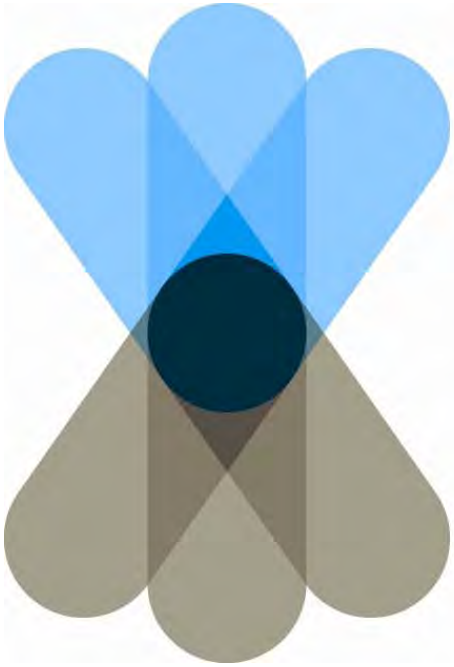

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Adaptation Research Network
TERRESTRIAL BIODIVERSITY

Australian Government
Department of Climate Change

Queensland Government

CSIRO

Griffith UNIVERSITY

Charles Darwin UNIVERSITY
Australia

THE UNIVERSITY OF MELBOURNE

THE UNIVERSITY OF WESTERN AUSTRALIA

MACQUARIE UNIVERSITY
SYDNEY ~ AUSTRALIA

JAMES COOK UNIVERSITY
AUSTRALIA

UTAS

THE UNIVERSITY OF ADELAIDE
AUSTRALIA

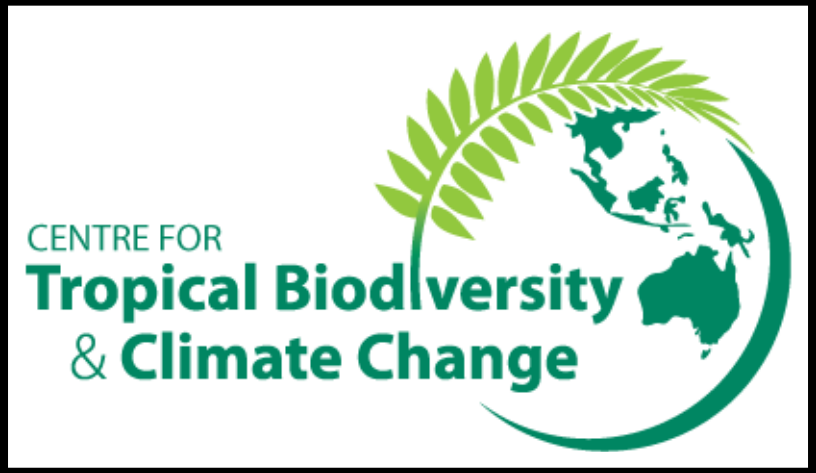
Curtin
University of Technology

Steve Williams

Stephen.williams@jcu.edu.au

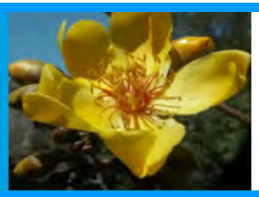
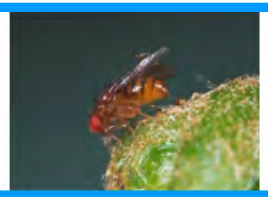
www.jcu.edu.au/ctbcc

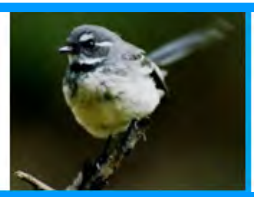
Professor / Director
Centre for Tropical Biodiversity & Climate Change
School of Marine & Tropical Biology
James Cook University
Townsville, Australia



Today's agenda

- National Overview – Steve
- Network – Yvette Williams
- State Overview – Hugh Possingham
- Regional adaptation science:
  - Jean-Marc Hero (Griffith) – Steering committee
  - Catherine Lovelock (UQ)
  - Roger Kitching (Griffith) – Steering committee
- Stakeholders:
  - Danielle Shanahan – DERM / QCCCE
  - Stacey Mclean – Brisbane City Council
  - Martin Taylor - WWF
- Workshop session

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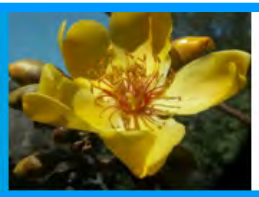
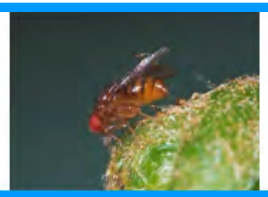
Why have a Roadshow?

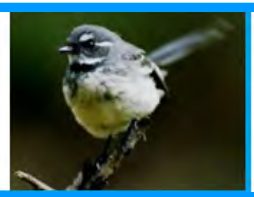
Why are we here?

- 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

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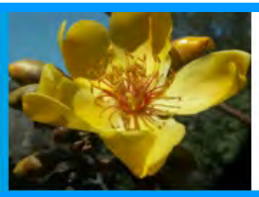
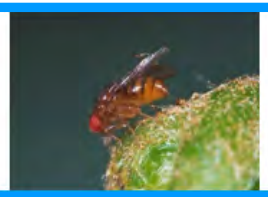
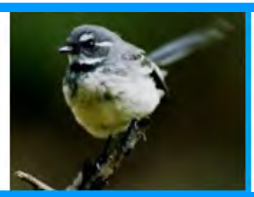
How do YOU think the national priorities fit your ecosystem / region / sector?

- 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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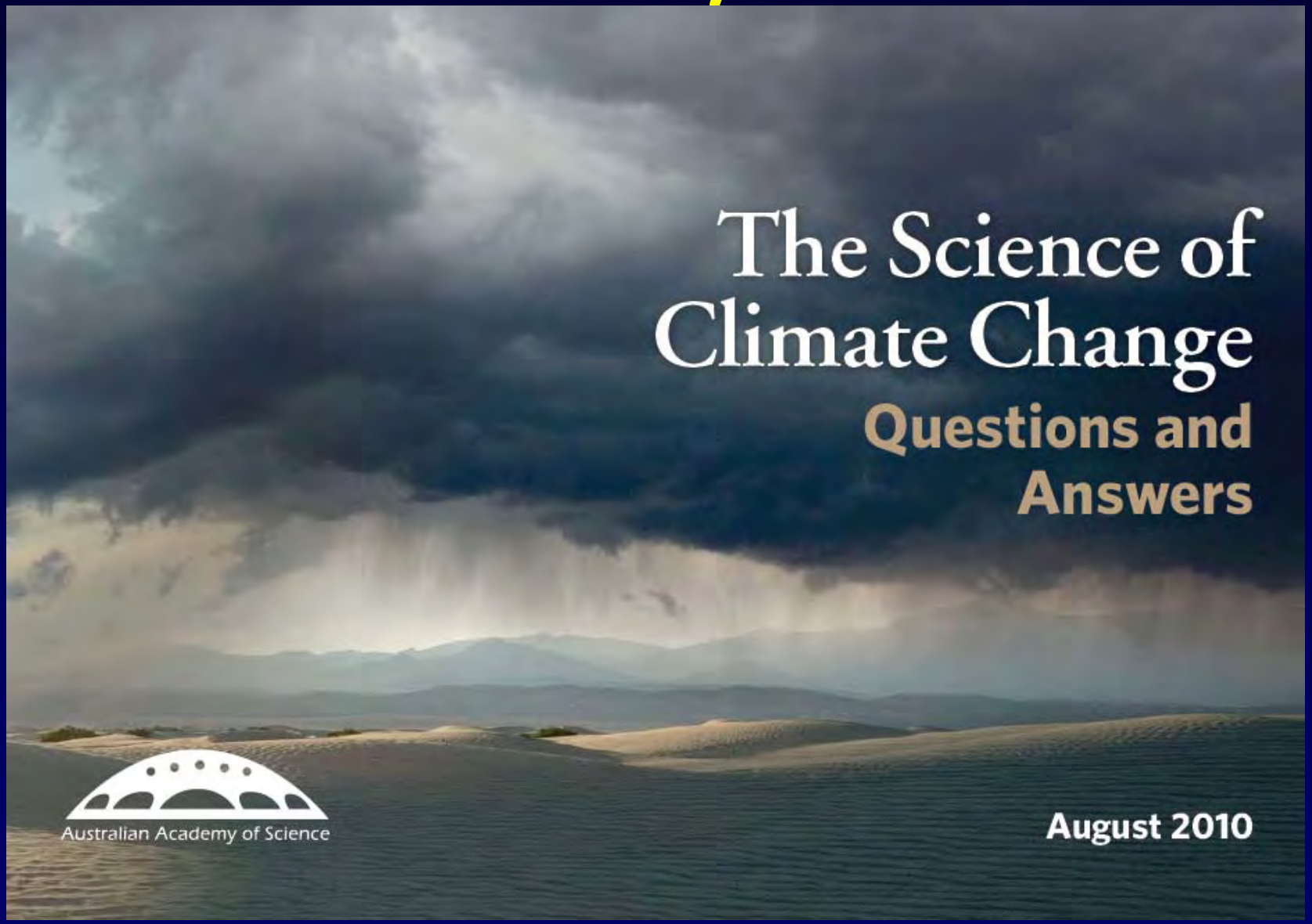
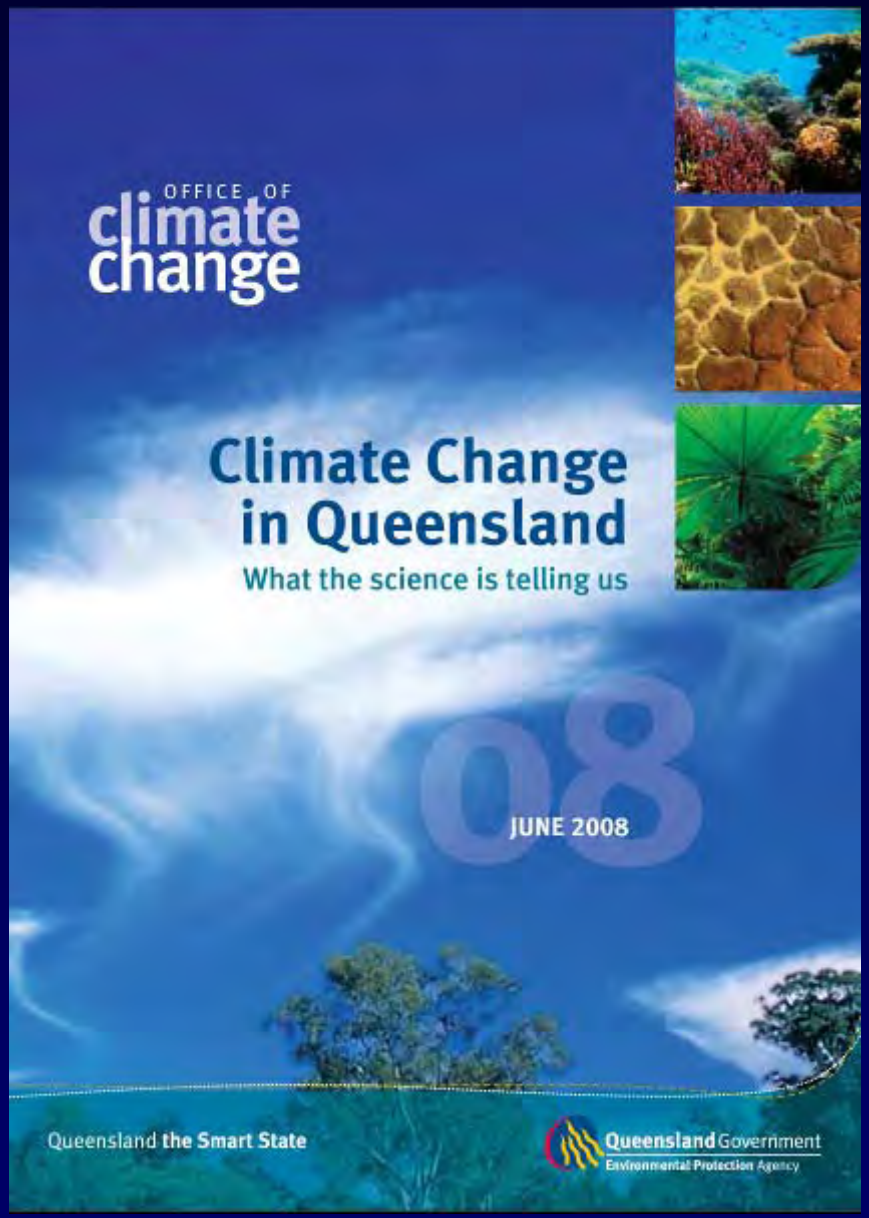
Global Climate Change & Terrestrial Biodiversity

