NCCARF:
research networks, research agenda and links with regional initiatives

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Australian Government Department of Climate Change · Griffith University · Queensland Government · University of the Sunshine Coast · Murdoch University · QUT isr Institute for Sustainable Resources · USQ University of Southern Queensland fulfilling lives · JCU James Cook University · The University of Newcastle Australia · Macquarie University Sydney

Sustainability Research Excellence Workshop, Gold Coast, 14 January 2010

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The national effort

- Three pillars of the Australian climate change strategy:
  1. reducing Australia's greenhouse gas emissions;
  2. adapting to climate change that we cannot avoid; and
  3. helping to shape a global solution
- The Council of Australian Governments (COAG) agreed the National Climate Change Adaptation Framework in April 2007
- Sets the agenda for the national approach to long-term adaptation to climate change

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Role of NCCARF

- “to lead the research community in a national inter-disciplinary effort to generate the biophysical, social and economic information needed by decision makers in government and in vulnerable sectors and communities to manage the risks of climate change impacts”
- Four years, $20 million + $30 million from the Commonwealth to fund research to address priority needs in climate change adaptation knowledge

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NCCARF Partners

James Cook University

University of Southern Queensland

University of the Sunshine Coast

Queensland University of Technology

Griffith University

Newcastle University

Macquarie University

Murdoch University

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The priority themes

1. Water resources and freshwater biodiversity
2. Terrestrial biodiversity
3. Marine biodiversity and resources
4. Primary industry
5. Settlements and infrastructure
6. Human health
7. Emergency management
8. Social, economic and institutional issues

and, latterly

Indigenous communities

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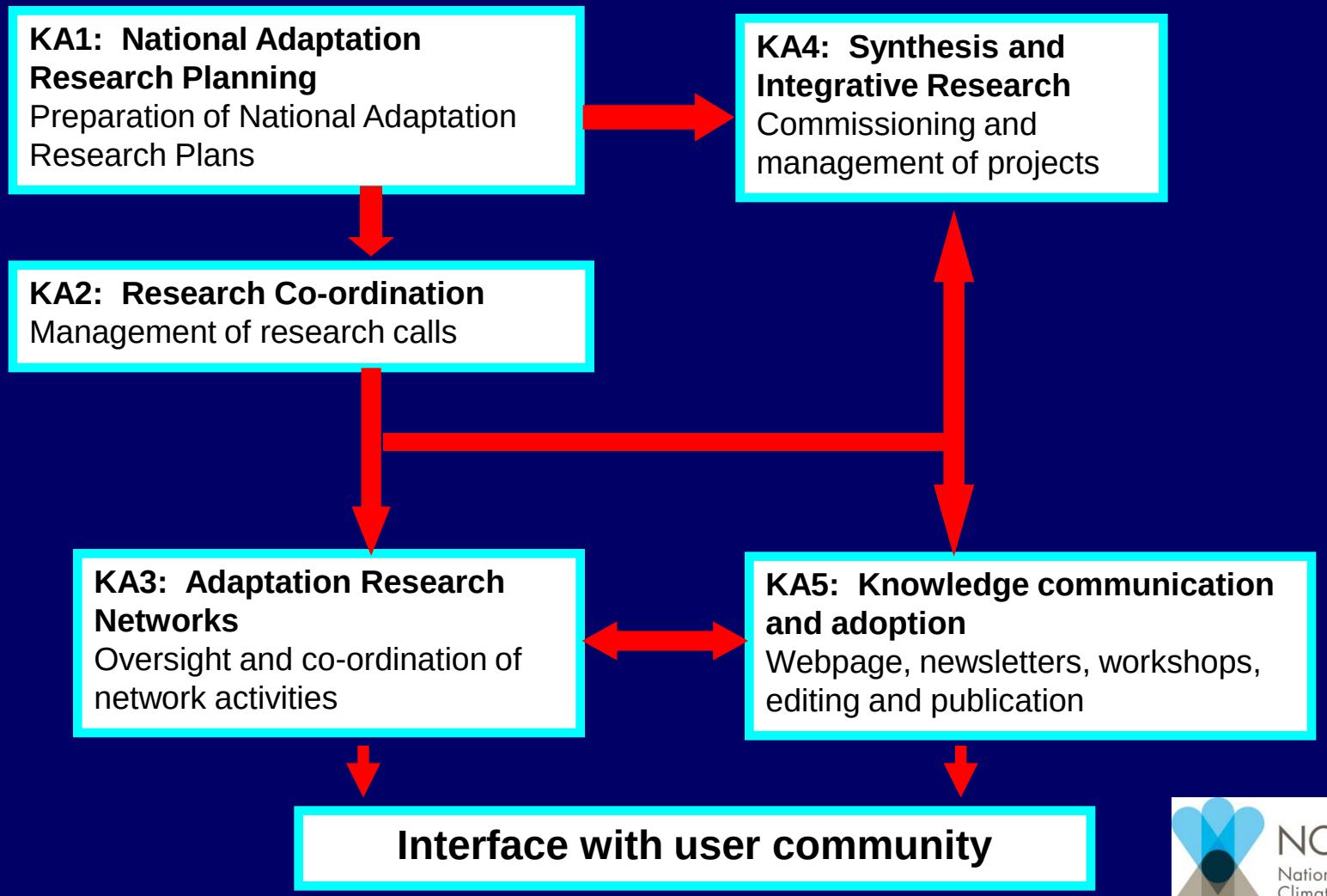
NCCARF activities



