

NCCARF

National
Climate Change Adaptation
Research Facility

Adaptation Research Network
TERRESTRIAL BIODIVERSITY



Australian Government
Department of Climate Change



Queensland
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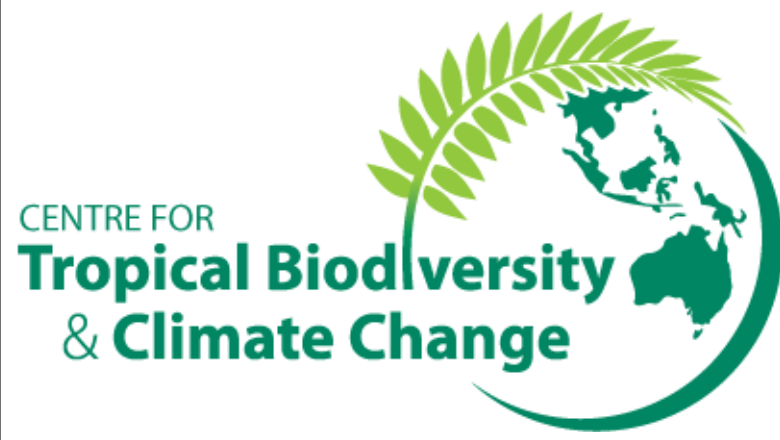


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Centre for Tropical Biodiversity & Climate Change
School of Marine & Tropical Biology
James Cook University
Townsville, Australia



Today's agenda

- National Overview – Steve Williams
- Network – Yvette Williams
- CSIRO Climate Adaptation Flagship & NCCARF – Trevor Booth
- Adaptation science:
 - Brendan Mackey (ANU) – Climate change and drought
 - Bob Webb (ANU) – Priorities in the ACT
- Stakeholders:
 - John Higgins (DCCEE)
 - Eliza Murray (DSEWPC)
 - John Hibberd (ACT Conservation Council)
- Workshop session



Why have a Roadshow?

Why are we here?

- Roadshow across Australia in each state/node
- Scope of workshop:
 - What is adaptation?
 - Sector / State / Regional / Ecosystem priorities
 - Increase stakeholder involvement in network
- How can involvement benefit everyone concerned?
- Outcomes:
 - Raising awareness and participation in NCCARF & the Terrestrial Biodiversity network
 - Increased networking/collaboration between research & stakeholder groups
 - Summary of each node workshop – network website / DCCEE
 - Report collating results across all nodes



How do YOU think the national priorities fit your ecosystem / region / sector?

- Are there any serious omissions?
- What are the priorities / challenges in your area of interest ?
- What research is needed to have the knowledge to make the best possible choices about adaptation?
- What are the main impediments?





Global Climate Change & Terrestrial Biodiversity



Is the global
climate changing
and are people
causing it?

YES !!!

New summary report by the Australian Academy of Science

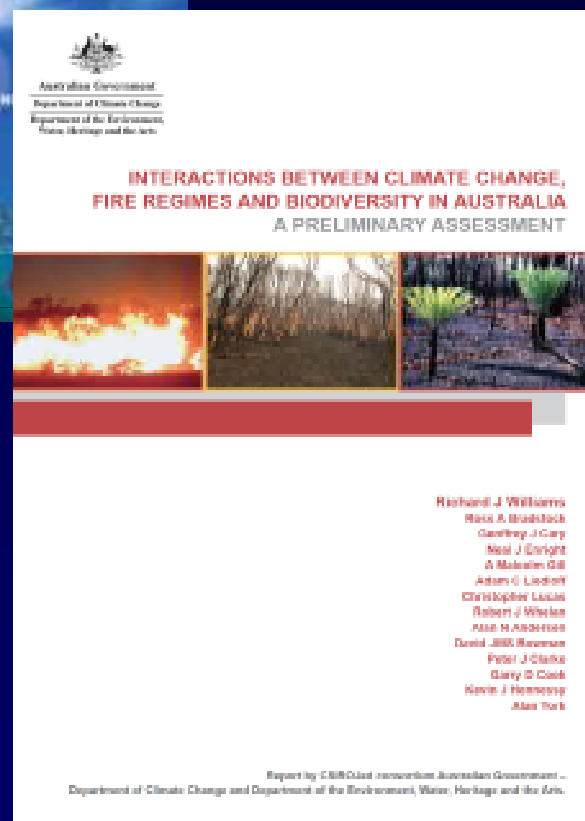
The background image is a landscape photograph showing a body of water in the foreground, with rolling hills or dunes in the middle ground, and a range of mountains in the distance. The sky is filled with dark, heavy clouds, with some rain visible falling from the clouds over the mountains.