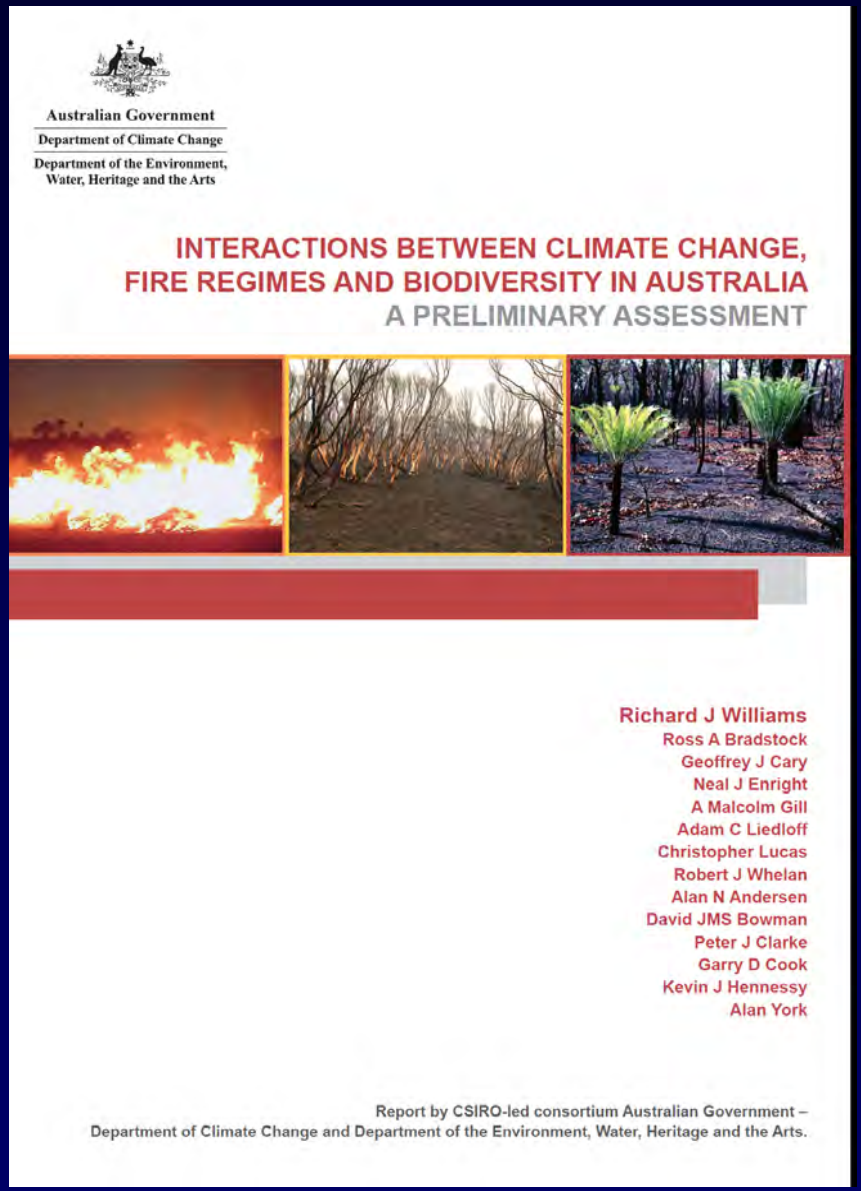
Is the global climate changing and are people causing it?

YES !!!

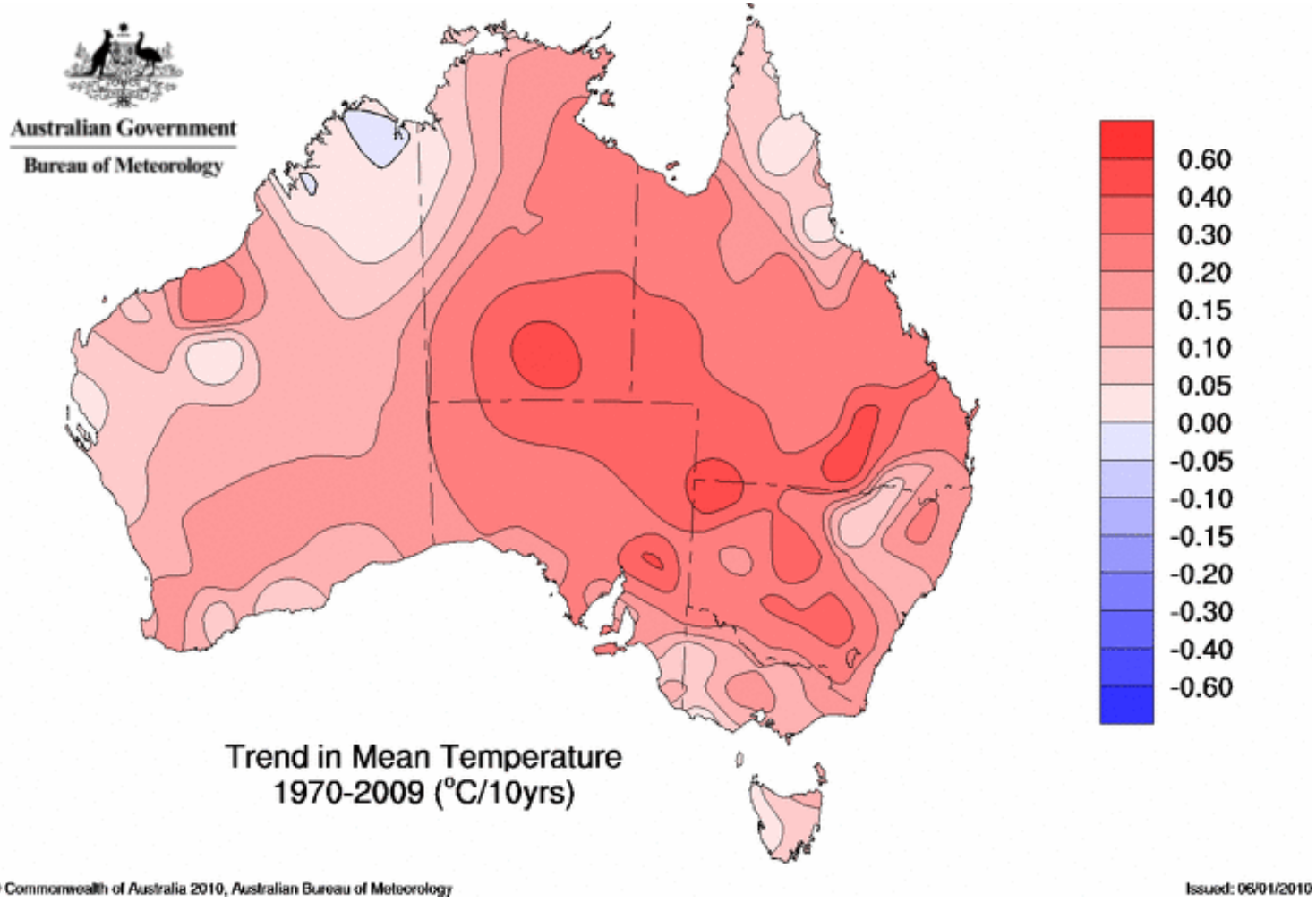
New summary report by the Australian Academy of Science

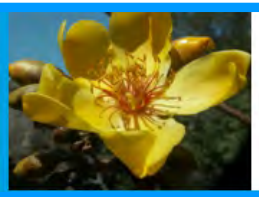
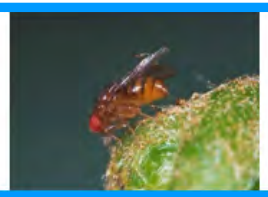


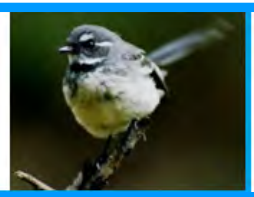

OFFICE OF
climate change
Climate Change in Queensland
What the science is telling us
08
JUNE 2008
Queensland the Smart State
Queensland Government
Environmental Protection Agency


Australian Government
Department of Climate Change
Department of the Environment, Water, Heritage and the Arts
INTERACTIONS BETWEEN CLIMATE CHANGE, FIRE REGIMES AND BIODIVERSITY IN AUSTRALIA
A PRELIMINARY ASSESSMENT
Richard J Williams
Ross A Bradstock
Geoffrey J Cary
Neal J Enright
A Malcolm Gill
Adam C Liedloff
Christopher Lucas
Robert J Whelan
Alan N Andersen
David JMS Bowman
Peter J Clarke
Garry D Cook
Kevin J Hennessy
Alan York
Report by CSIRO-led consortium Australian Government – Department of Climate Change and Department of the Environment, Water, Heritage and the Arts.

Current Trends - Temperature



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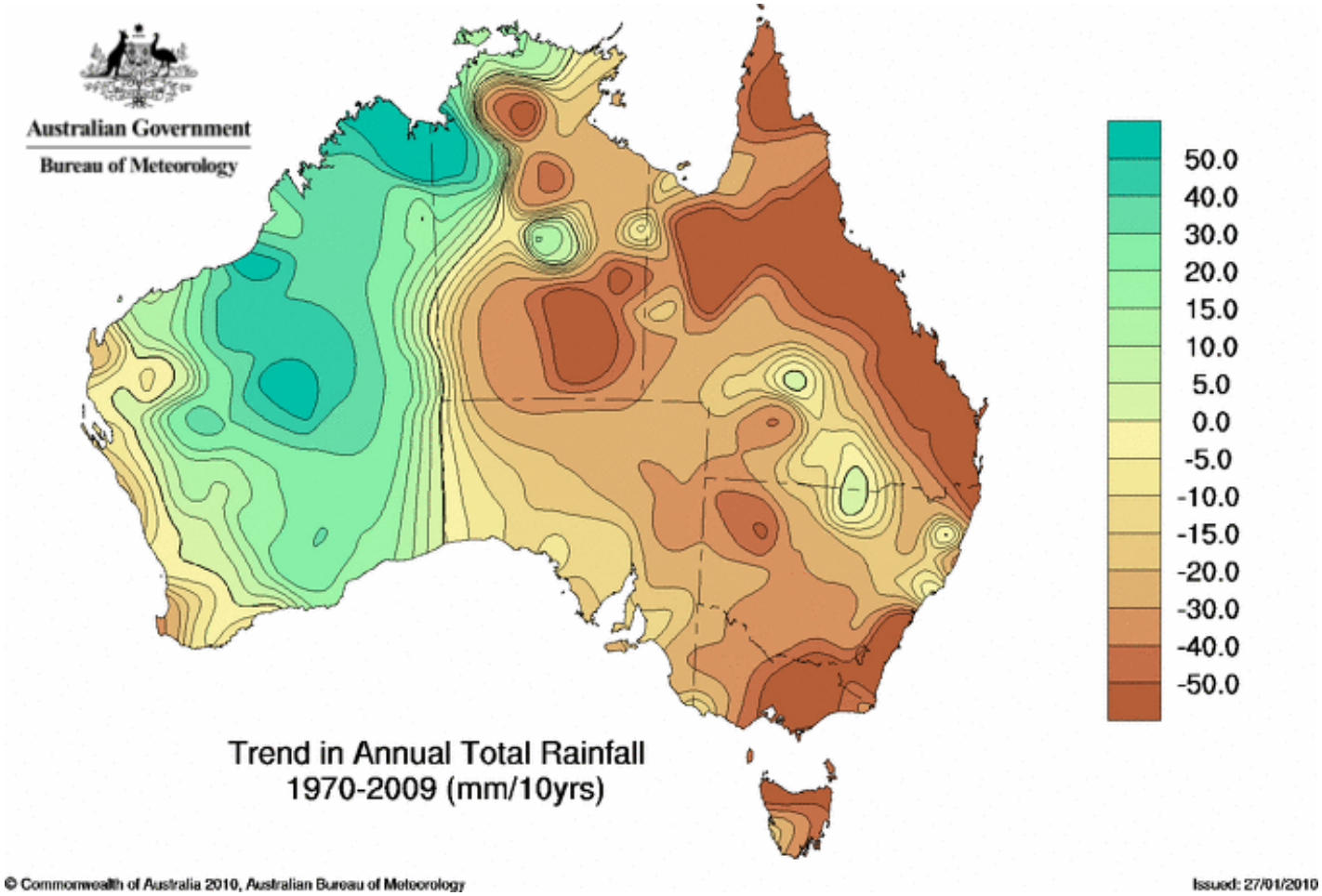
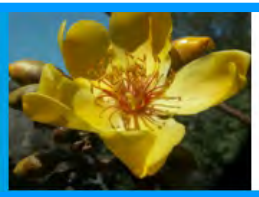
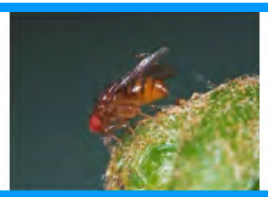
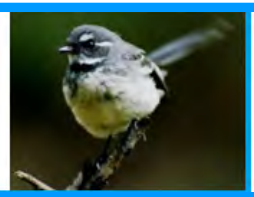
Current Trends - Rainfall