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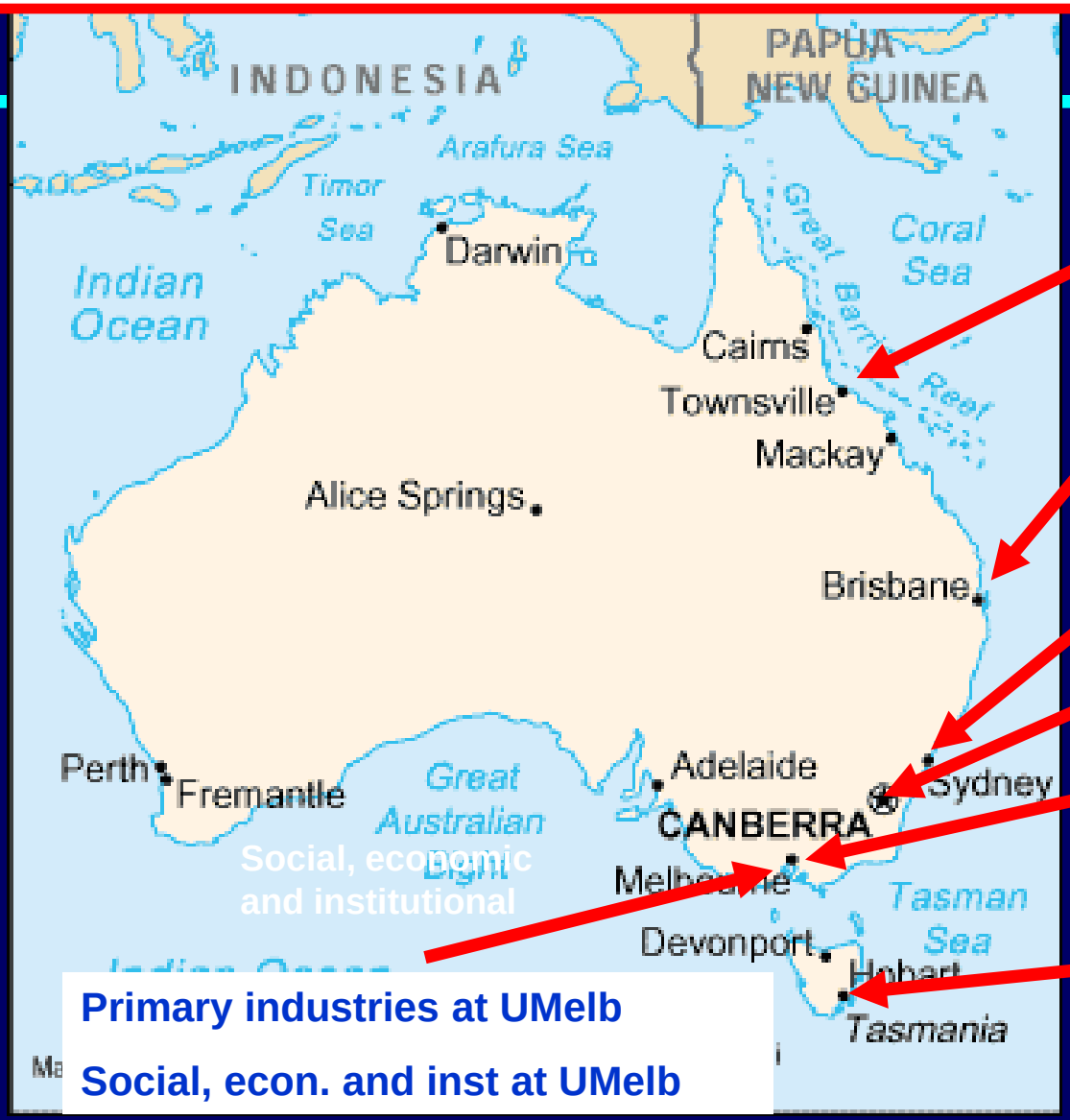
NCCARF Networks: convenors