The Science of Climate Change Questions and Answers

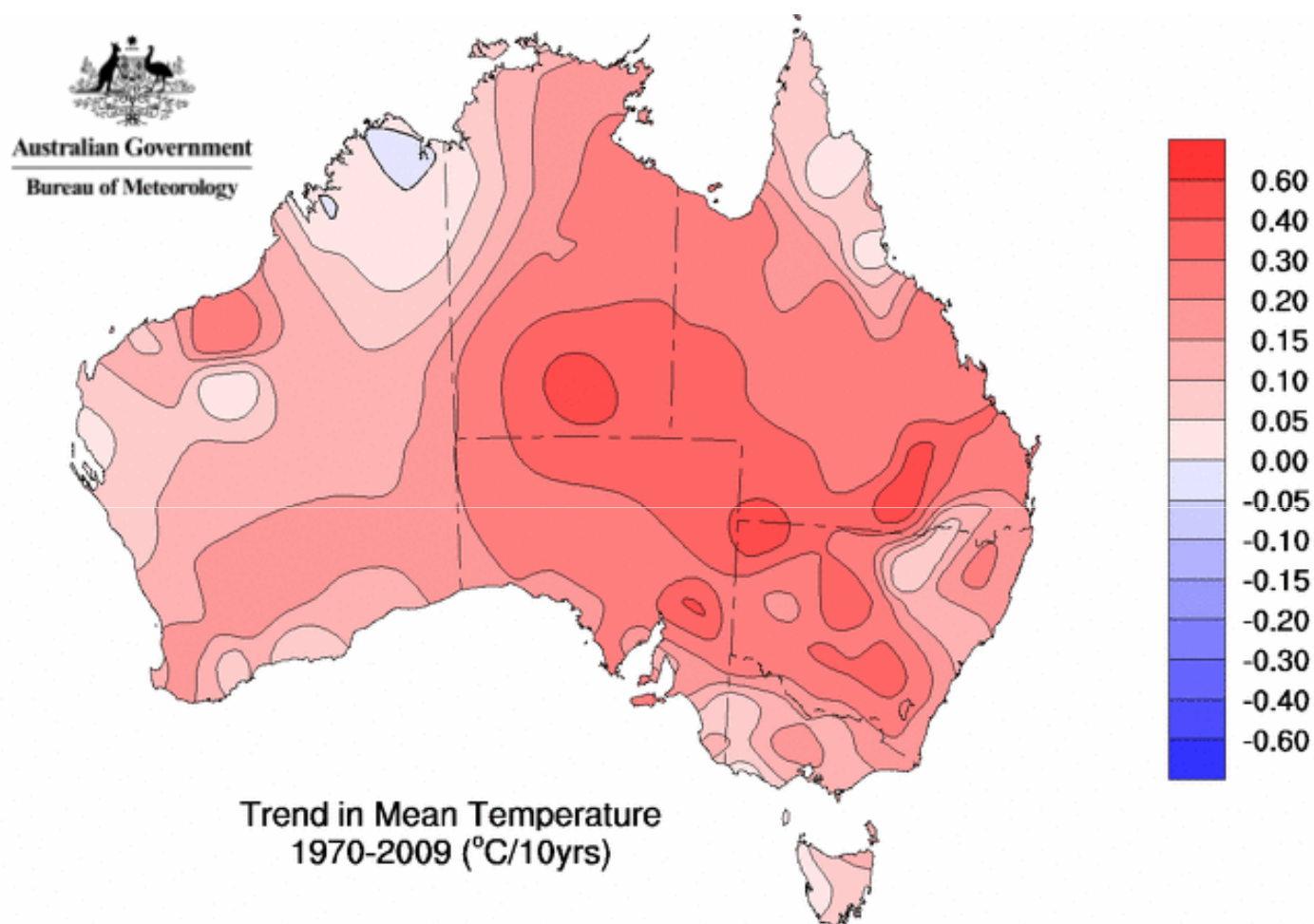


Australian Academy of Science

August 2010



Current Trends - Temperature

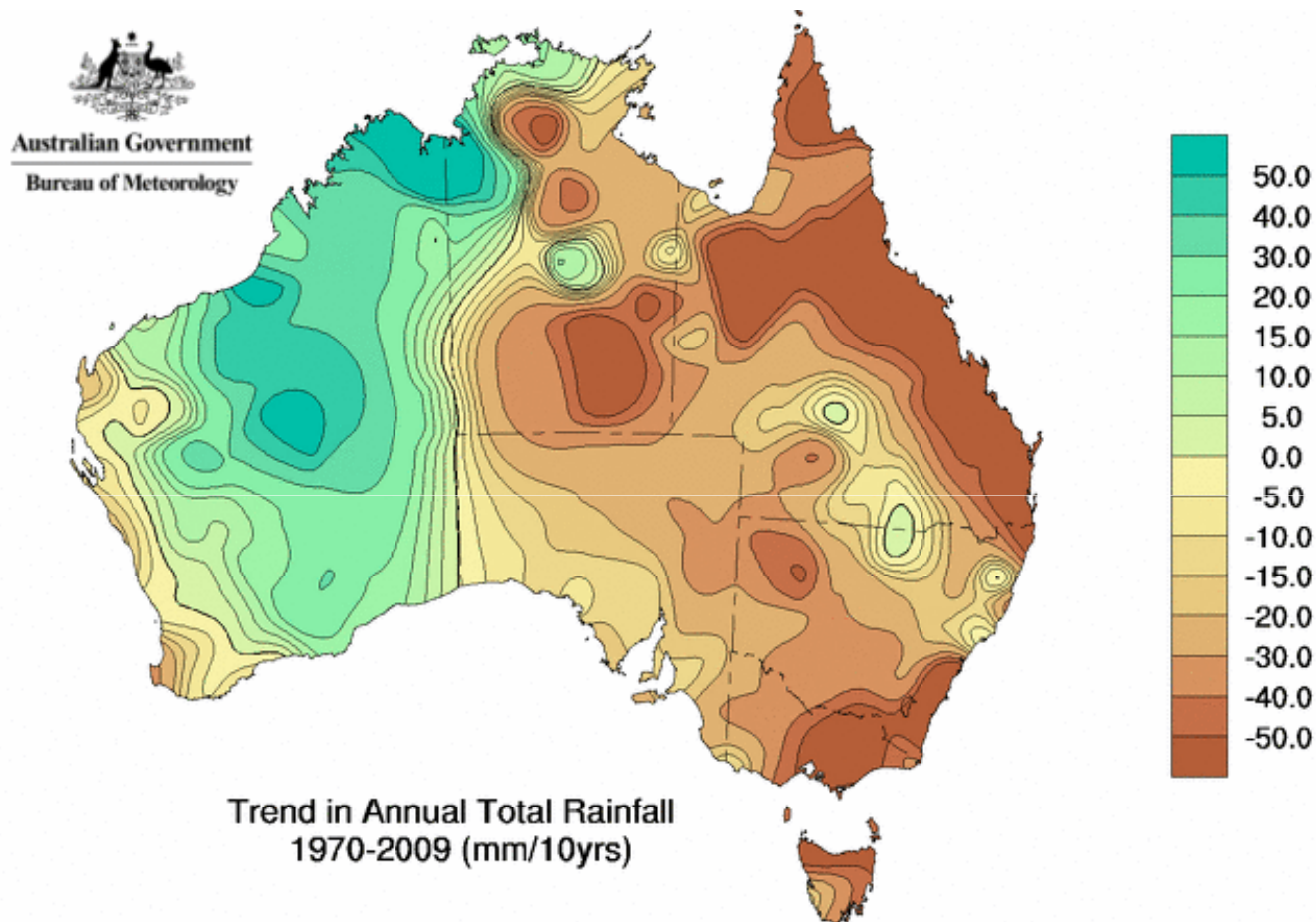


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Issued: 06/01/2010



Current Trends - Rainfall

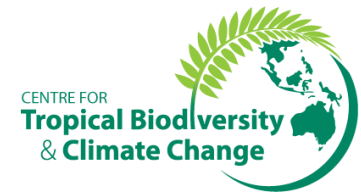


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Issued: 27/01/2010

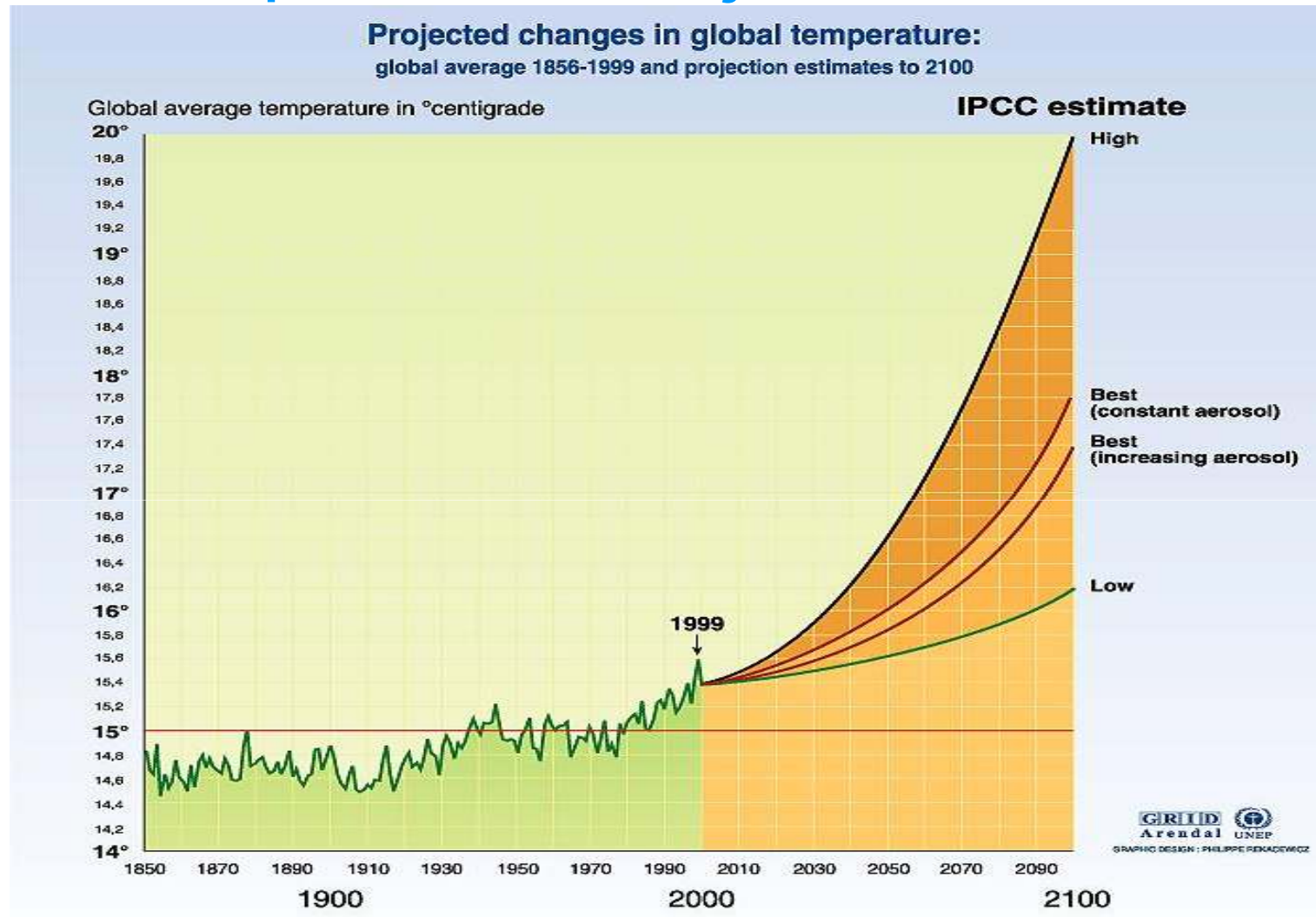


Records continuously being broken.....



- 7 out of the top 10 hottest years ever recorded have been in last decade
 - Last year hottest ever in Australia
 - July 2010 was hottest ever July
 - Increasing extreme events (eg. droughts, fire, heat waves)
 - Etc etc etc etc etc
-

IPCC Temperature Projections



Source : Temperatures 1856 - 1999: Climatic Research Unit, University at East Anglia, Norwich UK. Projections: IPCC report 95.



In Summary:

- Higher average temperatures
- More frequent and more intense heat waves
- Changing rainfall patterns
- Increased frequency and intensity of droughts
- Increasing fire weather & incidence of extreme fire danger days
- Higher cloud base





What will be the
impacts on our
natural environment?

Intergovernmental Panel
on Climate Change (IPCC)
identified natural
ecosystems as the most
vulnerable sector



Climate Change, Biodiversity & Adaptation



Observed and predicted impacts of Climate Change on Terrestrial Biodiversity

- Climate change already has been demonstrated to impact on:
 - The distribution and abundance of species
 - Phenology (the timing and duration of events such as migration, breeding, and flowering)
 - Physiology
 - Interactions between species
 - Interactions with other stressors (habitat fragmentation, fire, invasive species)
 - Disease dynamics



Global Biodiversity

Globally 18 – 35% of ALL species predicted to be “committed to extinction” or highly threatened by climate change

Thomas et al. 2004, *Nature*





What can we do
about minimising
the impacts of
global climate
change on
biodiversity?

Conservation planning for climate change

```
graph TD; A[Conservation planning for climate change] --> B[Adaptation]; A --> C[Mitigation]; B --> D["Spatial / Temporal  
Prioritisation  
Resilience Management  
Species, habitat, processes"]; C --> E["Emission reduction  
Carbon sequestration  
Biofuels  
Carbon credits"];
```

Adaptation

Spatial / Temporal
Prioritisation
Resilience Management
Species, habitat, processes

Mitigation

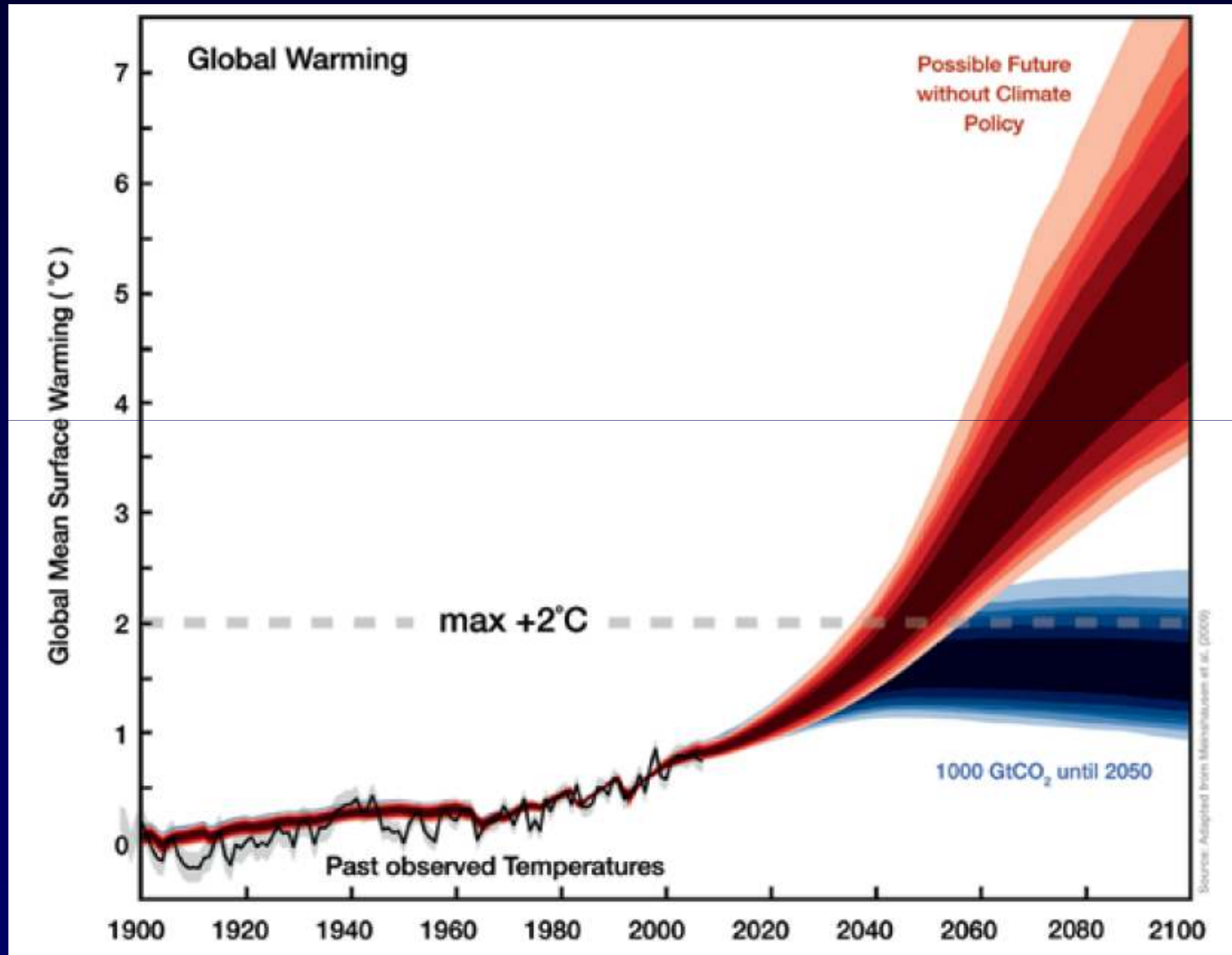
Emission reduction
Carbon sequestration
Biofuels
Carbon credits