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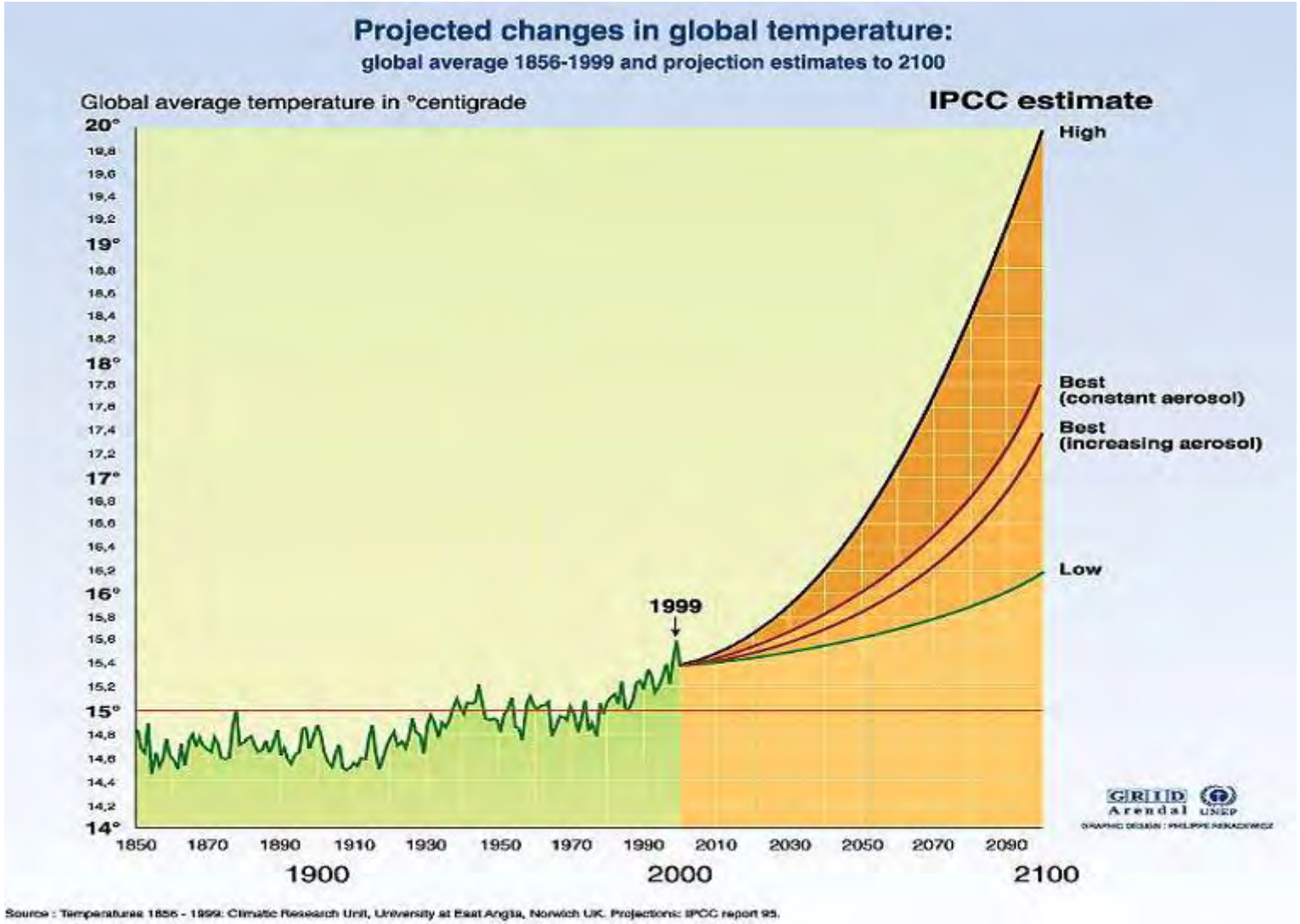
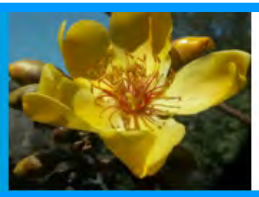
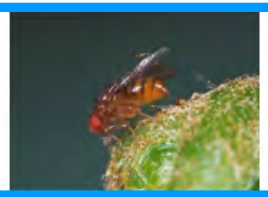
Records continuously being broken……

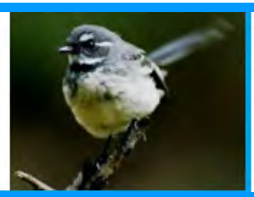
- 7 out of the top 10 hottest years ever recorded have been in last decade
- Last year hottest ever in Australia
- July 2010 was hottest ever July
- Increasing extreme events (eg. droughts, fire, heat waves)
- Etc etc etc etc etc

IPCC Temperature Projections



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

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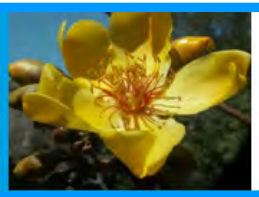
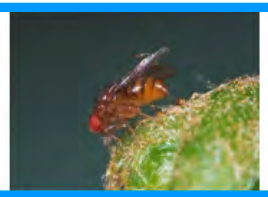
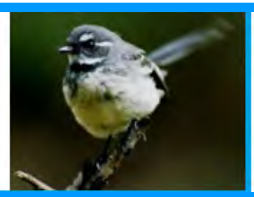
In Summary:

- 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

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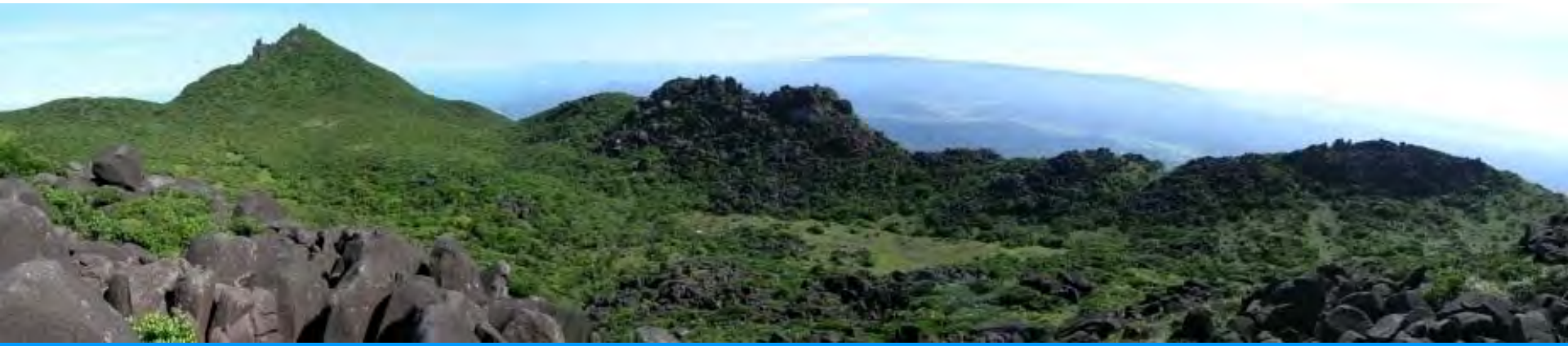
What will be the impacts on our natural environment?

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

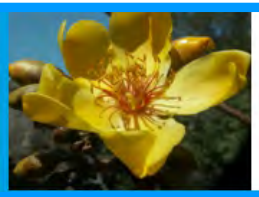
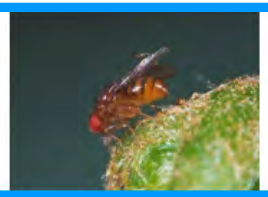