Terrestrial biodiversity at James Cook

Water res. and bio. at Griffith

Settlements and Infrastructure at UNSW

Human Health at ANU

Emergency management at RMIT

Marine bio. and res. at UTas

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Adaptation research networks

2500 members

- Role to build:
  - National research capacity
  - Interactions between researchers and decision-makers
- Through a range of activities:
  - Workshops for early career researchers
  - Grants to post-graduate researchers
  - Newsletters

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Network key achievements

1. **Open exchange of information and sharing of resources**
   - Establishing Network websites
   - Building and managing Network membership
   - Searchable databases
   - Network email lists and forums
   - Network workshops and other events
   - Network roadshows
   - Network newsletters, e-bulletins
   - Science/policy connections

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Network key achievements

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Adaptation Research Network
MARINE BIODIVERSITY AND RESOURCES

FACT SHE

Species response to climate change in the ocean

Climate change is modifying the temperature and chemistry of our oceans, with
and indirect consequences on the oceanography and functioning of marine ecos
Below are some of the expected and/or observed responses of marine species t
change.

Physiological responses

All marine organisms live within a limited
range of temperature and pH
corresponding to the range where cellular
exchanges and whole-organism processes
are optimised for the species. Acidification
and/or increases in ocean temperature can
push some species towards their
physiological limits (i.e. the edges of their
thermal or pH range), resulting in negative
effects on the organisms' growth,
reproduction, foraging, immunity,
behaviour and competitiveness[1]. A well
known example is the bleaching of tropical
coral reefs caused by the dissociation of
corals and their symbiotic unicellular algae
at temperatures close to their upper
thermal tolerance. Laboratory studies have
also demonstrated negative physiological
responses in other species under
predicted climate change conditions,
including compromised fertilisation and
early development in the purple sea
urchin[2] and impaired oxygen transport in
squids[3].

can be characterised by specific
temperature and salinity, depth r
substrate, as well as the presen
adequate food supplies and shel

Environmental changes associ
climate change are leading spec
move to different locations to m
habitat requirements. For exam

benthic and demersal fish spec
eastern and south-eastern Aus
shifting polewards to cooler wa
some cases this is creating sig
negative impacts by promoting
of invasive species (e.g. the Ea
sea urchin establishment in Ta

Changes in distribution

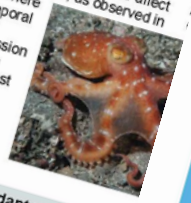
Marine species have a particular habitat
preference which
reflects the most
suitable
environment for
them to thrive and
defines their
distribution.
Suitable habitats

Changes in phenology

Phenology corresponds to the timing of
life-history events (e.g. timing of egg-
laying, migrations, peaks in abundance).
Changes in phenology are important
because species' life cycles are

interconnected and changes in the life-
history of one species can affect many
others, potentially resulting in an
asynchrony between dependent species
(i.e. decoupling of phenological
relationships).

Phenological changes are not easily
observable in marine systems and long
term datasets are lacking in Australia.
Nevertheless, changes in phenology
have been detected in seabirds[4] (i.e.
earlier laying) and are expected to affect
other taxa (e.g. plankton, as observed in
the North Sea where
substantial temporal
modifications in
seasonal succession
peaks have been
observed in the last
few decades[5]).



About the Marine Adaptation Network

The Adaptation Research Network for Marin
by the University of Tasmania and convene
Neil Holbrook. The Marine Adaptation Netw
supported by 14 partners nation-wide. This
interdisciplinary network aims to build adapti
capacity and adaptive response strategies f
effective management of marine biodiversity
natural marine resources under climate char
more information on the Marine Adaptation
or to subscribe to become a member of the
please email ammbr@ammbr.org.

