et al 2007 Ecol. Applic. ,Wood et al 2010 NCCARF report


Climate science
Decision-led adaptation

Implications of decision-led approach for forest managers

- Understand drivers of climate in your region
- Understand sensitivities of key species and ecosystems to climate variables
- Beyond simple measures like mean annual temperature or percentage shifts in rainfall
- Linking local knowledge of impact with understanding of the global climate system

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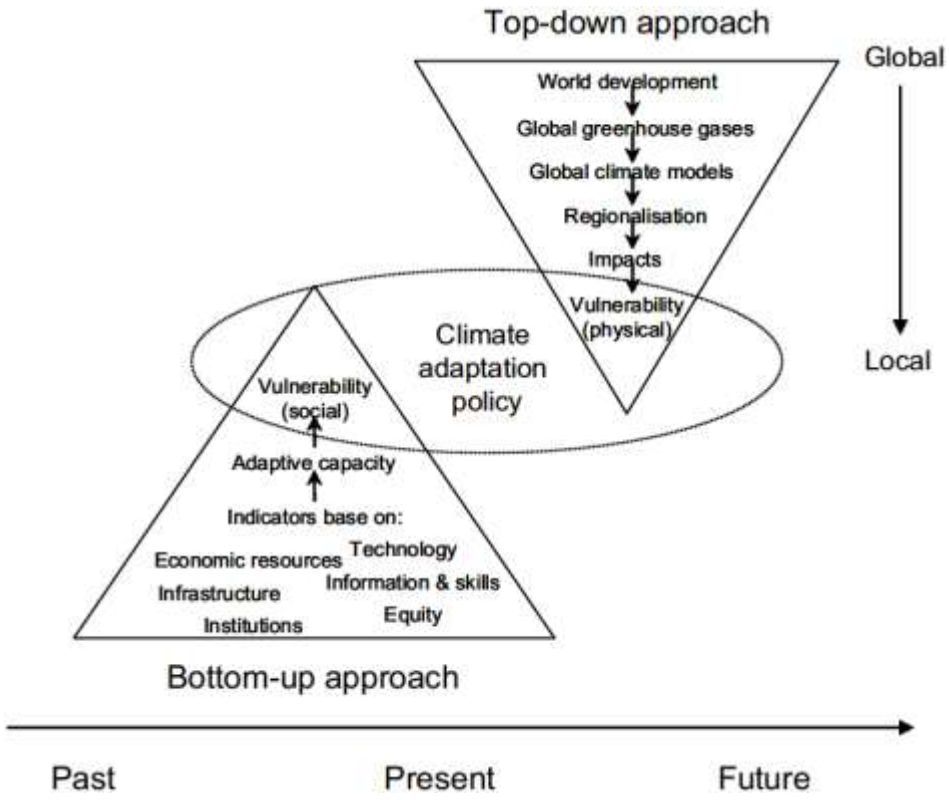
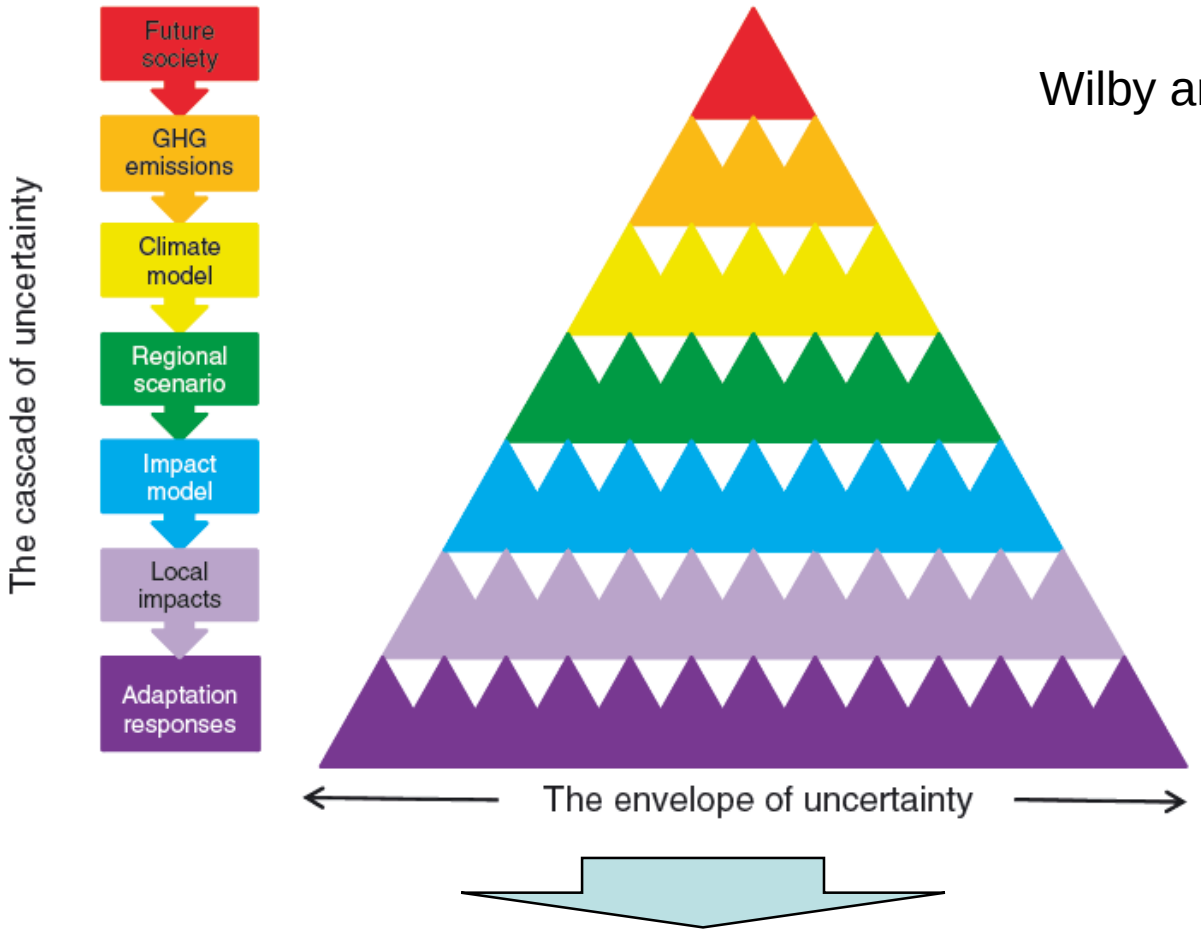
Systems approach to vulnerability assessment