MITIGATION:

We need a serious global effort on mitigation and reduction in greenhouse gas emissions and to stop waiting for someone else to go first



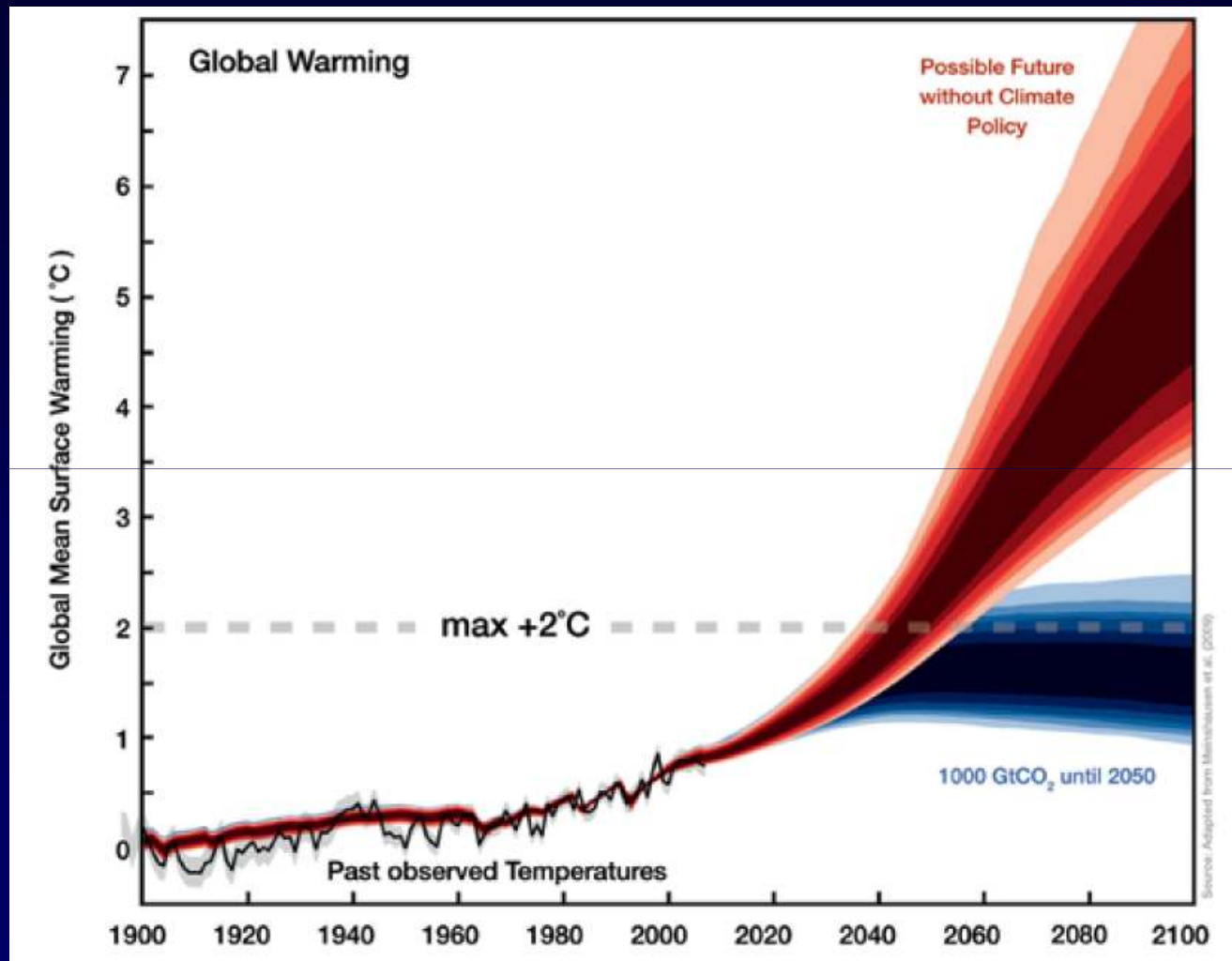
MITIGATION



Adaptation

Can we adapt enough to prevent major impacts on biodiversity?

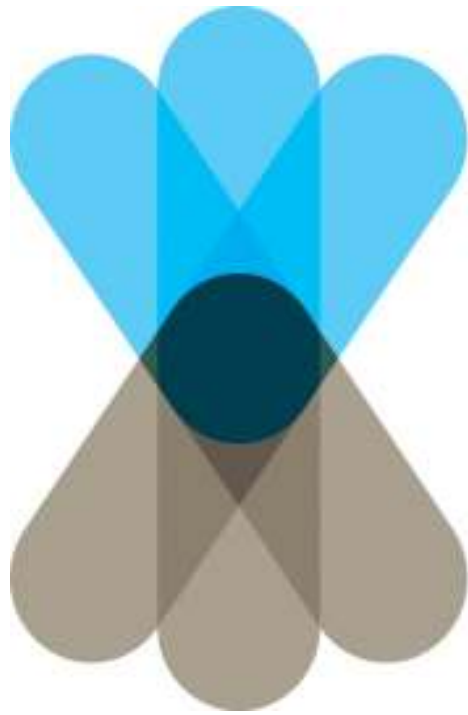




No mitigation –
Adaptation not possible

Some mitigation –
Adaptation very
important

Strong mitigation –
Adaptation not needed



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University of Technology



National Climate Change Adaptation Facility

- An initiative of the Australian Government, based at Griffith University's Gold Coast Campus.
- ~\$117 million (from 2008 to 2012) in climate change adaptation policies, programs and research through the Department of Climate Change
 - ~\$10m NCCARF
 - ~\$10m networks
 - ~\$30m NARP research funding



The key roles of NCCARF include:

- developing National Adaptation Research Plans (NARP's) to identify critical gaps in information available to decision-makers
- synthesising existing and emerging national and international research on climate change impacts and adaptation, and developing targeted communication products
- undertaking a program of integrative research to address national priorities, and
- establishing and maintaining Adaptation Research Networks (ARN's) to link key researchers and assist them in focussing on national research priorities.



National Climate Change Adaptation Facility

Eight Adaptation Research Networks:

- **Terrestrial biodiversity**
- Water resources and freshwater biodiversity
- Marine biodiversity and resources
- Primary industries
- Human health
- Emergency management
- Settlements and infrastructure
- Social, economic and institutional dimensions.



Terrestrial Biodiversity Adaptation Research Network

Providing decision makers with the information to develop and implement strategies that will promote adaptation to climate change in terrestrial ecosystems



Network Role – NCCARF Network Strategic Plan

Four key roles:

1. To promote and facilitate open exchange of information and sharing of resources.
2. To contribute to the work of NCCARF in synthesising existing and emerging research.
3. To contribute to the development and implementation of National Adaptation Research Plans.
4. To nurture the careers of young investigators and research students by promoting a sense of community, collaboration and strong, effective mentoring.



Adaptation Research Network -Terrestrial Biodiversity

Convenors:

Prof Steve Williams (JCU, nth QLD)

Prof Lesley Hughes (Macquarie, NSW)

- Co-ordinator: Dr Yvette Williams (JCU)

Steering committee (geographic, expertise, ecosystems):

Prof Andrew Lowe, Prof Barry Brook (SA)

Dr Dick Williams, Prof Stephen Garnett (NT)

Prof Ary Hoffmann, Dr Lynda Chambers (VIC)

Prof Roger Kitching, Prof Hugh Possingham, Prof Bob Pressey, A/Prof Jean-Marc Hero (QLD)