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Adaptation Research Network
MARINE BIODIVERSITY AND RESOURCES

INFORMATION SHEET 2

Ecosystem responses to climate change in the ocean

Climate change is modifying the temperature and chemistry of the oceans, with direct consequences on oceanography, species, and the functioning of marine ecosystems. The responses of marine ecosystems to climate change fall into several categories, including changes in productivity, changes in community structure, and changes in ecosystem function (processes that contribute to ecosystem maintenance) and ecosystem services (resources and processes that are supplied by natural ecosystems and support human quality of life). It is important to note that the resilience of our marine ecosystems to the potential impacts of climate change is also affected by interactions with other human threats such as pollution and overfishing.

Changes in productivity

How a changing climate will modify ocean
systems is difficult
to predict, but most
evidence suggests
that the net effect will
be negative. Climate
change induced
modifications of
ocean circulation, pH,
seawater chemistry,
nutrient availability
from coastal runoff,
incident solar radiation,
upwelling and surface
winds will change ocean primary production
(e.g. phytoplankton biomass). These changes in
primary productivity are expected to propagate
upwards in marine food chains, leading to
increased productivity in some systems and
decreased productivity in others. So far, such
changes have not yet been detected in Australian
waters, although it is important to note the lack
of long-term marine data sets in the region.
While future changes in deep-sea and land-
based nutrient supply to the surface ocean are
speculative, it is expected that Australia's already
low productivity will decrease further in areas
where nutrient supply to surface waters declines[1].

Changes in community structure

The assemblages of species in ecological
communities reflect interactions among organisms
as well as between organisms and their
environment[2]. Ocean properties responding to
climate change will alter the dynamics between
species, favouring increased predation and
grazing in some areas, facilitating invasion in
others and reducing biodiversity. Modifications to

species ranges (either through range extension
or range shift), tends to initially increase the
local biodiversity (i.e. species richness) as new
species arrive in a region.
This has already been
observed in Tasmanian
waters where New South
Wales fish species have
become established
south of Bass Strait
and others have shifted
their range south along
the Tasmanian coast[1].
Changes in community
structure can also result
from the disappearance of
local species due to unfavourable conditions – an
example being lower coral biodiversity recorded
on the Great Barrier Reef as a result of changing
rainfall regime and runoff associated with climate
change[3].

Changes in ecosystem function and services

Marine
biodiversity
provides
most
ecosystem
services we
obtain from
the sea,
including
food,
protection
against
coastal
erosion,
recycling of
pollutants,

CARF
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ch Facility

Network key achievements

3. **Contributing to the development and implementation of the National Adaptation Research Plans**
   - Network Convenors on (or leading) NARP drafting teams, promoting input by Network members
   - Networks playing a key role in supporting calls for funding, including by supporting the establishment of research teams