Ciurean et al 2013 Conceptual Frameworks of Vulnerability Assessments for Natural Disasters Reduction

Dealing with uncertainty



Wilby and Dessaix 2010

Robust decisions under multiple scenarios

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Assessing potential impacts on species – high uncertainty!

Lots of SDM modelling but

- **Can species really move?**
- **Likely future climate – precipitation highly uncertain?**
- **Models generally do not include flowering, fruiting and important life history traits or effects of extreme events or gene flow within species or effects of insect pests and disease, dependence on other plants or animals for reproduction or competition within and between species**
- **Evidence that many species have local adaptation capacity**

Implications for forest management

Forest management objectives have always been a moving target. Climate change means

1. redefining goals for future climate

2. Adjusting management to meet current goals in a range of future climate conditions

Examples of new management

- **More flexible targets for wood or water supply**
- **Enhancing the capacity of vulnerable people or places**
- **Supporting industry to harness new opportunities presented through a changing climate**

Adaptation options – practice SFM!

Biodiversity conservation

- Minimise habitat fragmentation and maintain connectivity
- Protect representative forest types in reserves
- Increase reserve size
- Protect primary forests
- Protect climate refugia
- More dynamic reserve boundaries
- More structural complexity to increase habitat value
- Identify and protect functional groups and keystone species
- Protect highly threatened or rare species ex-situ

Forest health

- Manage fire risks
- Increase prescribed burning in dry forests
- Monitor and manage pests and disease

Productive capacity

- Ensure effective regeneration
- Maintain seed banks (in soil, trees or ex-situ)
- Thinning to reduce water stress
- Reduced impact logging
- Plantation based short rotations

Soil and water

- Implement and maintain stream buffers
- Maintain/decommission roads to minimise sediment run-off
- Minimise soil disturbance during harvest

Socio-economic benefits

- Diversify local and regional economies

- ***Increase diversity, connectivity, flexibility***
- ***Monitor, plan for and manage risks such as fire, heat, insects, disease, drought on trees, people and infrastructure***

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Keenan and Nitschke 2016 **Forest management options for adaptation to climate change: a case study of tall, wet eucalypt forests in Victoria's Central Highlands region. Australian Forestry 1-12.**