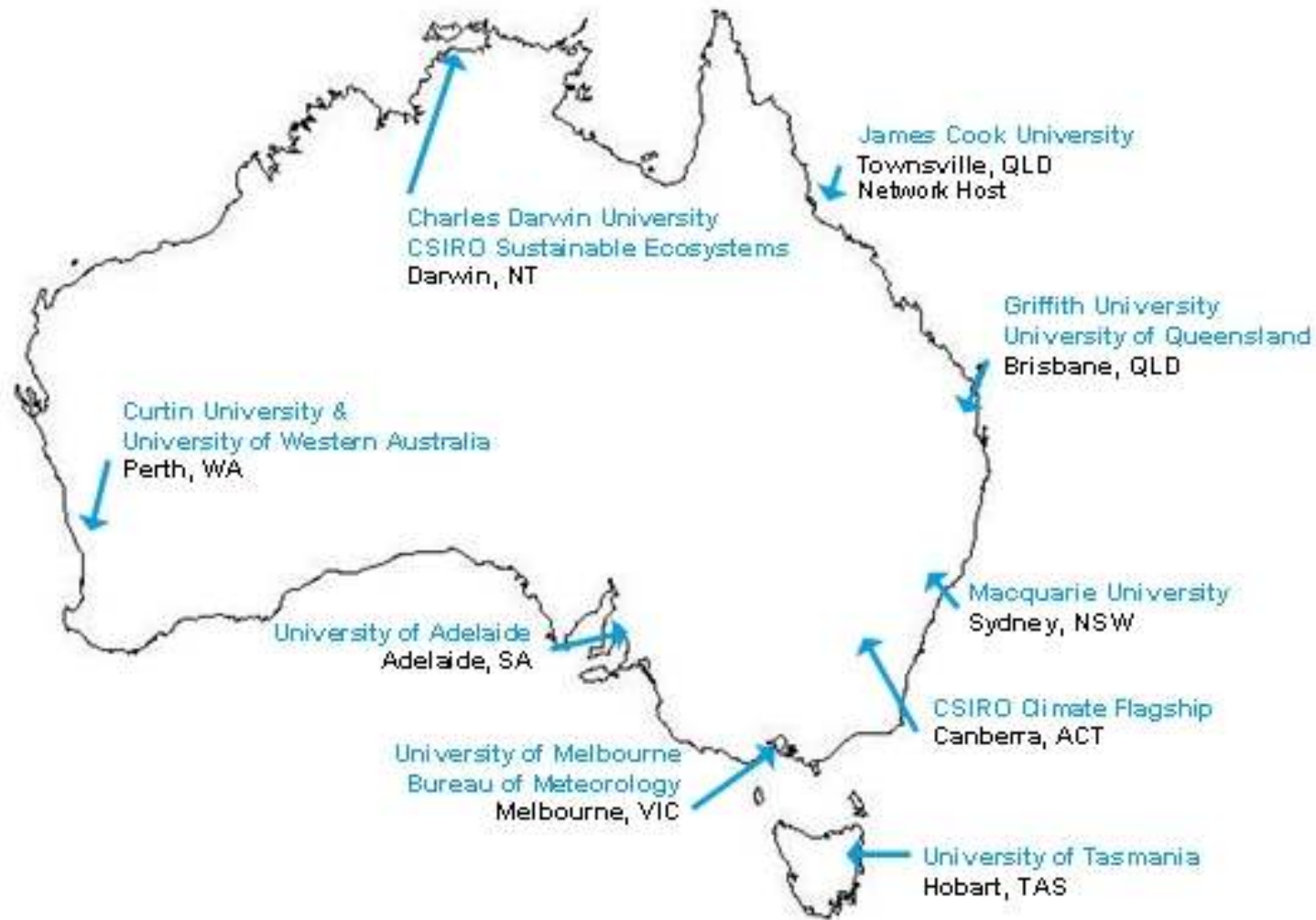
Dr Trevor Booth, Dr Mark Stafford Smith (ACT; CSIRO CAF)

Prof David Bowman, Dr Kerry Bridle (TAS)

Prof Richard Hobbs, Dr Grant Wardell-Johnson, Dr Nicola Mitchell (WA)



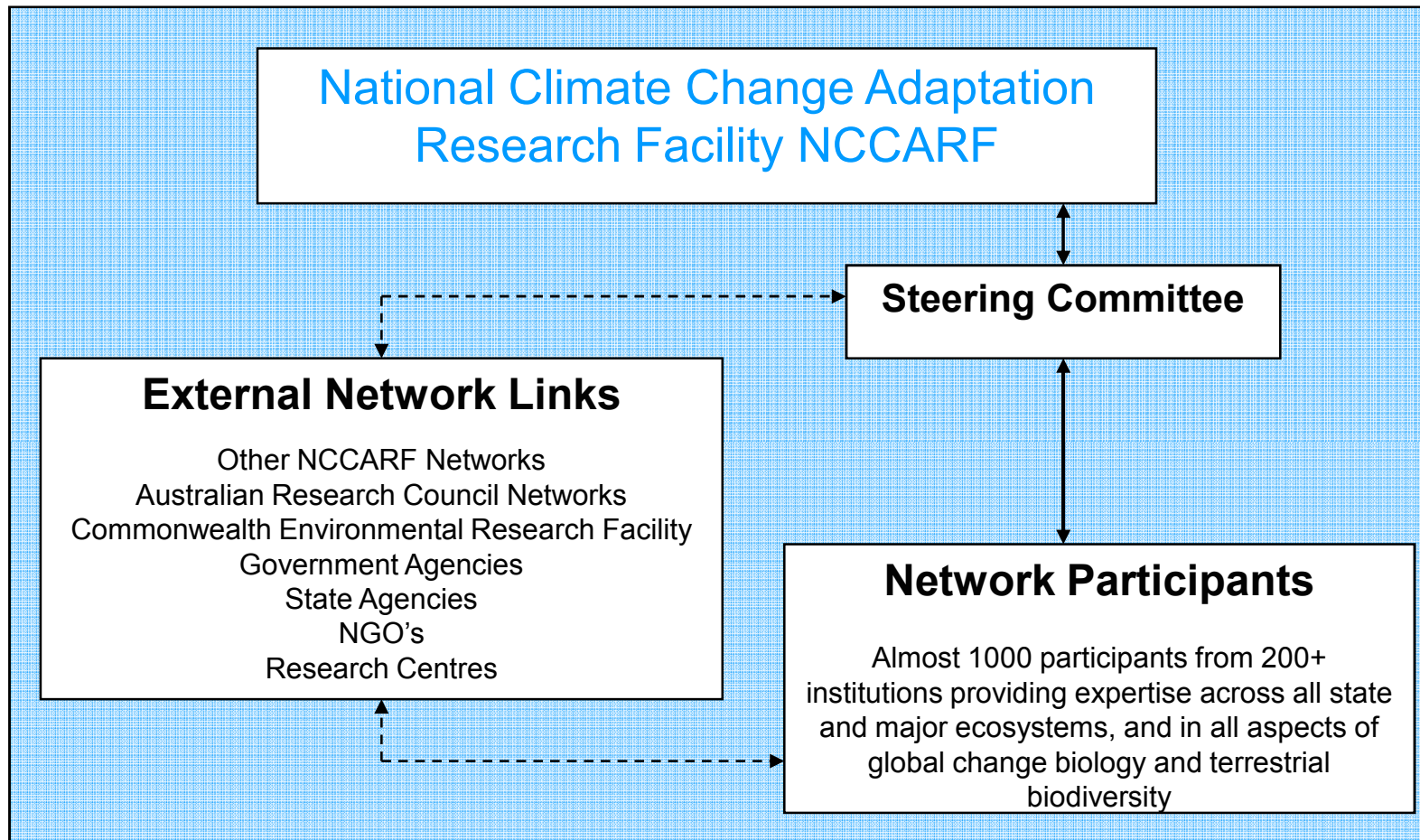
Regional Nodes



NCCARF

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Network Structure



Our Primary Goals

- Develop explicit and practical strategies to increase resilience in terrestrial ecosystems
- Maximise the adaptive potential of terrestrial ecosystems in the face of climate change
- Foster an inclusive collaborative research environment



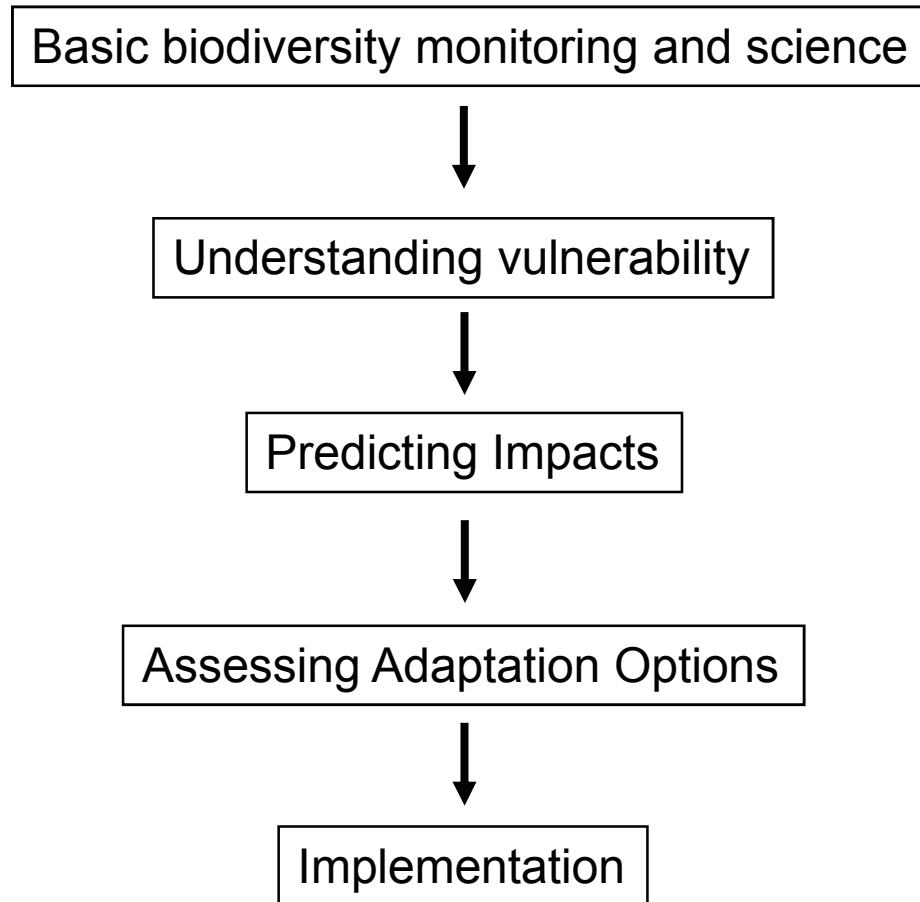
Our Primary Goals (no bull#&% version)

- Link expertise nationally
- Get people together
- Share information
- Foster collaboration
- Reduce duplication
- Facilitate exchange
- Encourage training and development
- Make a difference



Example:

Adaptation and
protecting the
biodiversity of
Australian tropical
rainforests



The rainforests of the Australian Wet Tropics

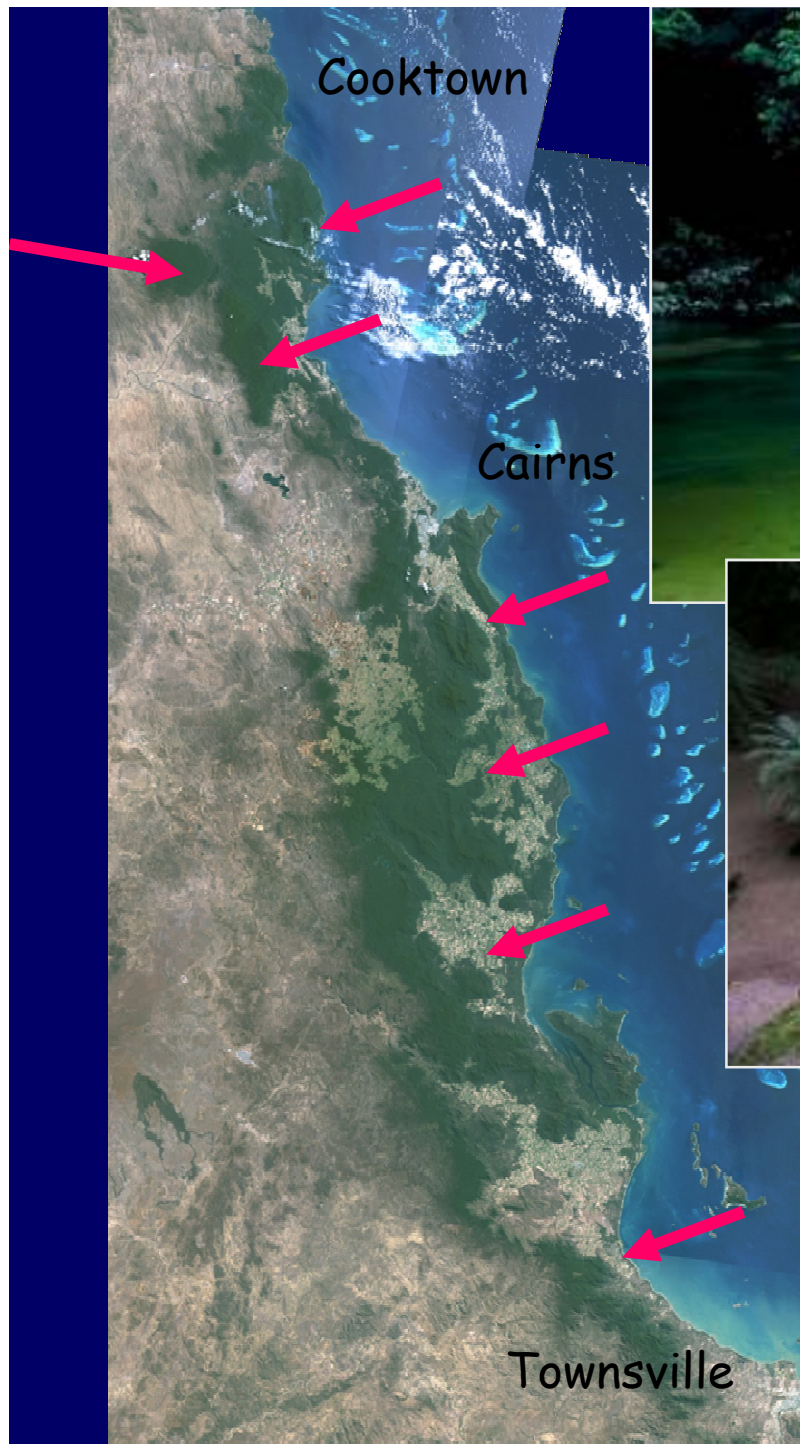


Most biologically rich area in Australia
with many unique

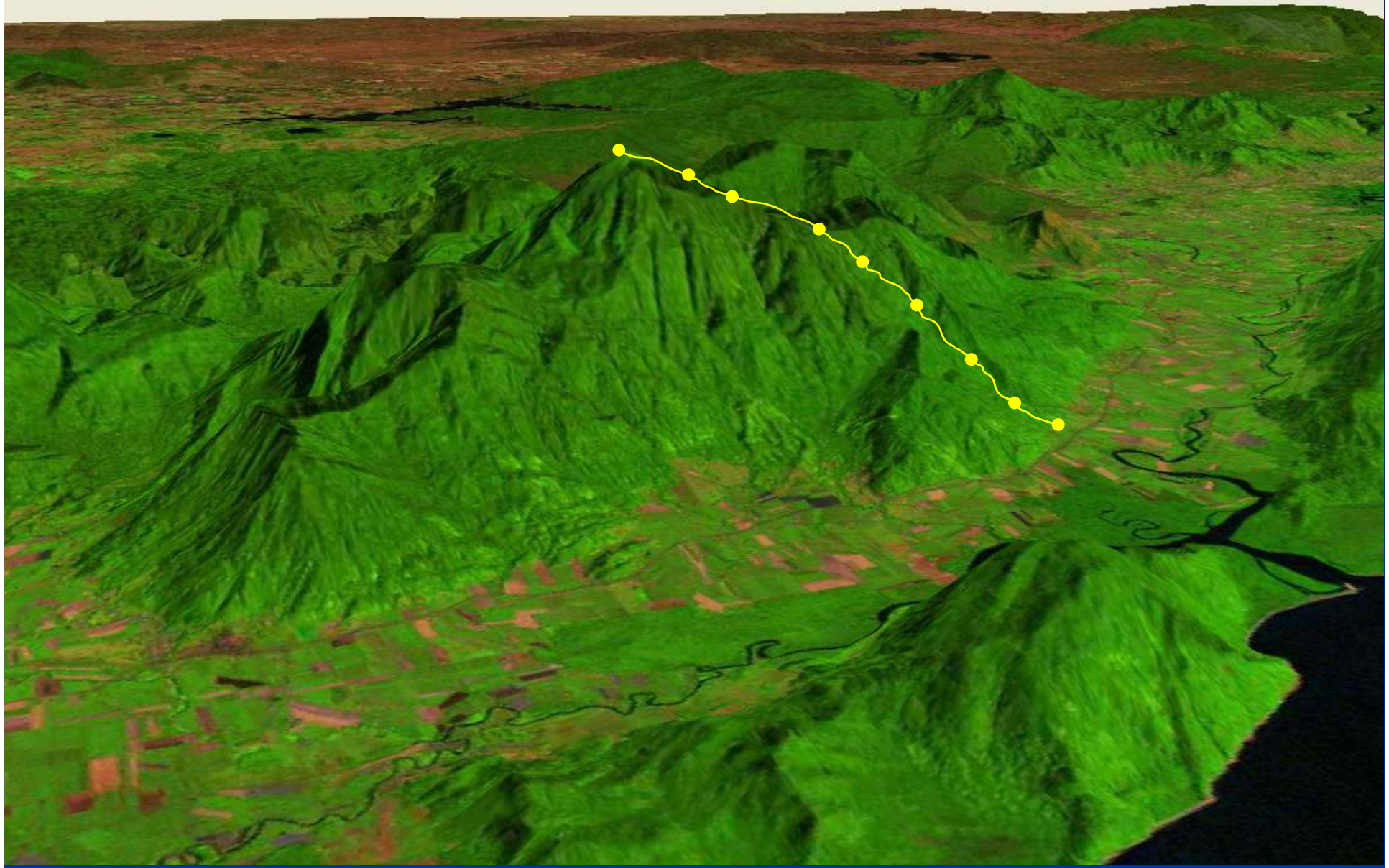


Mike Trenerry

~ 10,000 sq km rainforest



Elevational sampling at 200 m intervals



Standardized Data

Total number of surveys:

- ~2000 Bird
- ~750 Reptile
- ~350 Spotlight
- 200 Stream Frog
- 400 Microhylid frog
- 6000 Malaise trap days



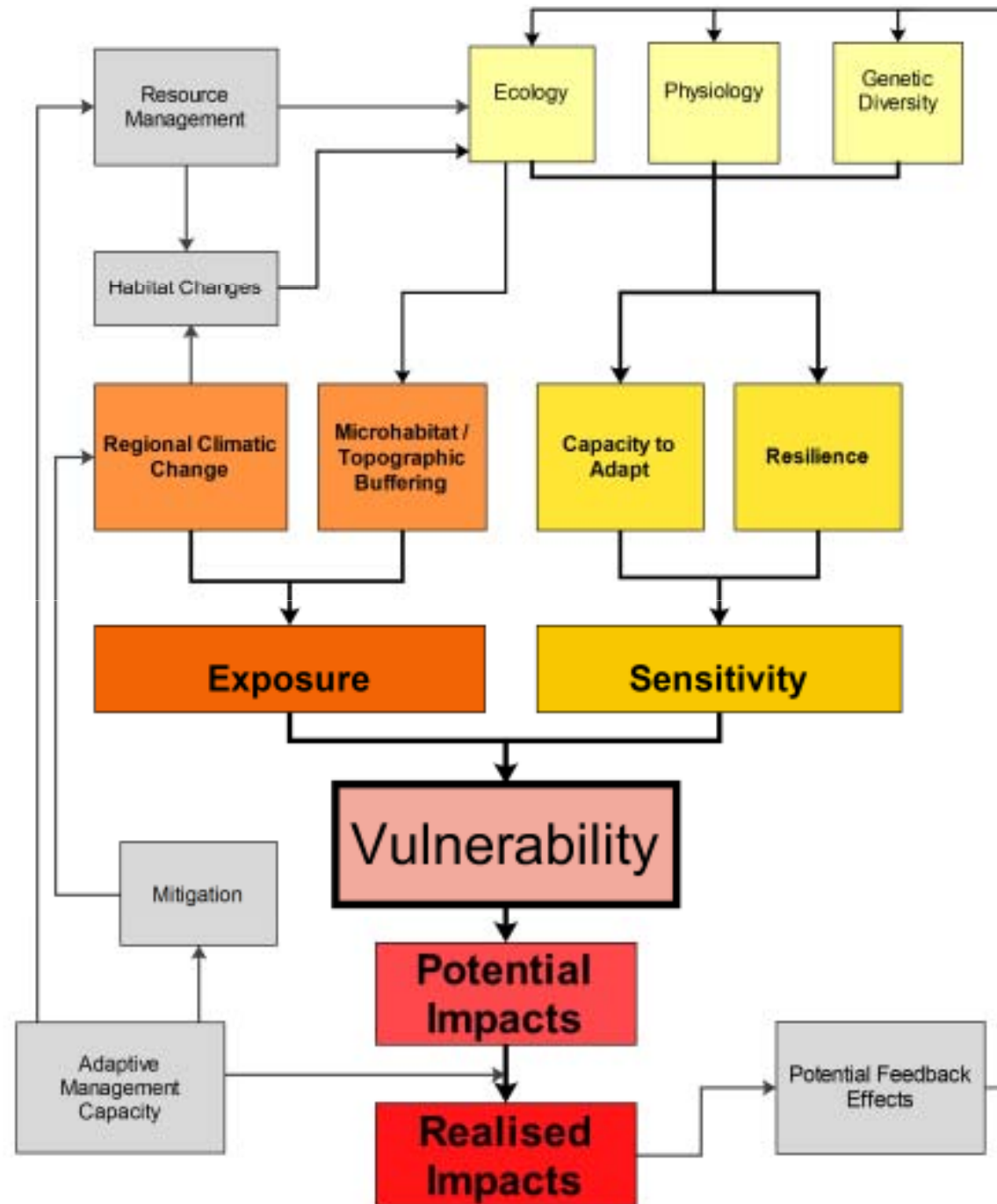
Informed adaptation

We need to carefully assess the vulnerability of species, habitats, processes and ecosystems so we can prioritise our responses...