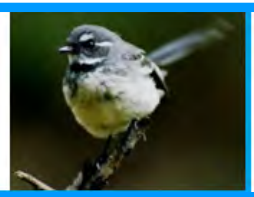

Climate Change and Biodiversity



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

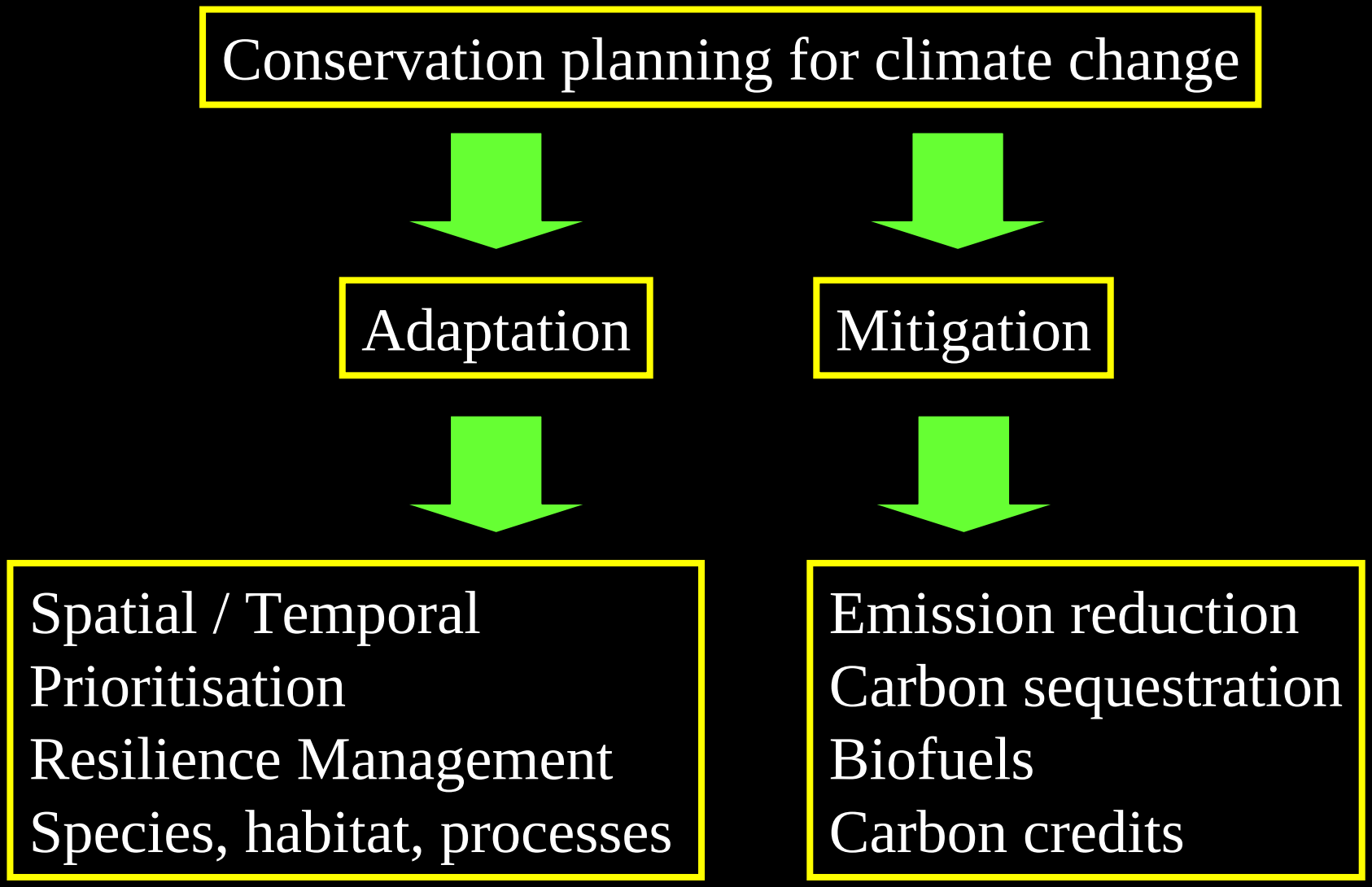



Global Biodiversity

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

Thomas et al. 2004, *Nature*

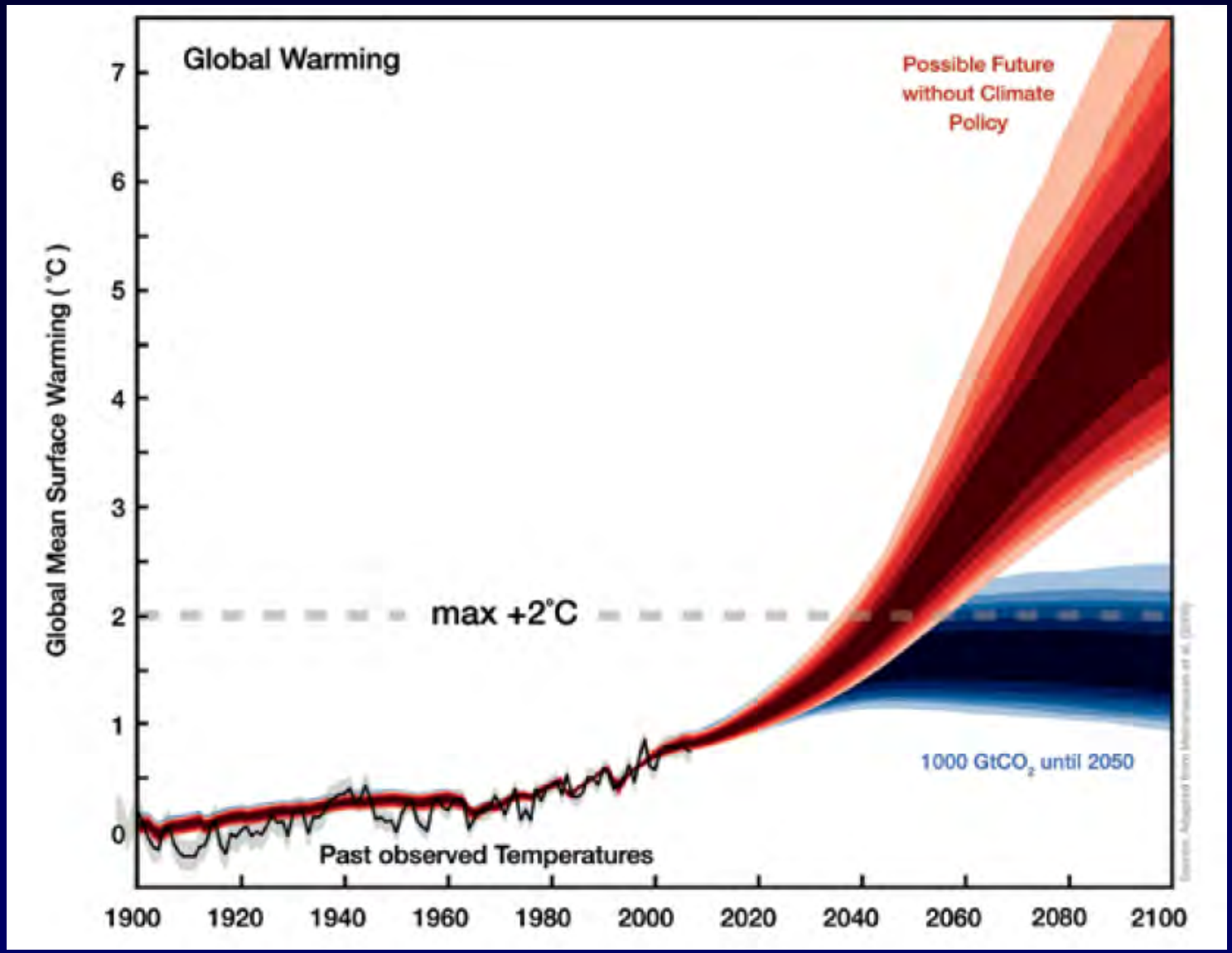
What can we do about minimising the impacts of global climate change on biodiversity?


Conservation planning for climate change
Adaptation
Mitigation
Spatial / Temporal
Prioritisation
Resilience Management
Species, habitat, processes
Emission reduction
Carbon sequestration
Biofuels
Carbon credits

MITIGATION:

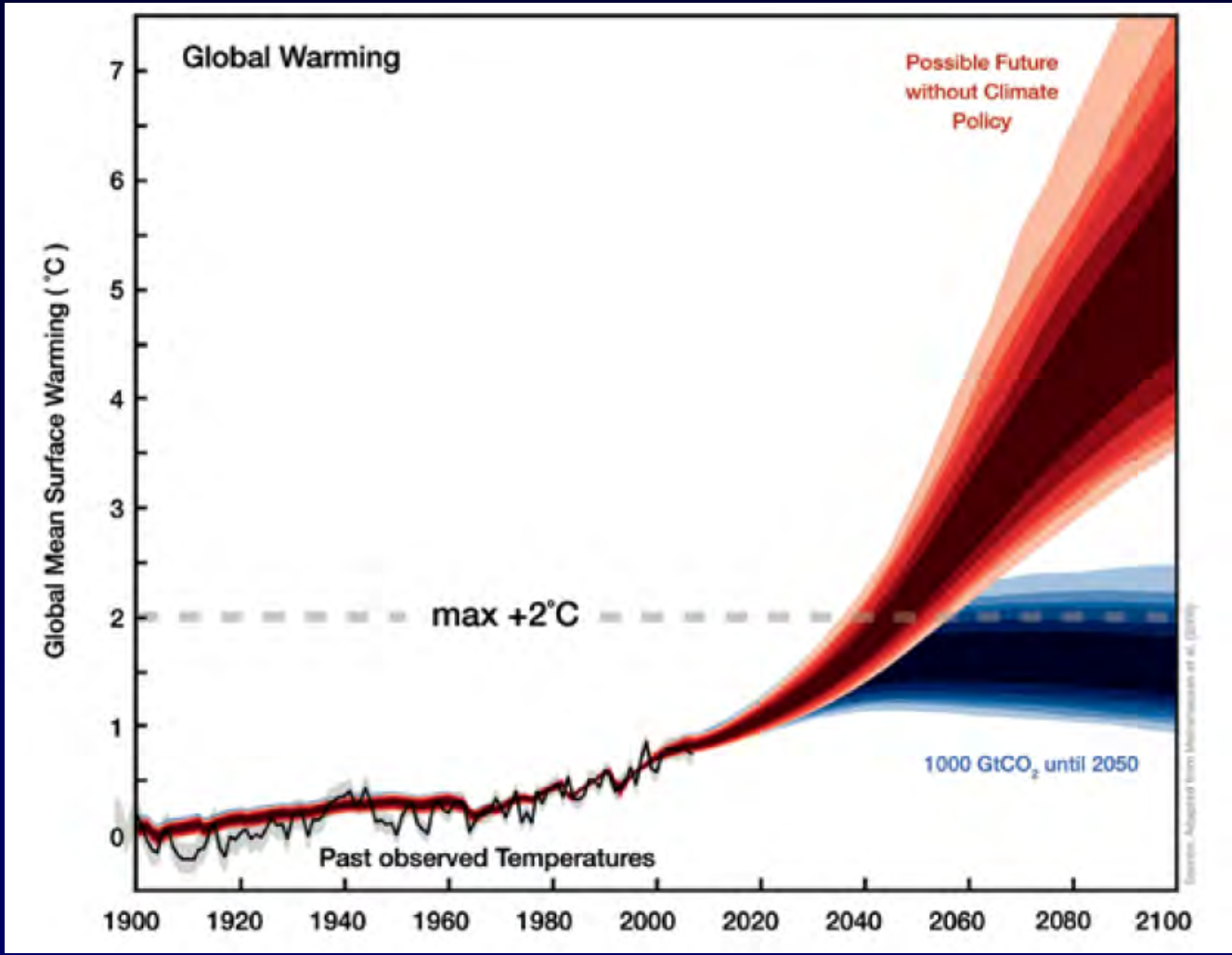
We need a serious global effort on mitigation and reduction in greenhouse gas emissions and to stop waiting for someone else to go first …..

MITIGATION


Global Warming
Possible Future without Climate Policy
max +2°C
1000 GtCO2 until 2050
Past observed Temperatures
Global Mean Surface Warming (°C)
0
1
2
3
4
5
6
7
1900
1920
1940
1960
1980
2000
2020
2040
2060
2080
2100

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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THE UNIVERSITY OF MELBOURNE

THE UNIVERSITY OF WESTERN AUSTRALIA

MACQUARIE UNIVERSITY SYDNEY ~ AUSTRALIA

JAMES COOK UNIVERSITY AUSTRALIA

UTAS

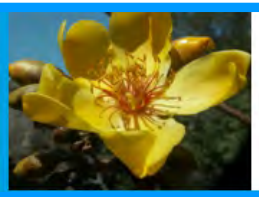
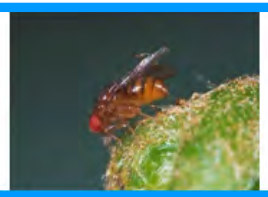
THE UNIVERSITY OF ADELAIDE AUSTRALIA

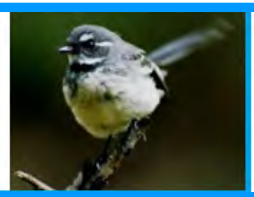
Curtin University of Technology

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

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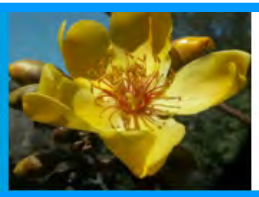
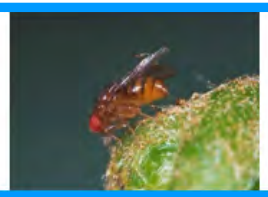
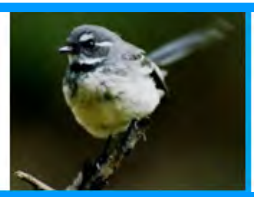
The key roles of NCCARF include:

- 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.