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Network key a

4. Building rese

- Honours, Mas
- Travel suppo
  career resear
- Supporting er

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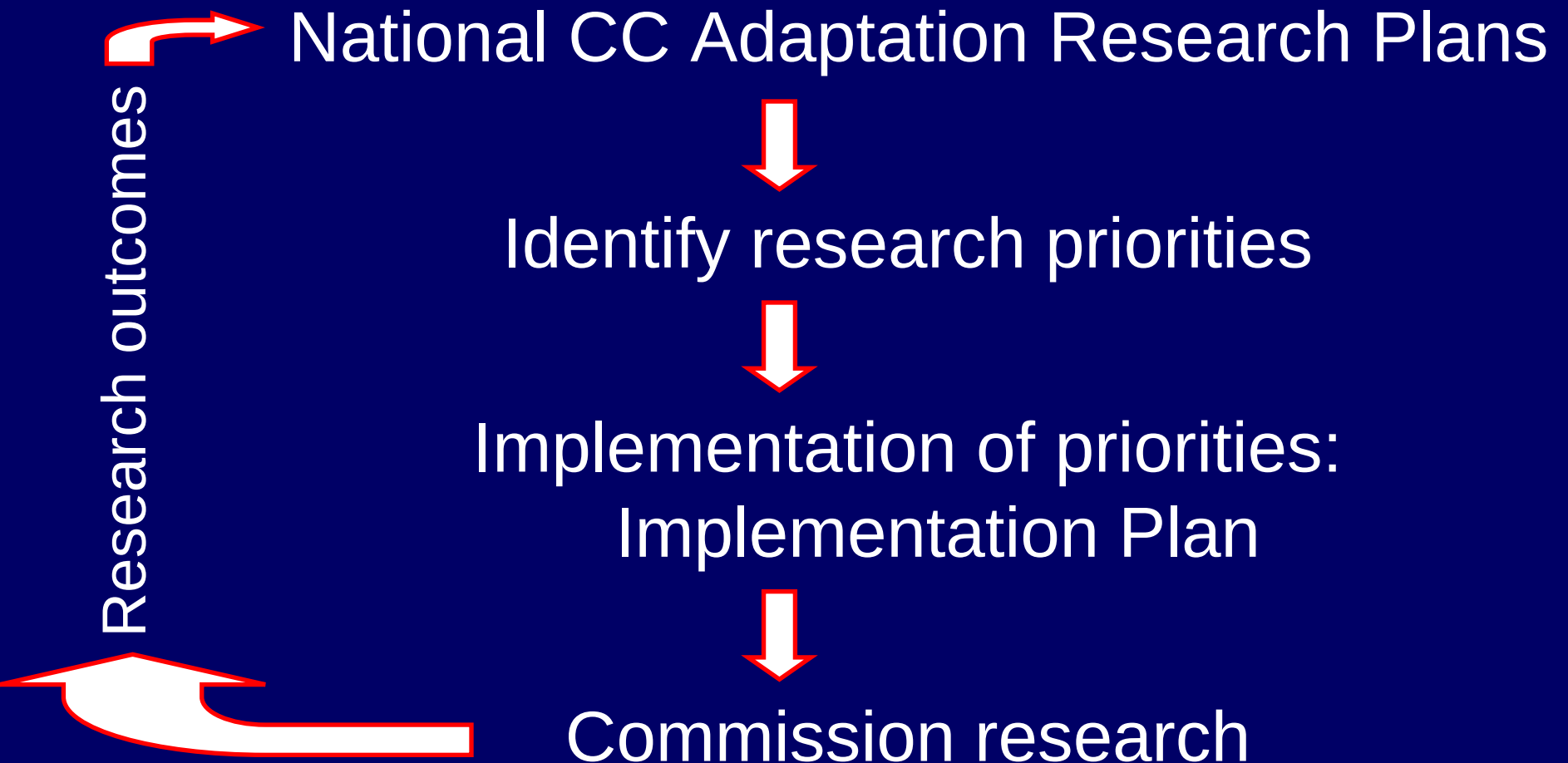
Thematic research



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Current state-of-play

1. Freshwater biodiversity: Consultation draft being prepared
2. Terrestrial biodiversity: NARP completed; awaiting Ministerial approval
3. Marine biodiversity and resources: NARP completed; call for proposals currently open (managed by FRDC)
4. Primary industry: Final draft being prepared
5. Settlements and infrastructure: NARP completed; call for proposals closed, EOIs under evaluation
6. Human health: NARP completed; second NHMRC Call closed
7. Emergency management: NARP completed; proposals recommended for funding submitted for Ministerial approval
8. Social, economic and institutional issues: Final draft being prepared
9. Indigenous NARP: Writing team selected

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Synthesis and integrative research

- To deliver to stakeholders research results in an accessible form tailored to their needs
- In Year 1:
  - Forest vulnerability assessment (4 studies + synthesis)
  - Case studies of present-day extremes and adaptation in the context of the Settlements and Infrastructure theme (+ synthesis)
    - Heatwaves in southern Australian cities
    - Storm/'King' tides
    - East coast lows
    - Cyclone Tracey
    - Drought and the public water supply in rural towns
    - Northern Queensland floods of 2009
  - Adaptive capacity (1 study)

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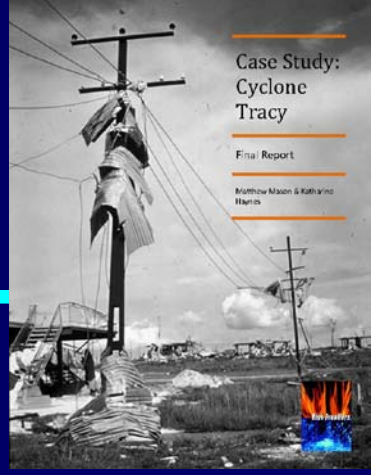
Purpose of the case studies



- To investigate adaptation in the immediate and extended period after the disaster
  - building industry
  - insurance and emergency management industries
  - building regulations & design standards
- Are there lessons to be learned for climate change adaptation?