Example: reducing wild fire risk at regional scale

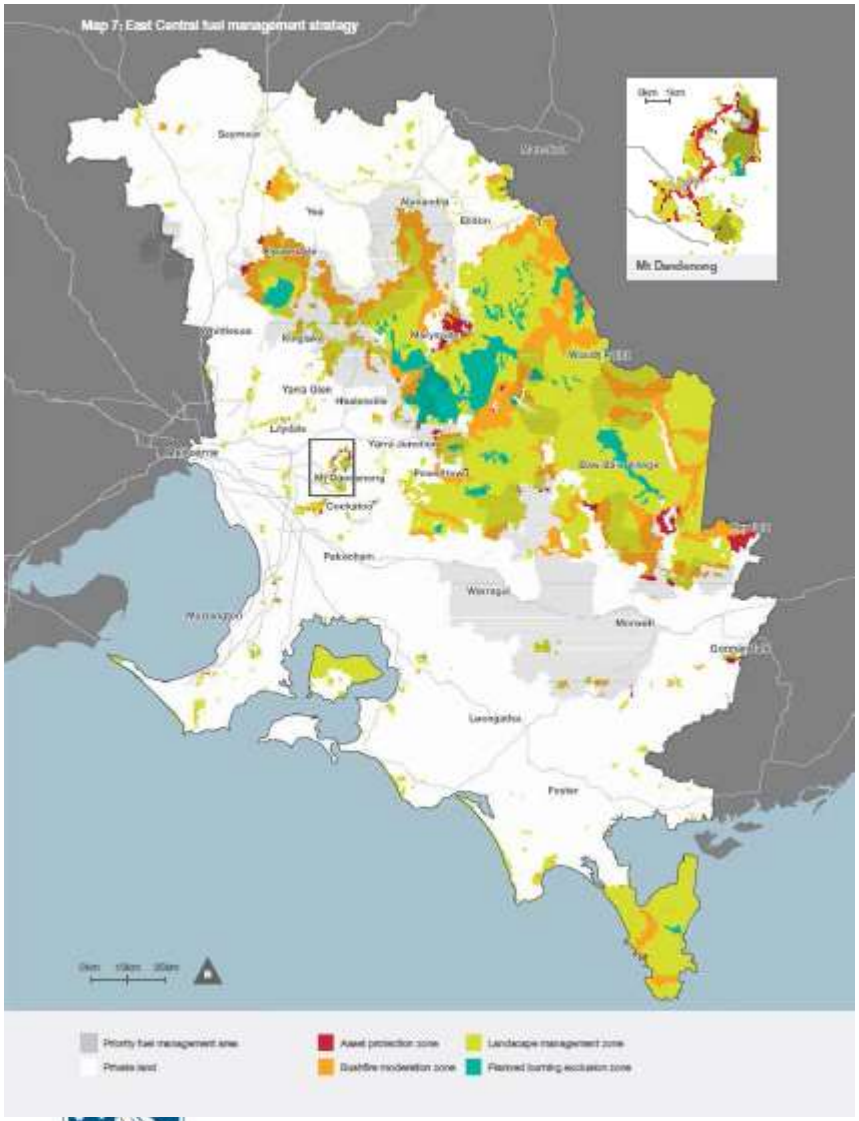
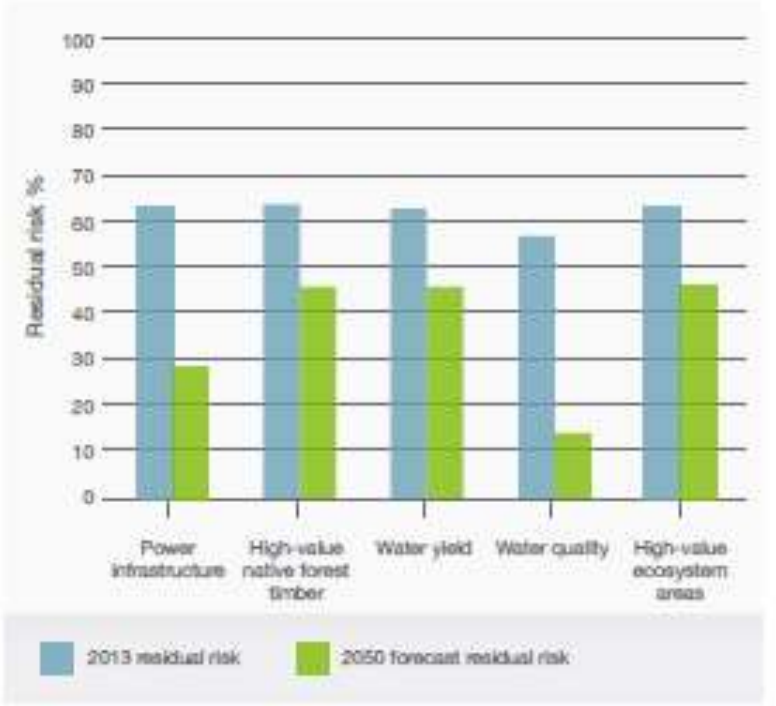


Figure 3: Risk reduction for priority infrastructure, high-value native forest timber and high-value ecosystem areas



- ***Identify assets and risks to assets under future climate***
- ***Test management options using fire models***
- ***Assess risk reduction under new management***