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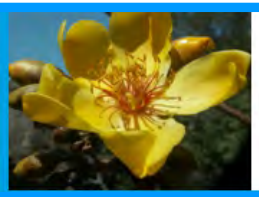
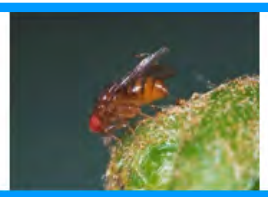
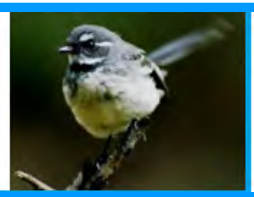
National Climate Change Adaptation Facility

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.

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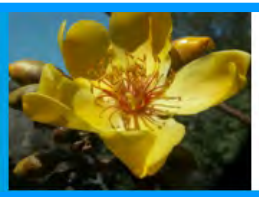
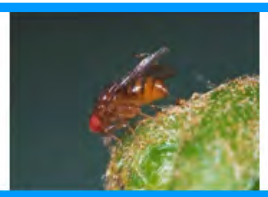
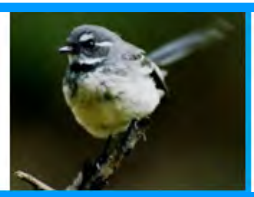
Terrestrial Biodiversity Adaptation Research Network

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

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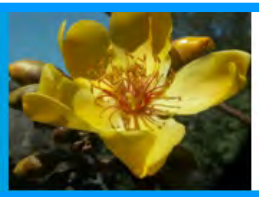
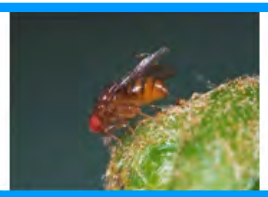
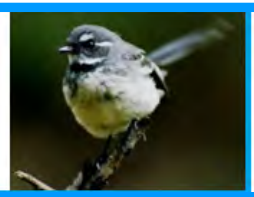
Network Role – NCCARF Network Strategic Plan

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.

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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)

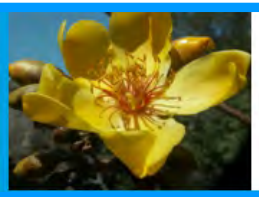
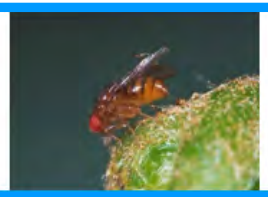
Prof Ary Hoffmann, Dr Lynda Chambers (VIC)

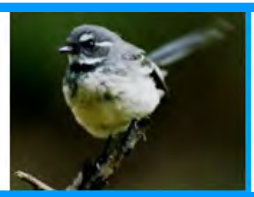
Prof Roger Kitching, Prof Hugh Possingham, Prof Bob Pressey, A/Prof Jean-Marc Hero (QLD)

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)

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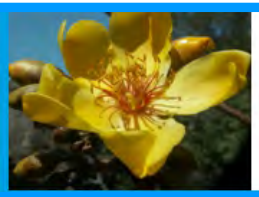
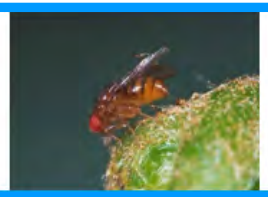
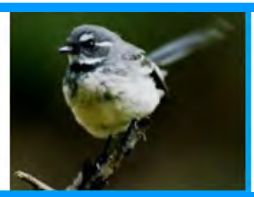
Regional Nodes

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Network Structure

National Climate Change Adaptation Research Facility NCCARF

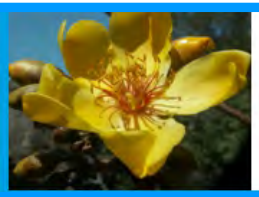
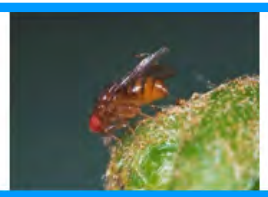
Steering Committee

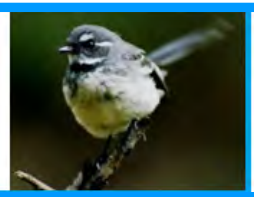
External Network Links

Other NCCARF Networks
Australian Research Council Networks
Commonwealth Environmental Research Facility
Government Agencies
State Agencies
NGO's
Research Centres

Network Participants

Over ~825 participants from 200+ institutions providing expertise across all state and major ecosystems, and in all aspects of global change biology and terrestrial biodiversity

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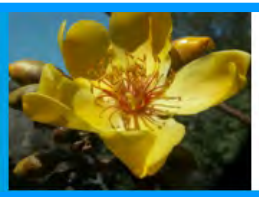
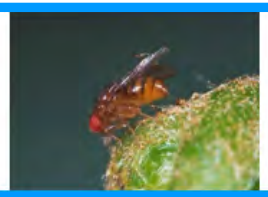
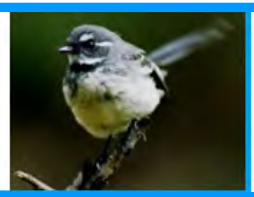
Our Primary Goals

- 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

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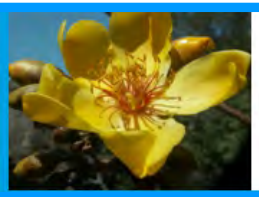
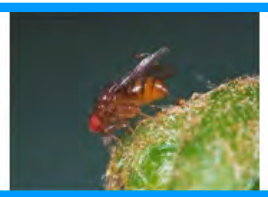
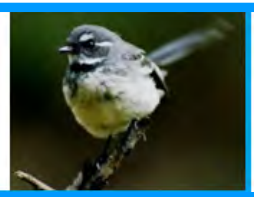
Our Primary Goals (no bull#&% version)

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

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Example:

Adaptation and protecting the biodiversity of Australian tropical rainforests

Basic biodiversity monitoring and science

↓

Understanding vulnerability

↓

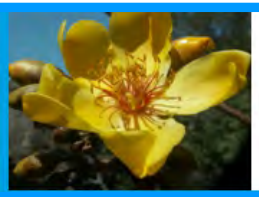
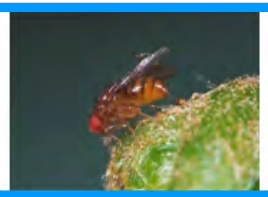
Predicting Impacts

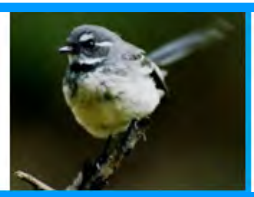
↓

Assessing Adaptation Options

↓

Implementation

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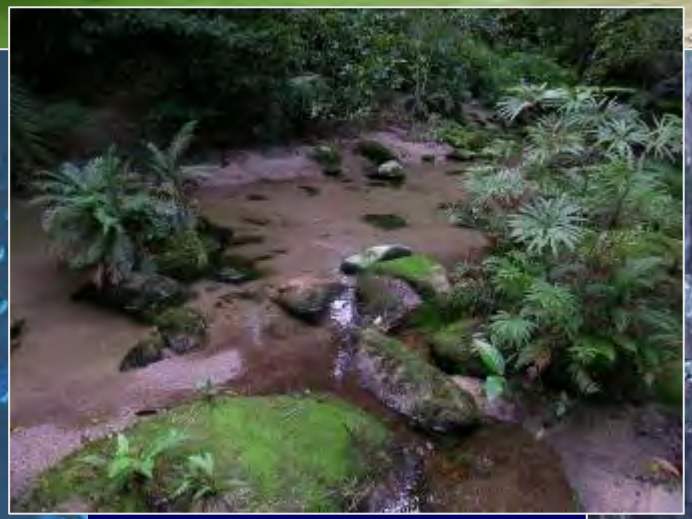
The rainforests of the Australian Wet Tropics

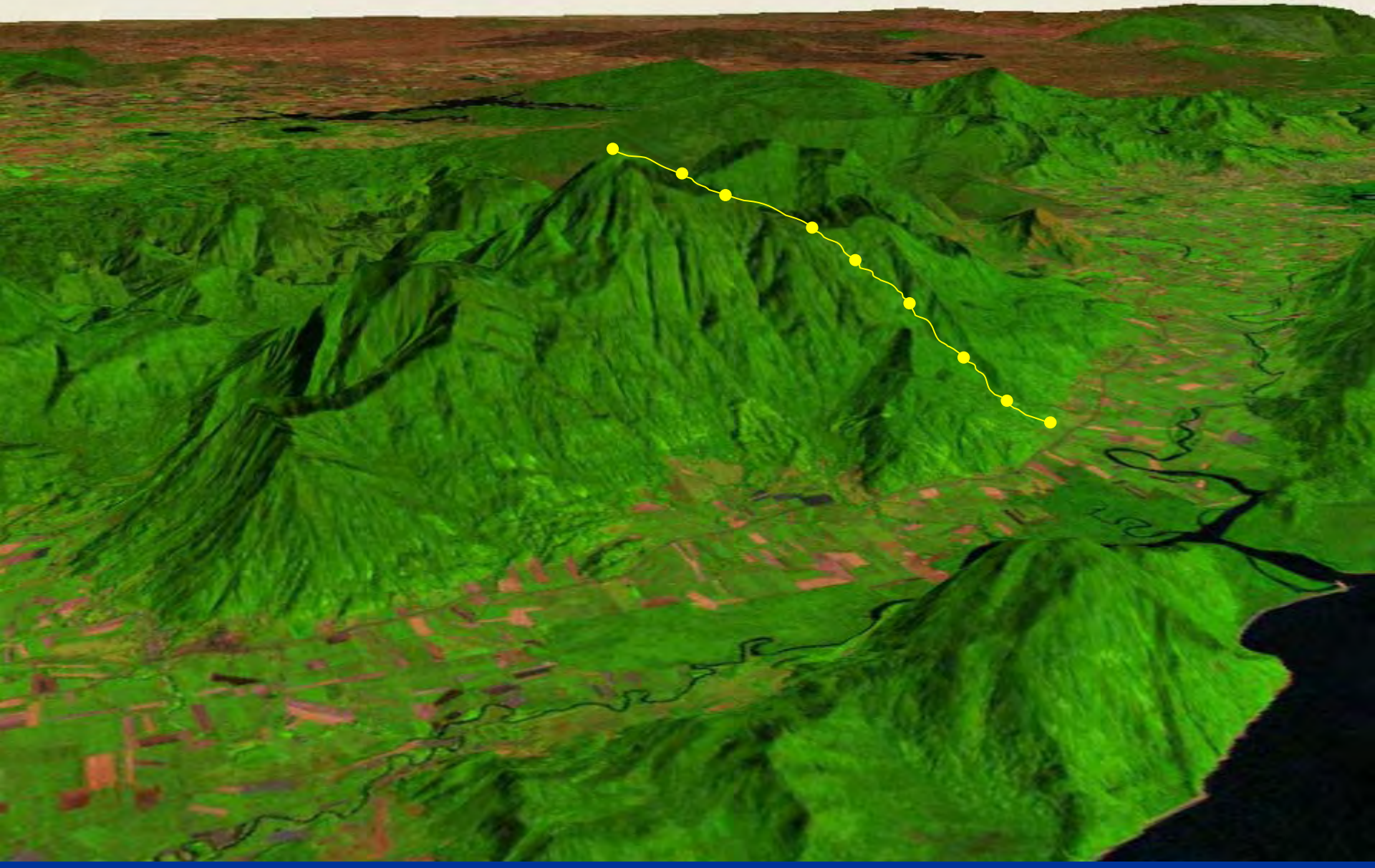
Most biologically rich area in Australia with many unique