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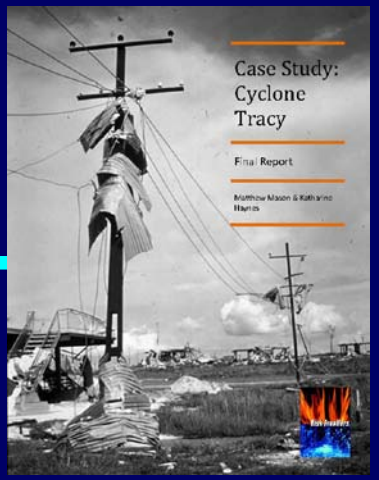
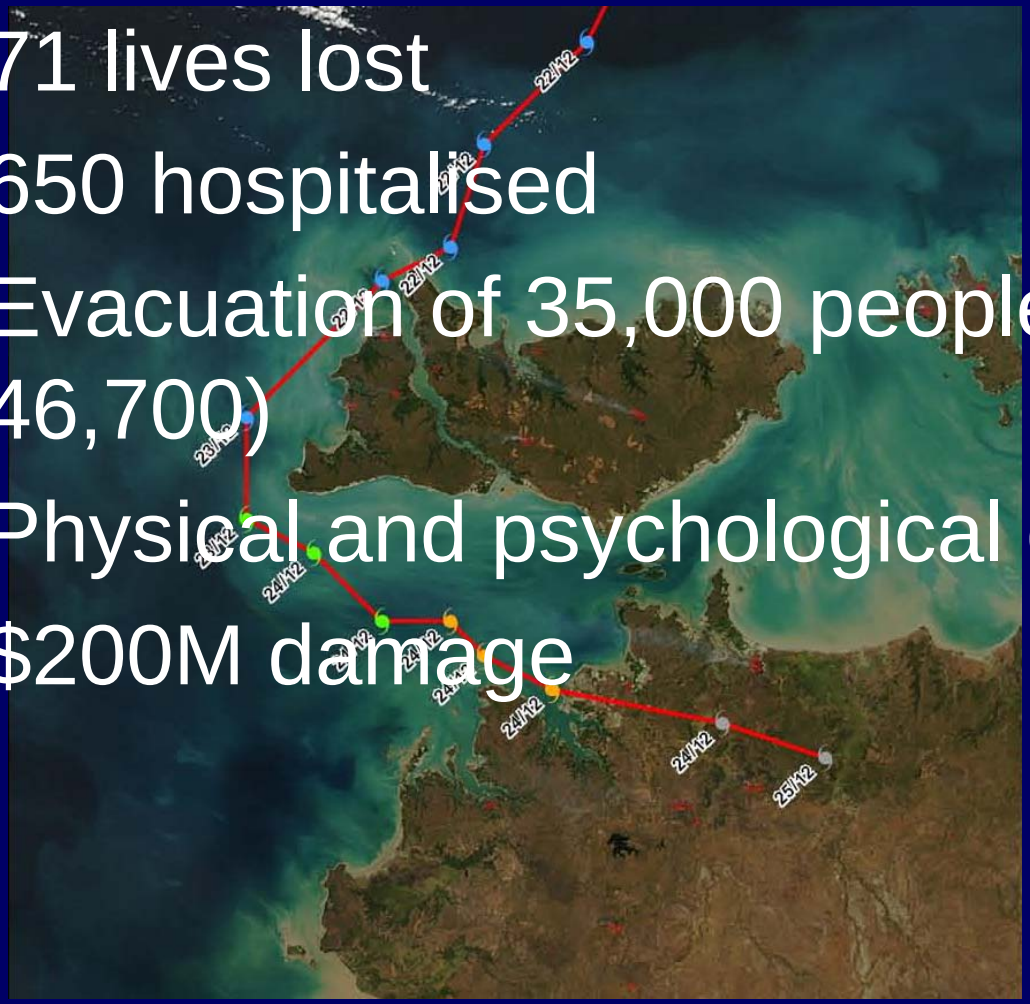
Cyclone Tracy project



- 71 lives lost
- 650 hospitalised
- Evacuation of 35,000 people (75% - 46,700)
- Physical and psychological damage
- $200M damage



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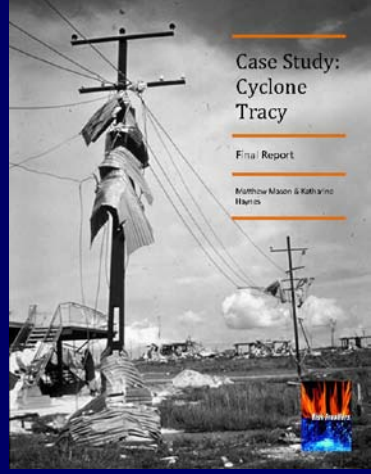
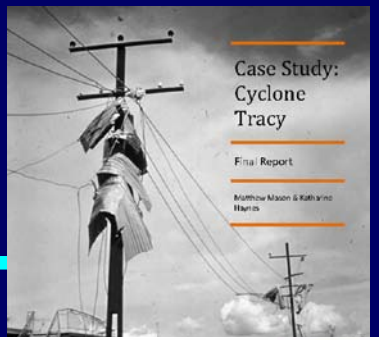