- What ?**
- Where ?**
- When ?**
- Why ?**
- Is there anything we can do?**

CHALLENGE:

Assessing
vulnerability
and predicting
impacts is
VERY complex.

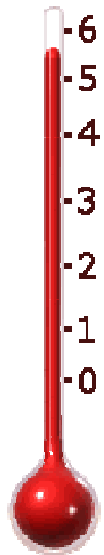


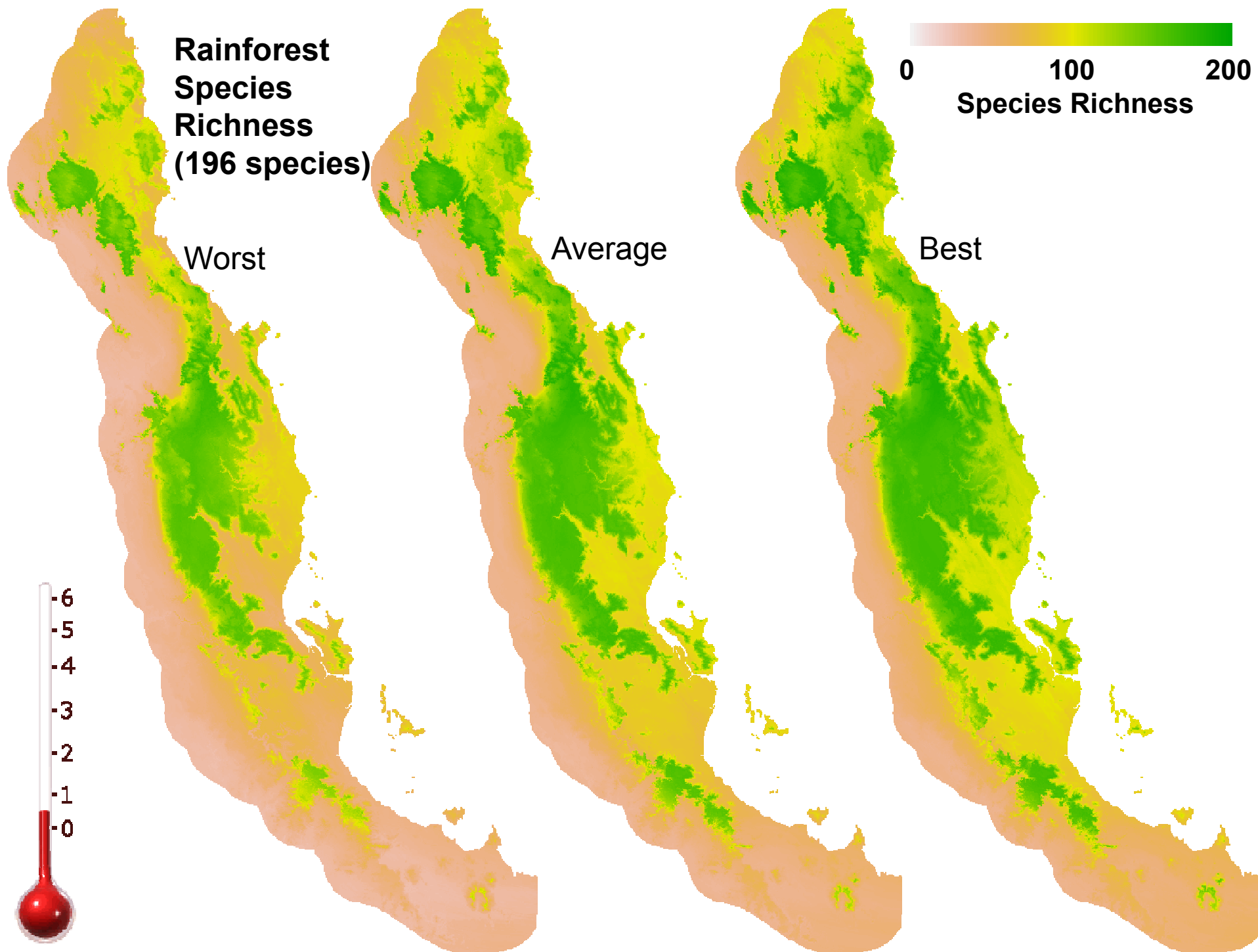
Golden Bowerbird

Worst

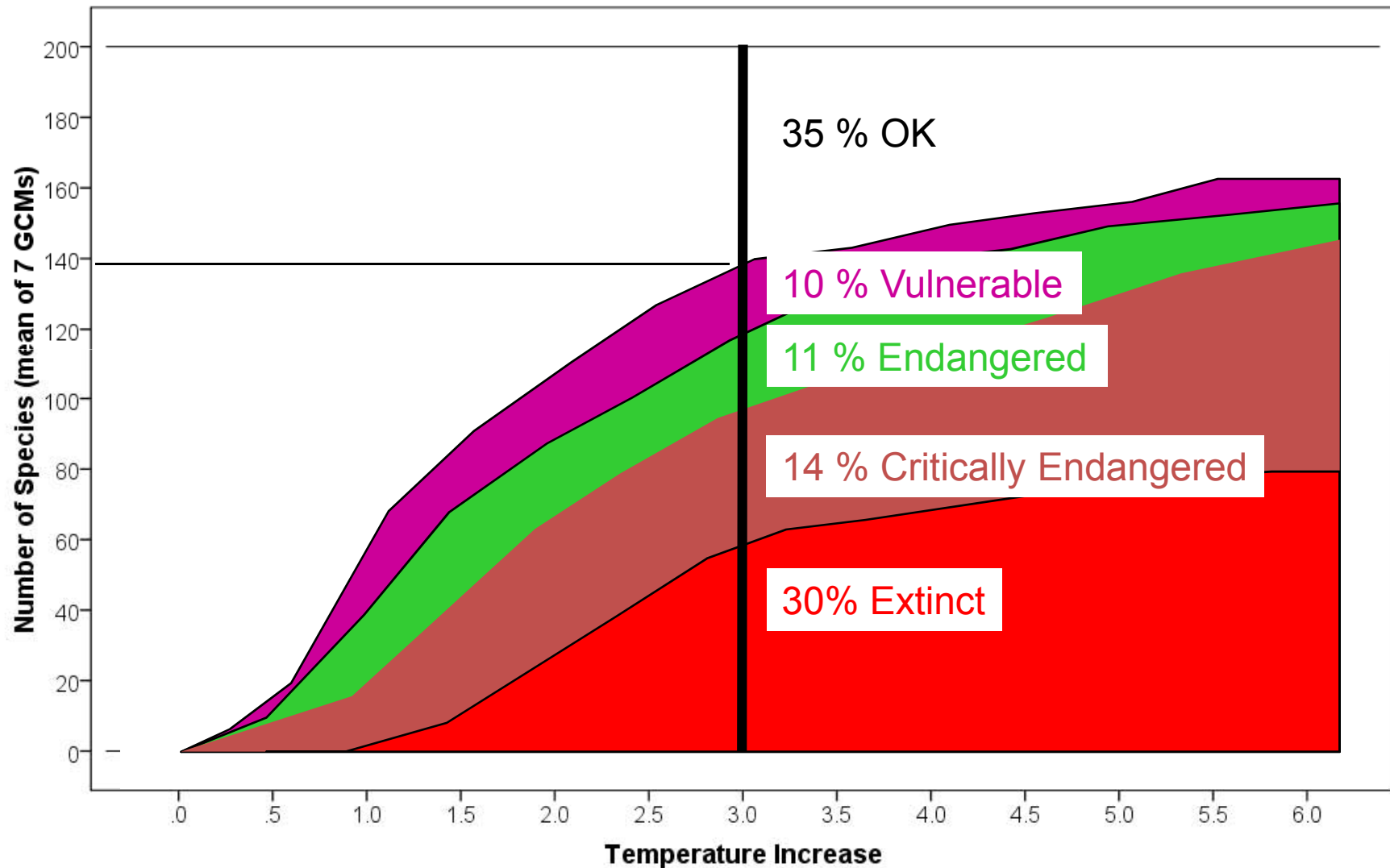
Average

Best





Wet Tropics biodiversity is extremely vulnerable to climate change



What adaptation actions are possible to protect a system where 84% of the species rely on cool refugia?

Cool Refugia

Where will they be?

How big do they need to be to be effective?

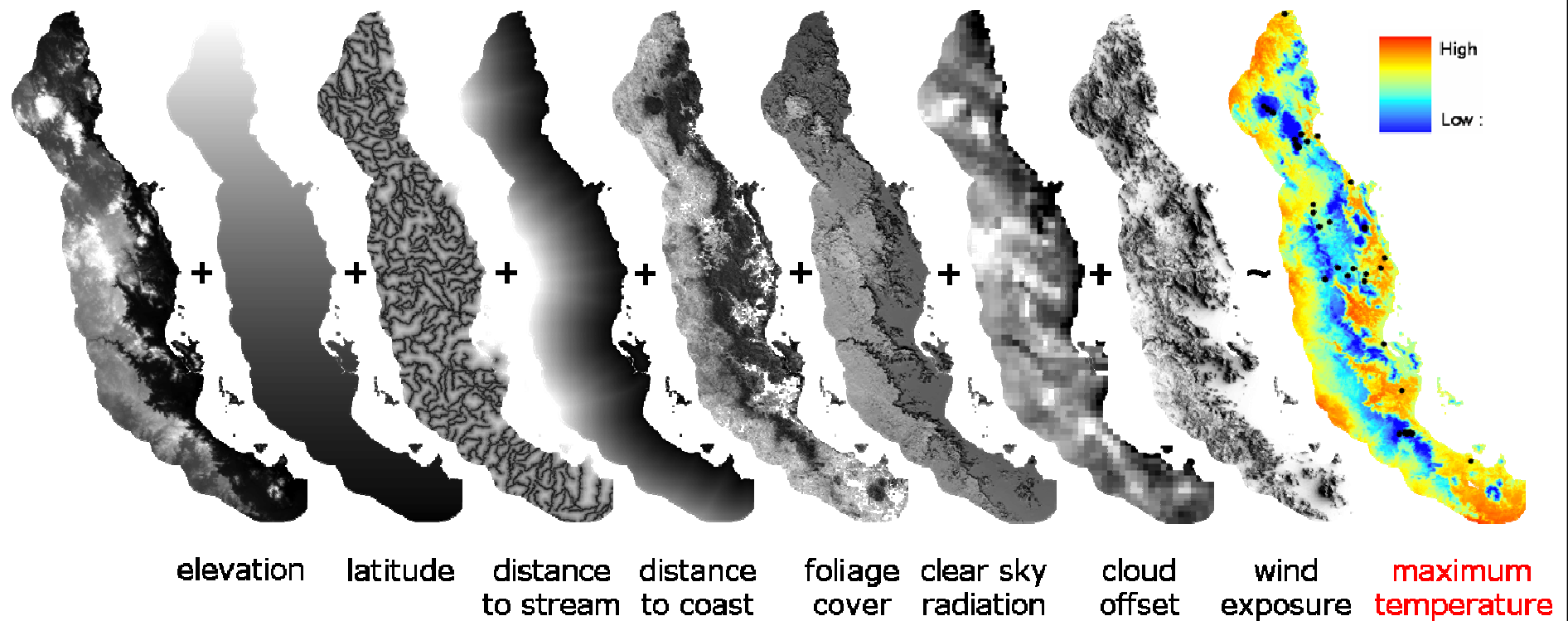
Which species will benefit?