~ 10,000 sq km rainforest


Cooktown
Cairns
Townsville



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





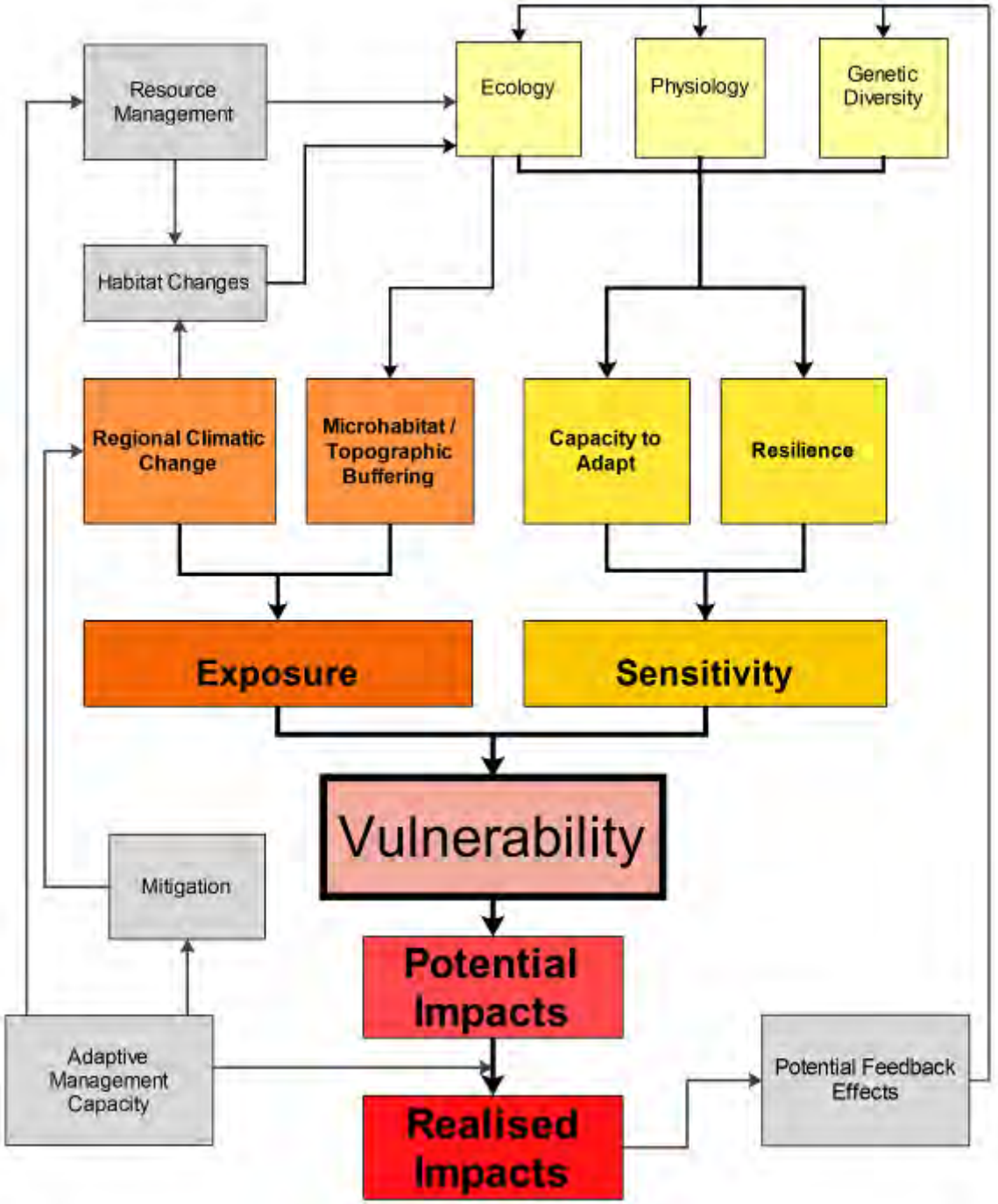

Informed adaptation

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.



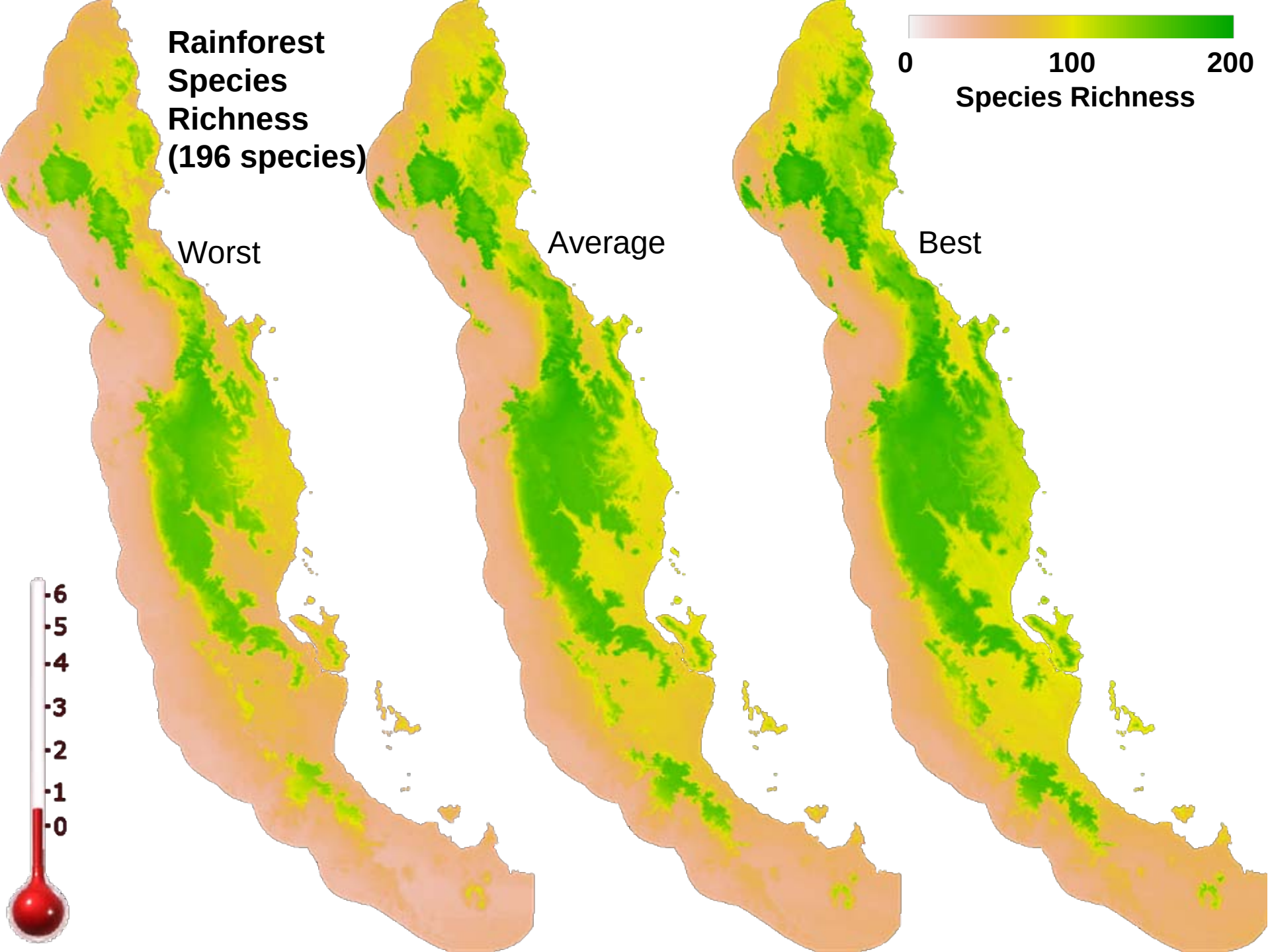
Williams & Shoo et al. 2008 *PLoS Biol*

Golden Bowerbird

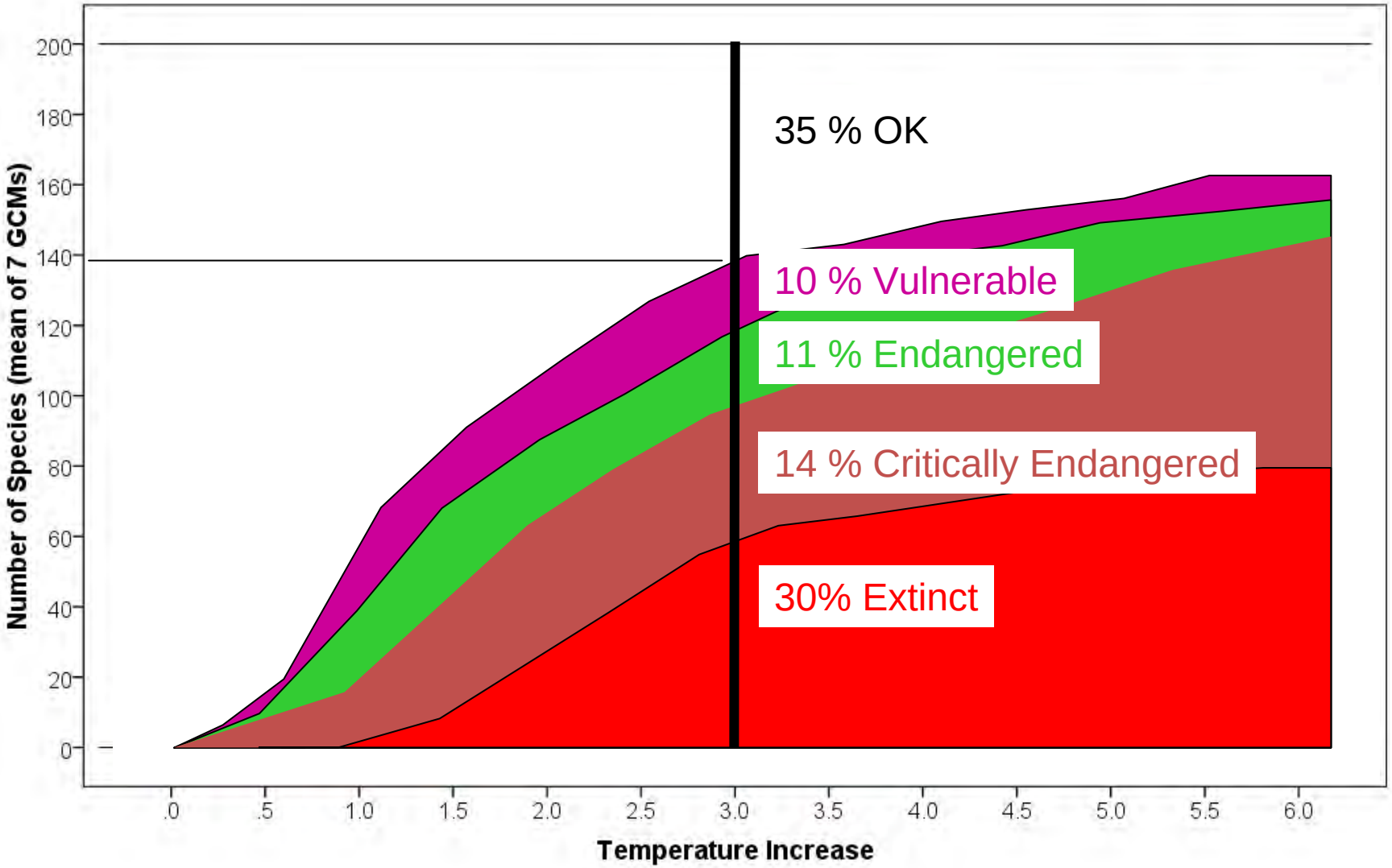
Worst

Average

Best


Rainforest Species Richness (196 species)
Worst
Average
Best
0
100
200
Species Richness
6
5
4
3
2
1
0

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?