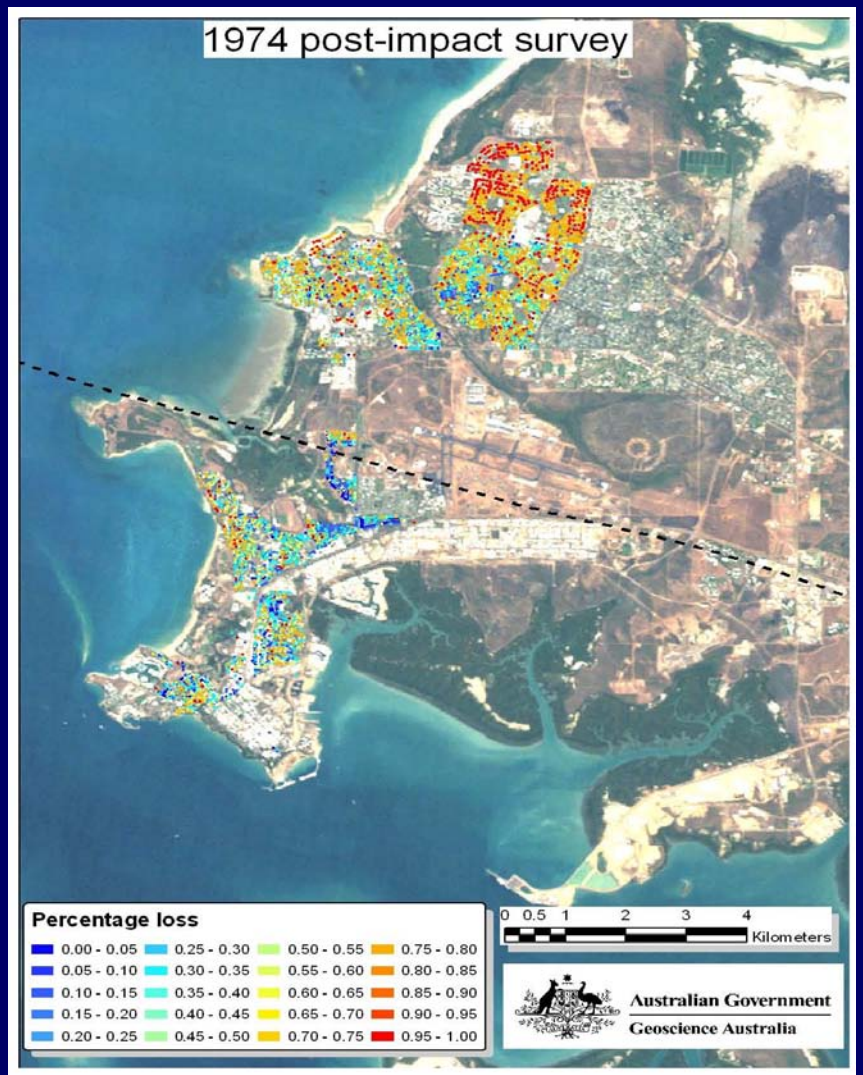
1. Housing performed poorly with approx 60% damaged
2. Elevated homes performed worse than low set housing
3. Buildings with engineering input into their design and construction performed considerably better than (non-engineered)