What factors will threaten these refugia?

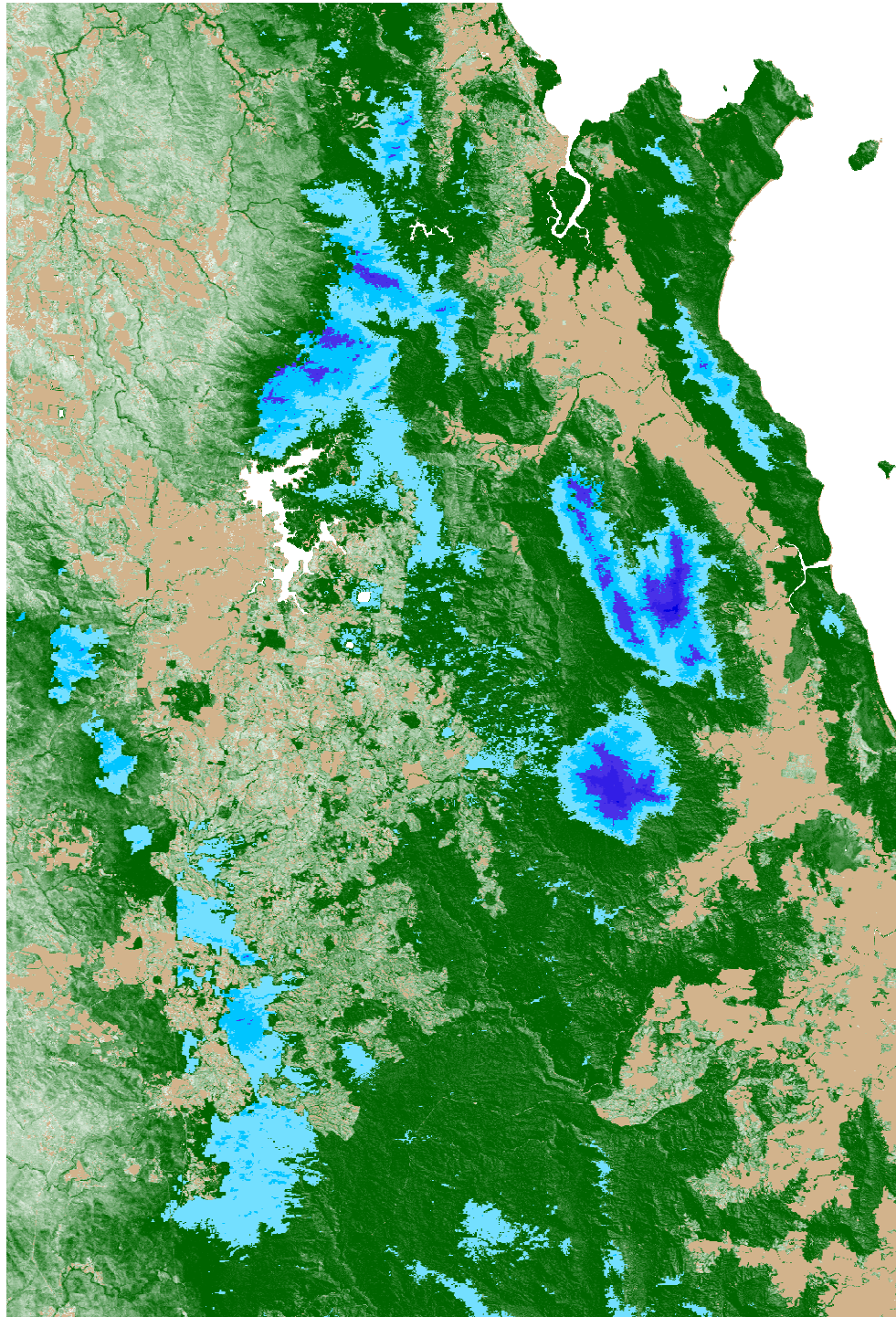
How do we protect, enhance and manage them?

Cool Refugia

A map showing the maximum temperature actually experienced by an organism in any part of the region

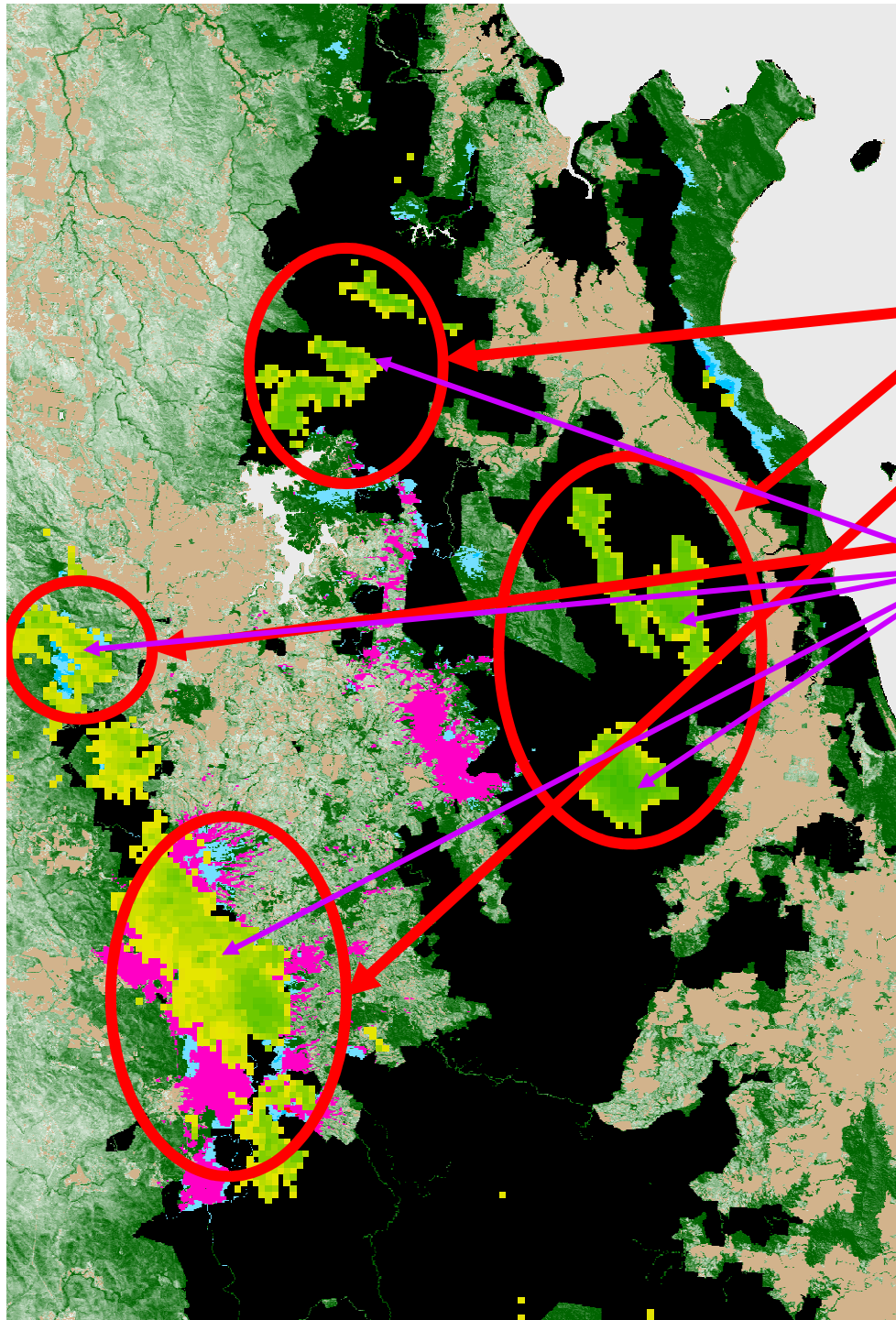


Shoo, Vanderwal & Williams. *Glob Change Biol* 2010



Existing
thermal
refugia

Adaptation Options



High value refugia already in protected area:

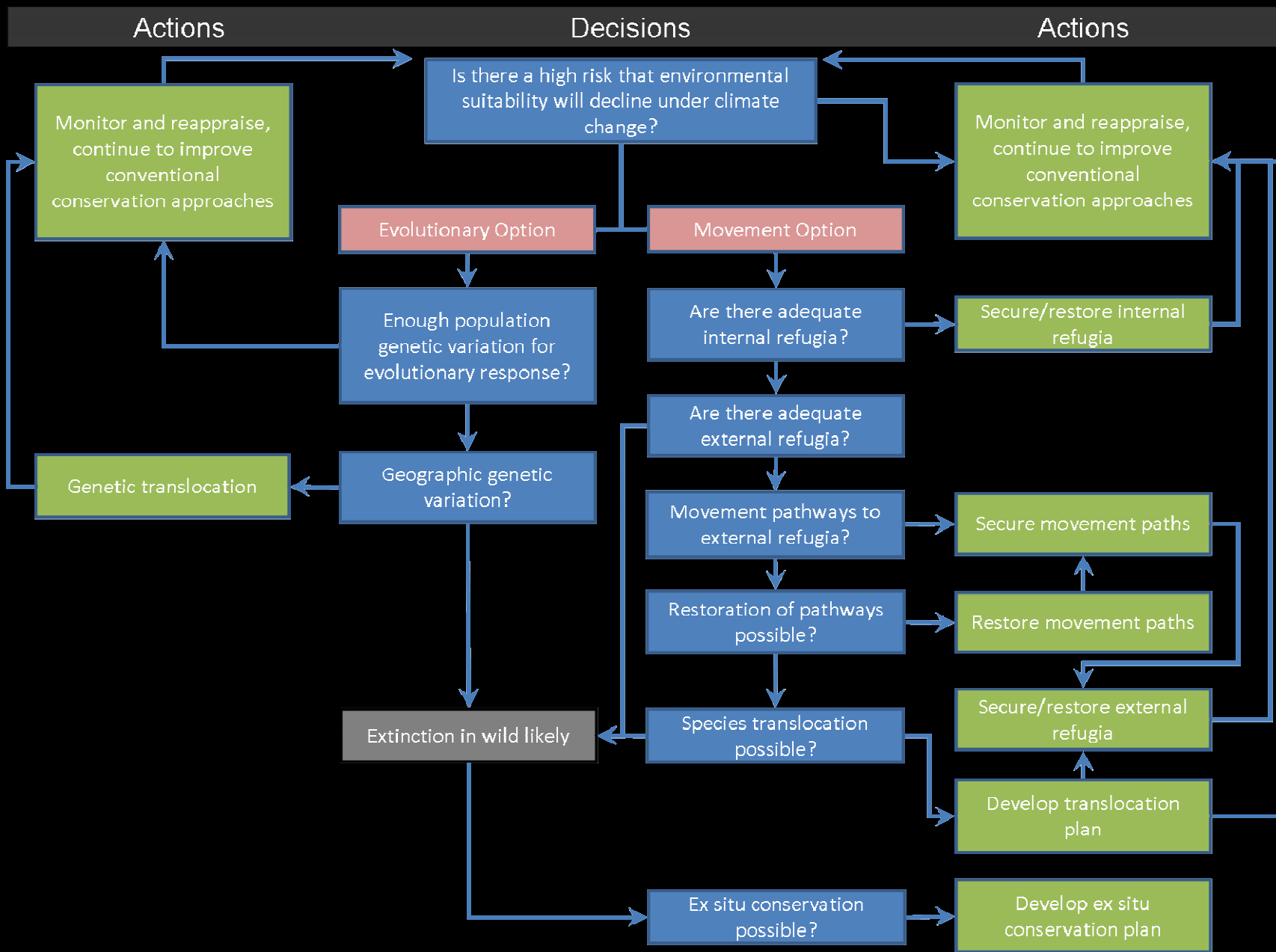
Biodiversity refugia based on overlaid distributions of all 200 rainforest vertebrates modelled using averaged potential future distributions of 7 GCMs at 4 deg C.

- Potential for assisted migration
- Off-reserve conservation agreements
- Land acquisition and off-reserve management

agreements

- Maintain corridors to re-establish corridor for movement and gene flow

Conservation Planning & Climate Change - workshop



increasing cost and uncertainty of success

National Adaptation Research Plan - NARP

National Adaptation Research Plan (NARP) for Terrestrial Biodiversity identifies research required to assist managers of the terrestrial estate prepare for the consequences of climate change



National Adaptation Research Plan for Terrestrial Biodiversity

Authors:

Prof. Lesley Hughes

(Macquarie University)

Prof. Richard Hobbs

(Murdoch University)

Prof. Jan McDonald

(Griffith University)

Dr. Mark Stafford Smith

(CSIRO - CAF)

Prof. Will Steffen

(ANU)

Prof. Stephen Williams

(James Cook University)



National Adaptation Research Plan for Terrestrial Biodiversity

The aims of this Plan are to:

- 1) Identify important gaps in the information needed by sectoral decision-makers to respond to climate change in ways that reduce the vulnerability of terrestrial ecosystems;**
- 2) Set adaptation research priorities based on these gaps; and**
- 3) Identify capacity that can be harnessed or that needs development to perform priority adaptation research.**



NARP – National Research Priorities

5.1 National/continental scale issues

- **5.1.1** How will climate change affect existing conservation goals and how should changed conservation goals be promoted and achieved?
- **5.1.2** How can the existing Australian legal, policy and institutional architecture for land management and biodiversity conservation respond to changes in conservation goals caused by climate change?
- **5.1.3** What conceptual models and long-term observation systems are needed to support the design, analysis and assessment of active adaptive management and policy experiments at regional and national scales under climate change?



NARP – Regional Research Priorities

5.2 Regional issues

- **5.2.1** What designs of landscapes in intensive and extensive land-use zones confer maximum resilience for biodiversity in the face of climate change, including the uncertainty associated with future climate scenarios?
- **5.2.2** How will climate change interact with other key stressors such as fire, invasive species, salinity, disease, water extraction, climate hydrology, grazing and clearing and what are the implications for ecosystem structure and functioning?
- **5.2.3** How can large-scale carbon mitigation initiatives such as revegetation and forest-related mitigation be designed to avoid adverse impacts on biodiversity and to maximise biodiversity conservation benefits?
- **5.2.4** How can major socio-economic trends occurring in many regions of Australia contribute to effective climate change biodiversity adaptation responses?



NARP – Local Research Priorities

5.3 Local land management issues

- **5.3.1** What are the costs and benefits of different climate change adaptation measures in key vulnerable communities and ecosystems?
- **5.3.2** How should fire management adapt to climate change?
- **5.3.3** How can management of local protected areas incorporate and adapt to climate change?
- **5.3.4** How can we better integrate conservation plans and actions across landscapes, incorporating protected area management, off-reserve conservation measures and other land-uses, to maximise biodiversity conservation benefits/outcomes under a changing climate?



NARP – Species Research Priorities

5.4 Managing key species

- **5.4.1** Which species should be the focus of investment in climate change adaptation?
- **5.4.2** How will climate change affect current management actions for protecting priority species and what management changes will be required?
- **5.4.3** How will climate change affect current or potential problem species and what management responses will be required?



Some common themes and priorities for biological research across NARP, BVA, Protected areas:

- 1) Develop planning strategies and policy that recognise novel ecosystems, shifting climates and conservation paradigms
- 2) Understand, and predict, responses and vulnerability
- 3) Identify refugia - both internal and external
- 4) Understanding the influence of extreme events
- 5) Interactions between climate change and other stressors
- 6) Protect more habitat & greater environmental diversity
- 7) Manage habitat to reduce threats and maintain resilience
- 8) Manage landscape-scale issues such as connectivity



NARP funding just released (\$3.3M):

Significant dates for applications are:

Call for Expressions of Interest	3/12/2010
Closing date for submission Expressions of Interest	21/01/2011
Invitations for Full Proposals	11/02/2011
Closing date for submission of Full Proposals	11/03/2011
Announcement of successful candidates by	May 2011
Funding Agreements signed by	June 2011



NARP funding **PRIORITY QUESTIONS:**

Highest Priority Research Areas for Immediate Investment

1. How will climate change affect existing conservation goals and how should changed conservation goals be promoted and achieved? (drawn from Terrestrial Biodiversity NARP priority question 1.1).
2. What designs of landscapes in regions having differing land uses confer maximum resilience for biodiversity in the face of climate change? How do these landscape designs integrate conservation plans and actions, incorporating protected area management, off reserve conservation measures and other land-uses, to maximise biodiversity conservation benefits/outcomes under a changing climate? How can integration be done more effectively? (drawn from Terrestrial Biodiversity NARP priority questions 2.1, 3.4).
3. How will climate change interact with other key stressors such as fire, (current and potential future) invasive species, salinity, disease, changes to water availability, grazing and clearing? What are the integrated implications for ecosystem structure and functioning and what management responses will be required? (drawn from Terrestrial Biodiversity NARP priority questions 2.2 and 4.3).



NARP funding PRIORITY QUESTIONS:

4. What are the costs and benefits of different climate change adaptation measures in vulnerable ecological communities and ecosystems? (Terrestrial Biodiversity NARP priority question 3.1).

5. Which species should be the focus of investment in climate change adaptation? (Terrestrial Biodiversity NARP priority question 4.1). Within Research Area 2 (above), two specific research topics have been identified.



NARP funding **PRIORITY QUESTIONS:**

2.1 Identifying key refugia to maintain Australia's terrestrial biodiversity under changing climate conditions.

Research is needed to identify key refugia for terrestrial species, systems and taxonomic or functional groups under changing climate conditions: refugia will include those reflecting evolutionary and ecological factors, contemporary land use and management pressures and also novel refugia that may exist under climate change. The products of this research must support sound decisions about selecting and managing protected areas and management regimes across landscapes with the objectives of minimising the loss of genes, species and ecosystem functions, and maximising conservation of biodiversity and provision of ecosystem goods and services at the regional and national scales.

2.2 Identifying integrated climate change adaptation options for multi-use landscapes.

Research is needed to identify and provide means of evaluating the utility of climate change adaption initiatives at the landscape scale where a number of land use goals and activities occur. The products of this research must support decisions by Governments at all levels, private landholders, utility companies and conservation agencies to understand the opportunities to increase the resilience of mixed use landscapes through integrated, collaborative or cooperative climate change adaptation responses.



How do YOU think the national priorities fit your ecosystem / region / sector?

- Are there any serious omissions?
- What are the priorities / challenges in your area of interest ?
- What research is needed to have the knowledge to make the best possible choices about adaptation?
- What are the main impediments?





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Impacts:

What are the main impacts / challenges / problems of climate change on terrestrial biodiversity in YOUR area of interest / responsibility?

- Examples:
 - Direct temperature impacts
 - Biogeographic barriers to movement
 - Changing rainfall
 - Sea level rise
 - Extreme events:
 - Fire
 - Drought
 - Cyclones
 - Floods
 - Storm surges
 - Interactions
 - Invasive species
 - Habitat Fragmentation



Local / Regional / Sectoral

Sector	Area	Ecosystem	Impacts	Ideas to manage	Adaptation Research	Impediment
National Park	Bogong High Plains	Alpine/ subalpine	<ul style="list-style-type: none"> • increased fire risk 	control burning	Which species most threatened <ul style="list-style-type: none"> • 	Money Changing ideas and attitudes to Climate Change <ul style="list-style-type: none"> •skills
National Park	Bogong High Plains	Alpine/ subalpine	<ul style="list-style-type: none"> • increased incidence of drought 	artificial structures to provide micro refugia / feeders	Would the animals use structures	
National Park	Bogong High Plains	Alpine/ subalpine	<ul style="list-style-type: none"> •increased threat of invasives 	•Sterilize vehicles	When to act	