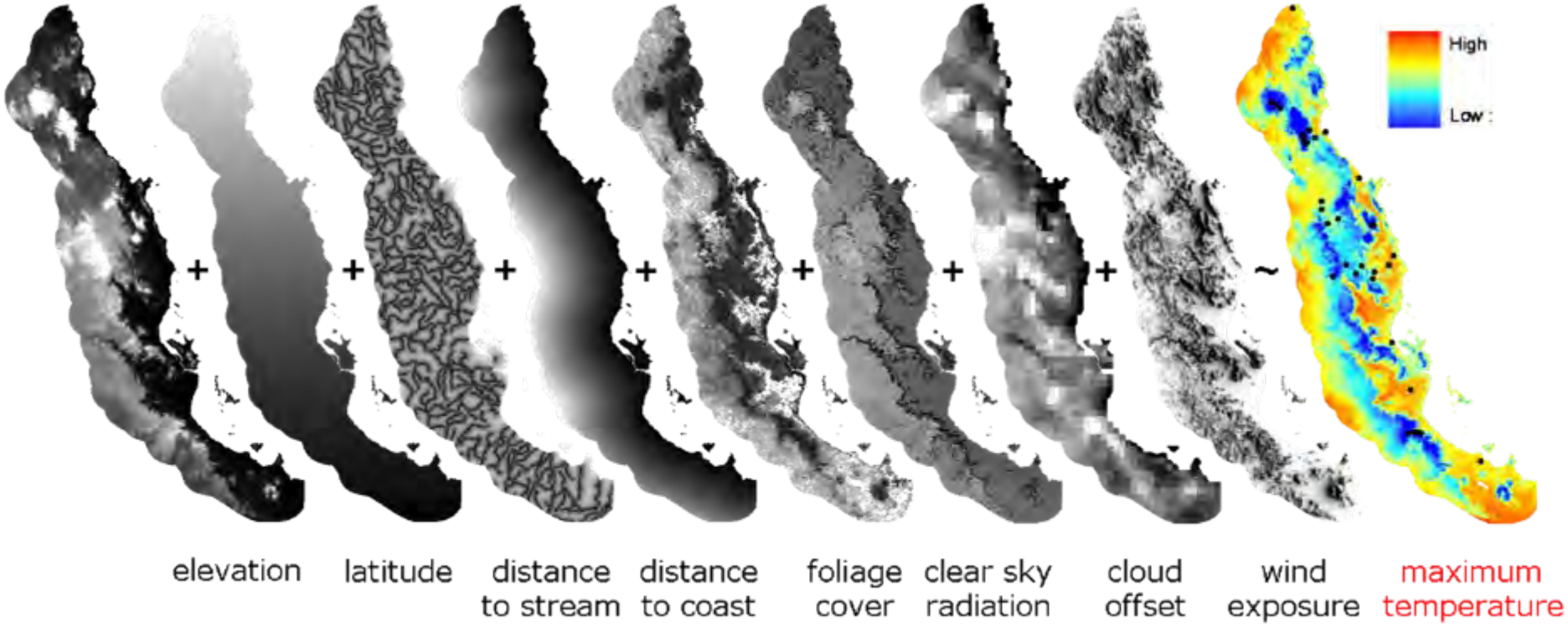
Which species will benefit?

What factors will threaten these refugia?

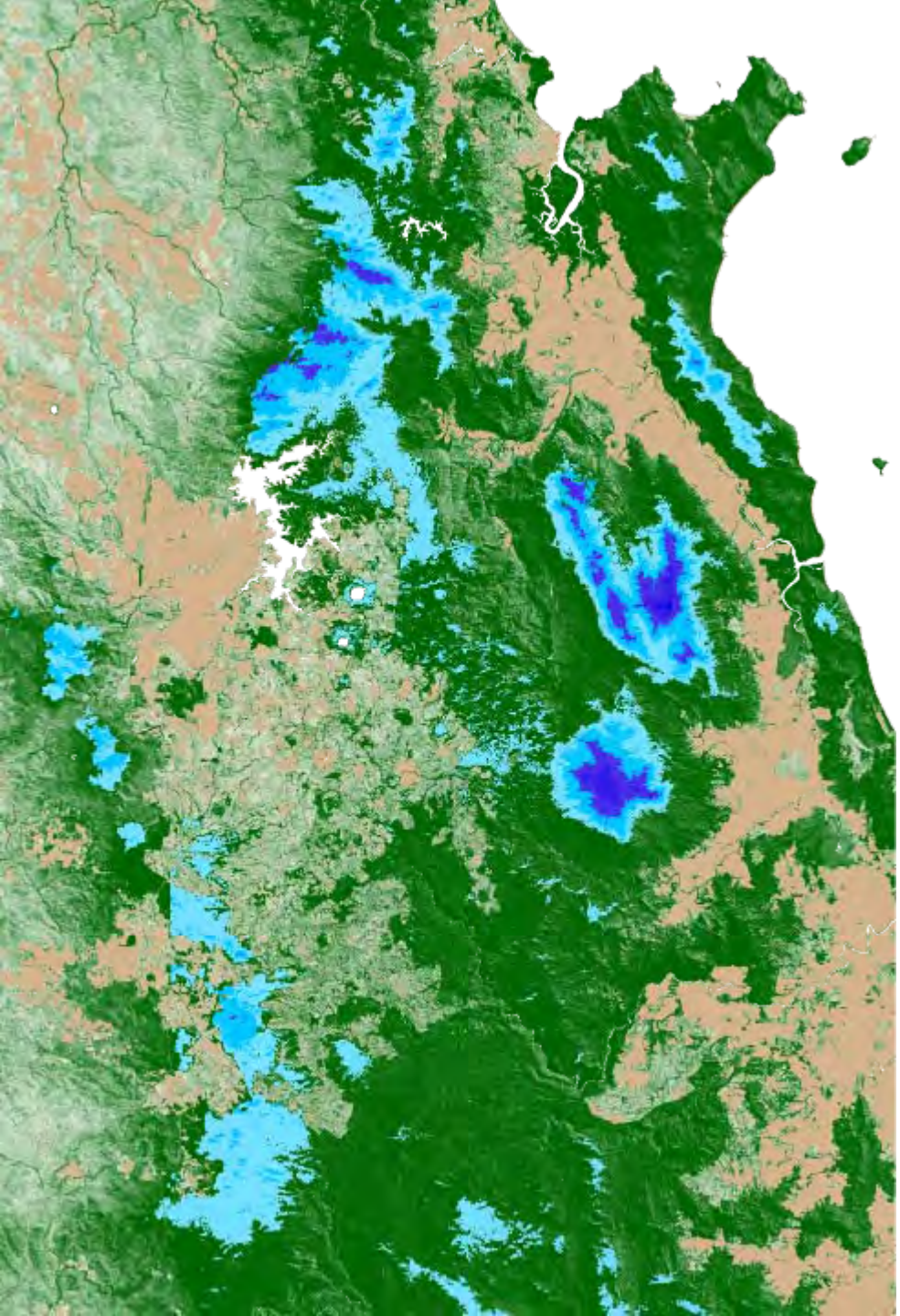
How do we protect, enhance and manage them?

Cool Refugia

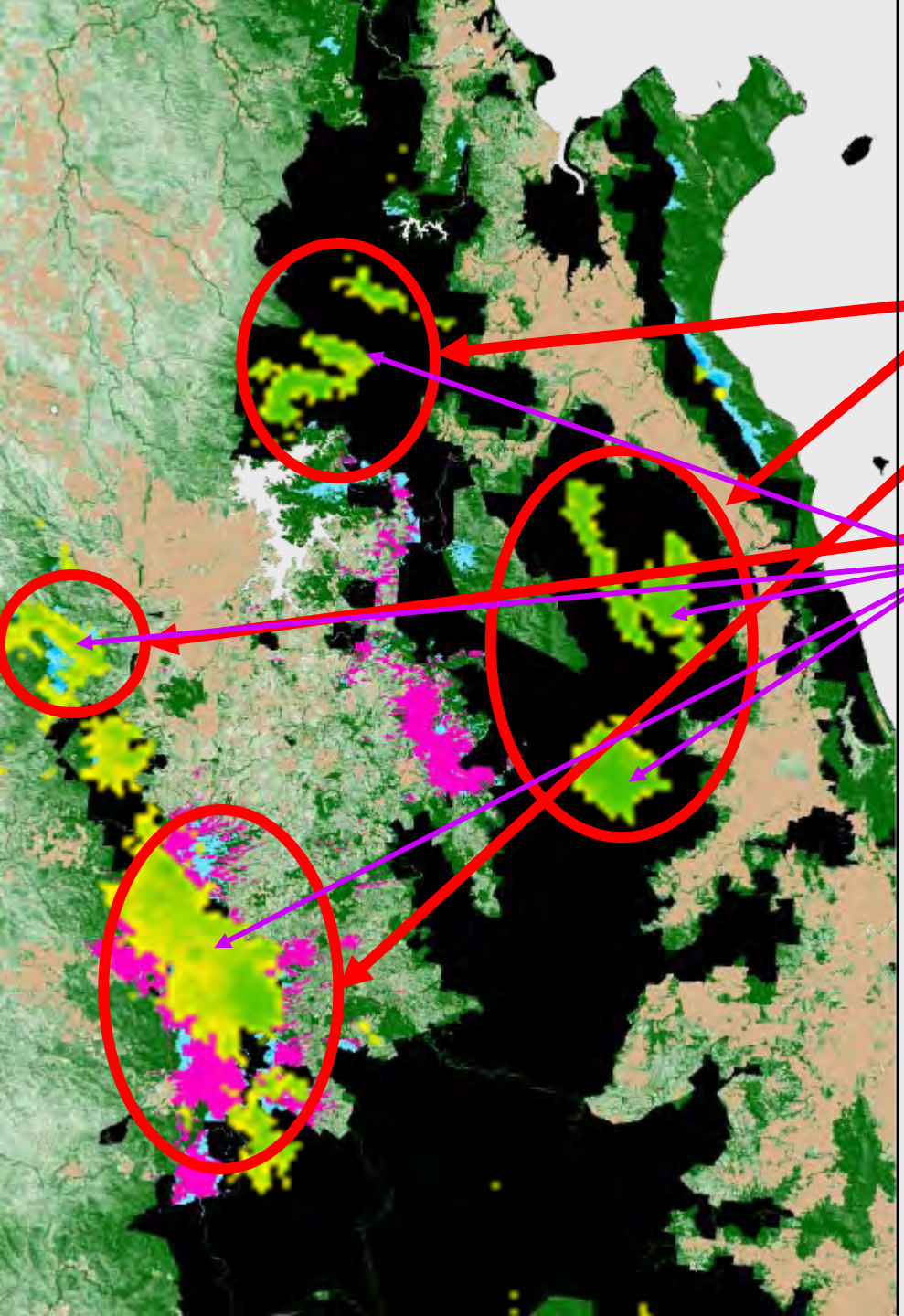
A map showing the maximum temperature actually experienced by an organism in any part of the region



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



Existing thermal refugia



Adaptation Options

High value refugia already in protected area:

- Maintain corridors to refugia
- Re-establish corridor for movement and gene flow

Biodiversity refugia based on overlayed distributions of all 200 rainforest vertebrates modelled using averaged Maxent future distributions of 7 GCMs at 4 deg C increase

Degraded landscape with potential to be high value refugia

- Land acquisition &/or off-reserve management agreements
- Habitat restoration

High value refugia connected to protected refugia:

- Potential for assisted migrations
- Off-reserve management agreements

Conservation Planning & Climate Change - workshop

Will predicted future climate affect this species?

Is there sufficient ecological plasticity?