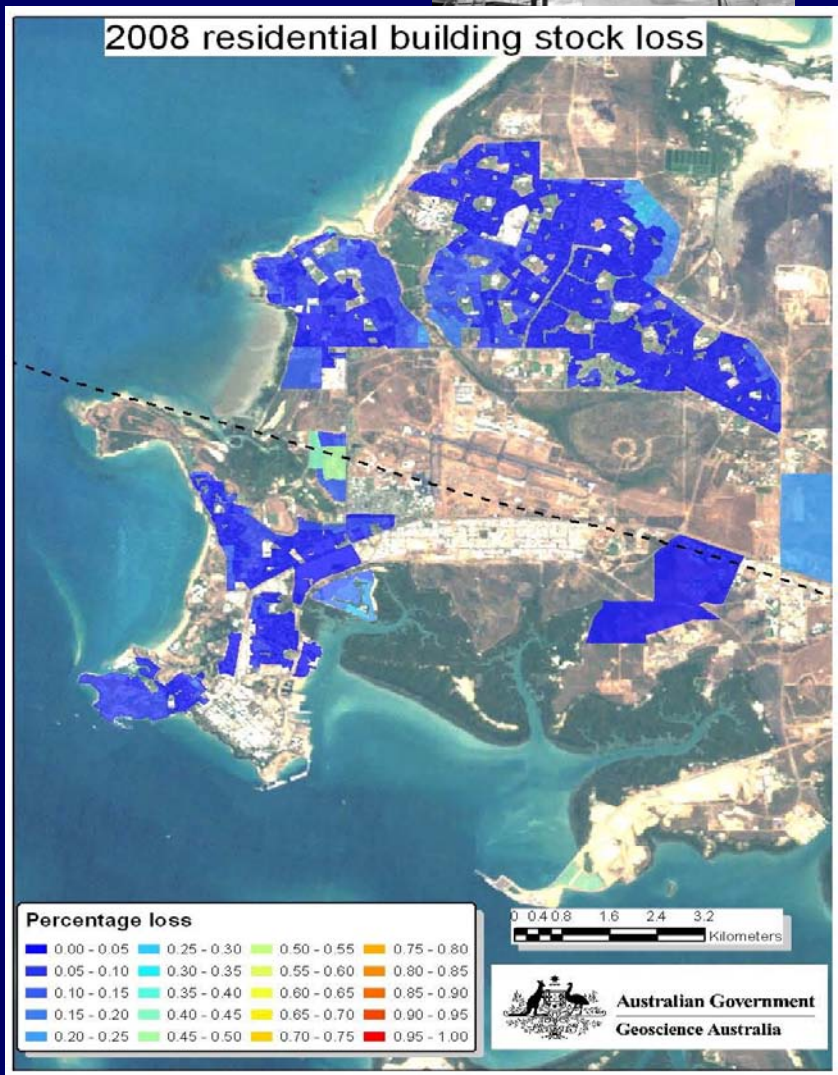
Conclusions for Cyclone Tracy report

- Have these changes to guidelines and building codes served to strengthen community resilience for future wind storm disasters?
  - Clearly successful example of societal adaptation to disaster
  - Immediate response: evacuation
  - Longer-term response: changes to building codes

“As-if” losses


Case Study:
Cyclone
Tracy
Final Report


1974 post-impact survey
Percentage loss
0.00 - 0.05
0.05 - 0.10
0.10 - 0.15
0.15 - 0.20
0.20 - 0.25
0.25 - 0.30
0.30 - 0.35
0.35 - 0.40
0.40 - 0.45
0.45 - 0.50
0.50 - 0.55
0.55 - 0.60
0.60 - 0.65
0.65 - 0.70
0.70 - 0.75
0.75 - 0.80
0.80 - 0.85
0.85 - 0.90
0.90 - 0.95
0.95 - 1.00
0 0.5 1 2 3 4
Kilometers
Australian Government
Geoscience Australia


2008 residential building stock loss
Percentage loss
0.00 - 0.05
0.05 - 0.10
0.10 - 0.15
0.15 - 0.20
0.20 - 0.25
0.25 - 0.30
0.30 - 0.35
0.35 - 0.40
0.40 - 0.45
0.45 - 0.50
0.50 - 0.55
0.55 - 0.60
0.60 - 0.65
0.65 - 0.70
0.70 - 0.75
0.75 - 0.80
0.80 - 0.85
0.85 - 0.90
0.90 - 0.95
0.95 - 1.00
0 0.4 0.8 1.6 2.4 3.2
Kilometers
Australian Government
Geoscience Australia

Phase 2 synthesis and integration projects

- Limits to adaptation
  - The *Great Barrier Reef*
  - *Alpine areas*
  - *Wetlands*
  - *Small Australian islands*,
- "Regional analogues" study
- Coastal ecosystem management
- Evaluation of impacts literature fo robust statements
- Call for proposals to appear on the website in May

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Links to regional initiatives

- Links to States and Territories:
  - FORNSAT
  - 2009 Symposium
  - 2010 Roadshow
- Links to local governments
- Links to industry and business
- Links through the networks
- Links through the research projects
- Links through visiting researchers

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