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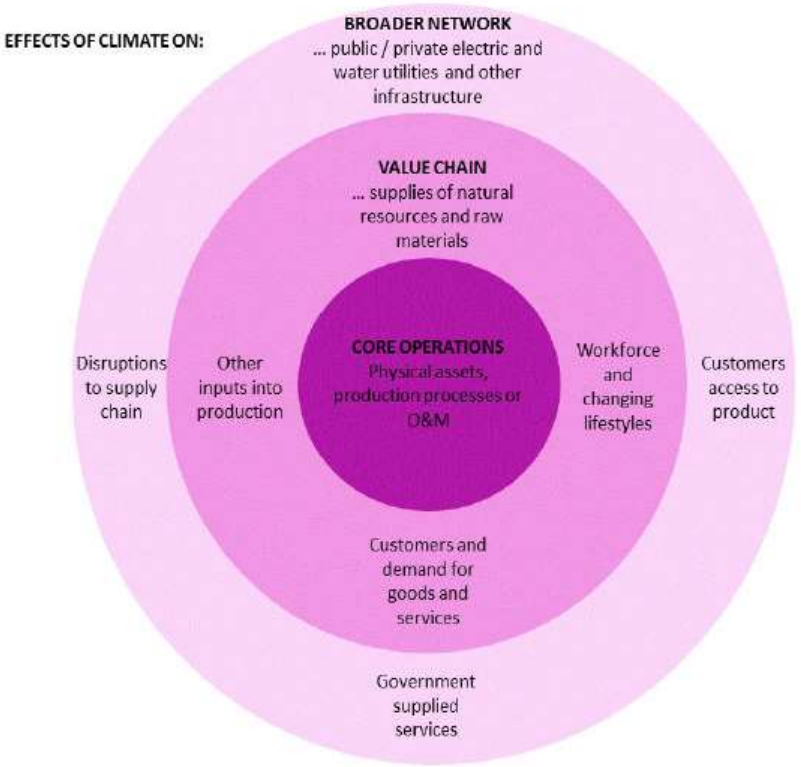
For forest industries



The risk disc Young and Jones 2013

Consider

- **Direct impacts on resource, workforce and capital assets**
- **Impacts on supply chains, customers and public infrastructure**
- **Impacts on competitors, often located in other regions or countries**

Forest adaptation policy

- **Flexible objectives, reviewed regularly**
- **Cross-tenure approaches to management and conservation**
- **Integrated with other sectors: agriculture, urban planning, infrastructure, health**

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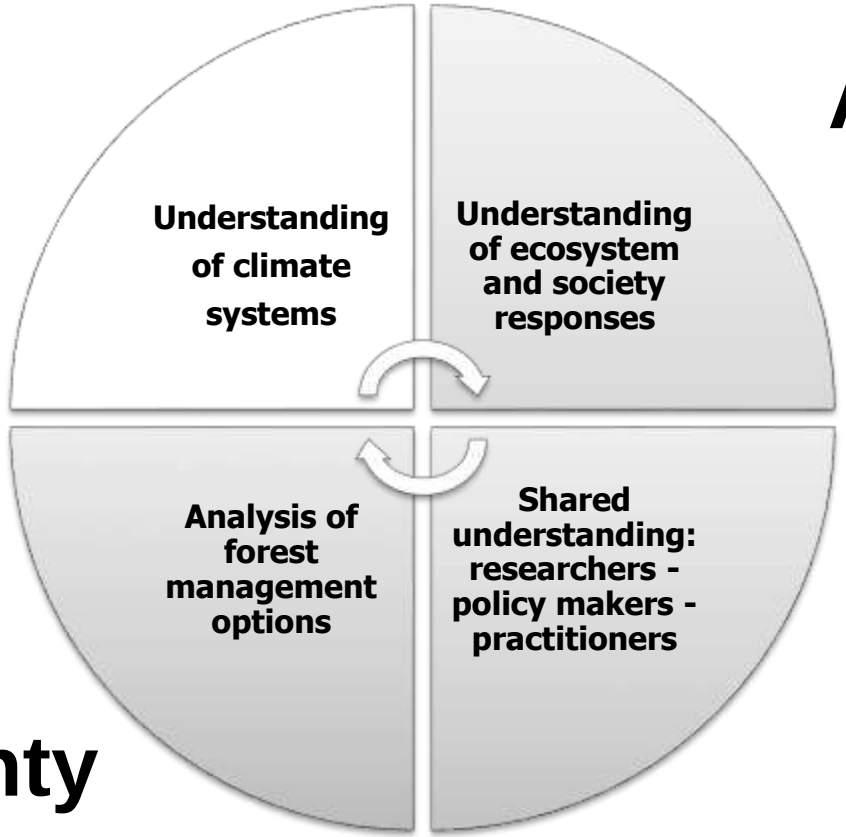
Climate smart forest management

Learn

Anticipate



Embrace uncertainty

Share

Keenan 2015 adapted from Nitschke and Hickey 2008