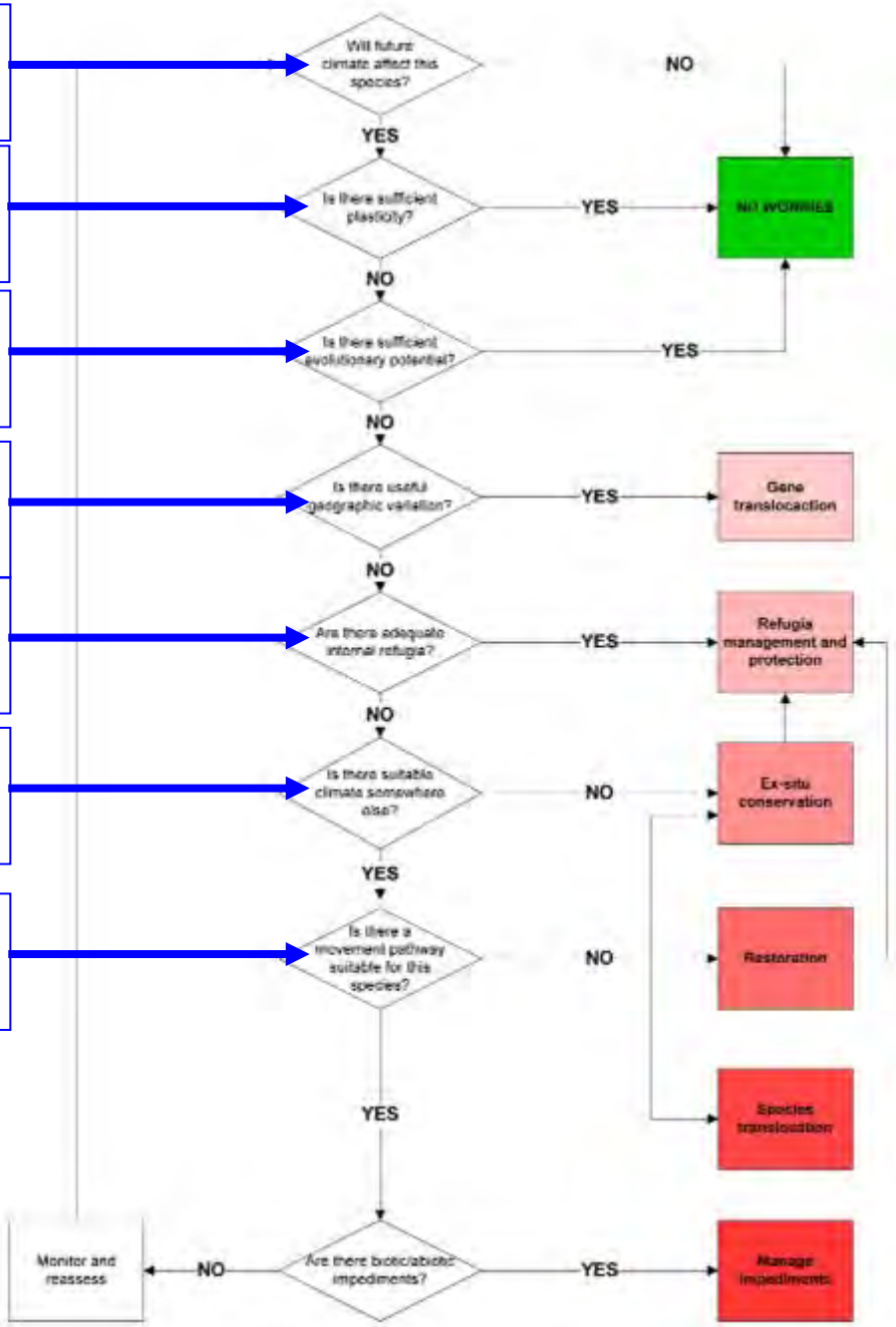
Is there sufficient evolutionary potential?

Is there useful geographic variation?

Are there adequate internal refugia?

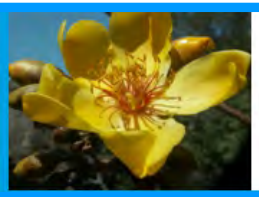
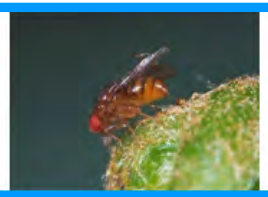
Is there suitable climate elsewhere?

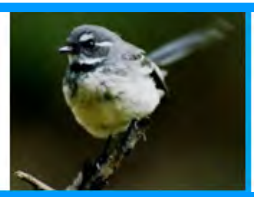
Is there a suitable movement pathway?



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

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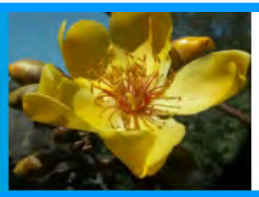
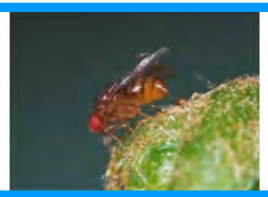
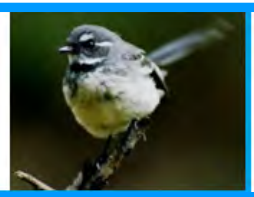
National Adaptation Research Plan for Terrestrial Biodiversity

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)

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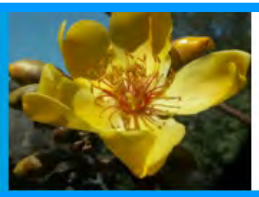
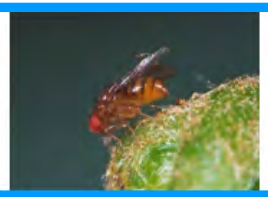
National Adaptation Research Plan for Terrestrial Biodiversity

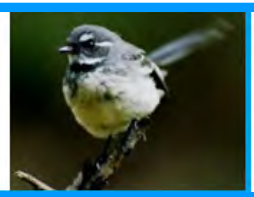
The aims of this Plan are to:

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.**

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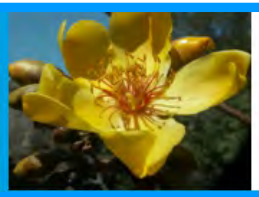
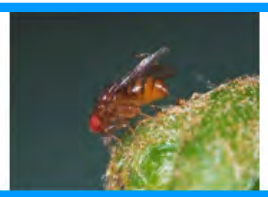
NARP – National Research Priorities

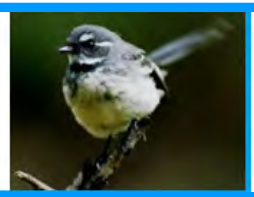
5.1 National/continental scale issues

- **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?

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NARP – Regional Research Priorities

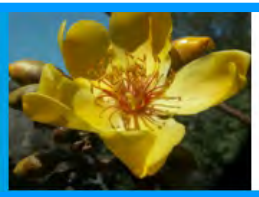
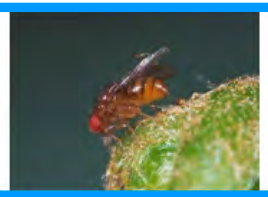
5.2 Regional issues

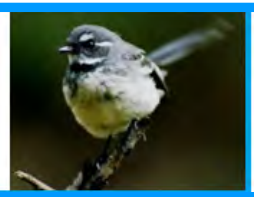
- **5.2.1** What designs of landscapes in intensive and extensive land-use zones confer maximum resilience for biodiversity in the face of climate change, including the uncertainty associated with future climate scenarios?

- **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?

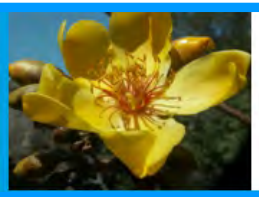
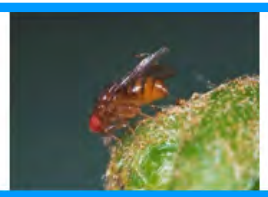



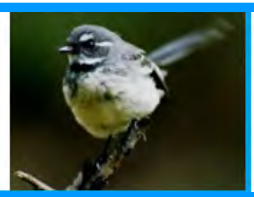



NARP – Local Research Priorities

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?

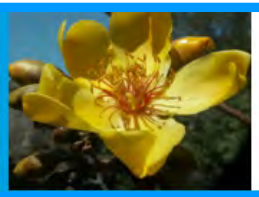
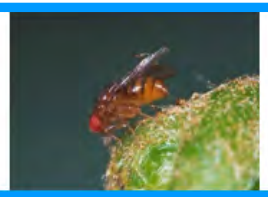



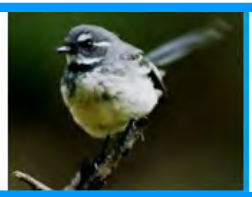



NARP – Species Research Priorities

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?

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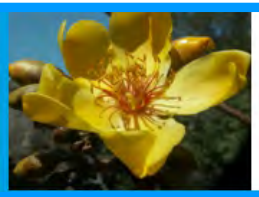
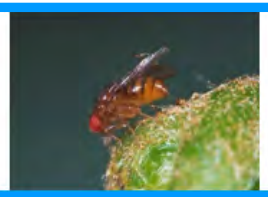
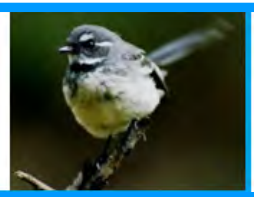
Some common themes and priorities for biological research across NARP, BVA, Protected areas:

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

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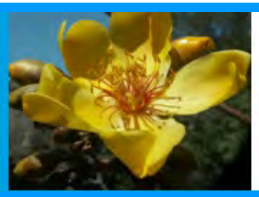
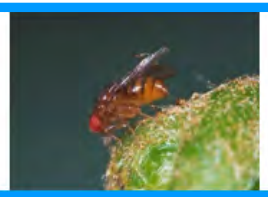
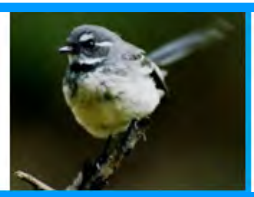
How do YOU think the national priorities fit your ecosystem / region / sector?

- 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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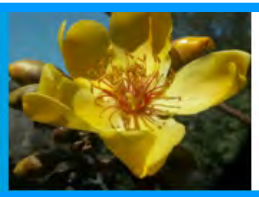
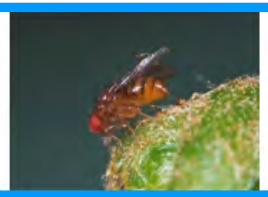


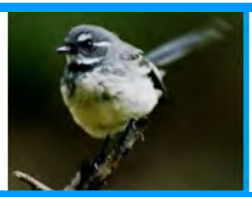

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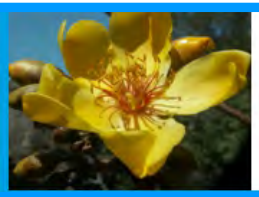
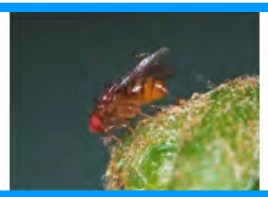
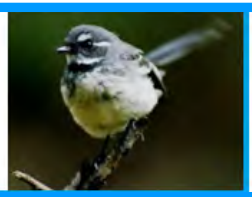
Workshop:

What are the main broad themes/challenges/problems for climate change impacts on biodiversity in Queensland?

- Temperature
- Changing rainfall
- Sea level rise
- Extreme events:
  - Fire
  - Drought
  - Cyclones
  - Floods
  - Storm surges
- Interactions
  - Invasive species
  - Habitat Fragmentation

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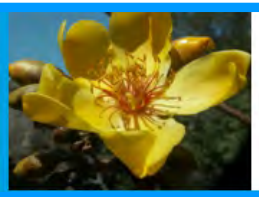
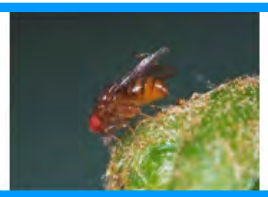
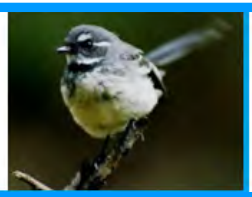
Local / Regional / Sectoral

Sector	Area	Ecosystem	Impacts	Ideas to Adapt & Manage	Adaptation Research	Impediment
National Park	SEQ	Rainforest	• Increase drying causing resource bottle necks • Extreme events	• sprinklers in the rainforest • Artificial structures to provide micro refugia / feeders	• Which species most threatened • Would the animals use these structures •When to act	• Money • Changing ideas and attitudes to Climate Change
Conservation Reserve		Coastal swamp	Salt water intrusion – sea level rise	• Dykes • manage stream flow	Will water management be effective at stopping saltwater intrusion? How much sealevel rise can it handle?	•Cost •Effectiveness • Negative side-effects
Revegetation / Tree planting		Forest	• fragmentation / temperature-induced dispersal	Restoration of corridors	Best practice restoration techniques	Overcoming resistance to use of non-local plants

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