Climate change adaptation knowledge for New South Wales

What is NCCARF?
The National Climate Change Adaptation Research Facility is a unique venture established by the Australian Government in 2008 to harness and coordinate the capabilities of Australia’s researchers, to generate and communicate the knowledge decision-makers need for successful adaptation to climate change. NCCARF fulfils its mission by:

- Building capacity in research and end user communities, principally through its eight thematic Adaptation Research Networks;
- Generating knowledge for adaptation through its research programs;
- Effectively delivering knowledge through the NCCARF annual conference, workshops and master classes, reports, policy briefs and information sheets, the website and social media.

NCCARF research programs delivering useful results for New South Wales

The National Climate Change Adaptation Research Facility manages two research areas, the Adaptation Research Grants Program (ARGP), with a $36 million budget (including cash leveraging) and 96 projects, and the Synthesis and Integrative Research Program (SIRP), with a $6 million budget and 40 projects. Together, these seek to address knowledge gaps and deliver the information decision-makers need to successfully adapt Australia to climate change. Research projects in the ARGP and SIRP can be clustered to address the needs of particular locations and critical adaptation challenges. NCCARF is producing a series of fact sheets to show where information can be found in NCCARF’s research programs to support decision-making and policy development to address critical adaptation challenges.

This fact sheet outlines thirty-one projects addressing challenges of adaptation, that comprise $6.2 million of NCCARF funding in New South Wales.

NCCARF Adaptation Research Networks in New South Wales

NCCARF’s Adaptation Research Networks are a community of researchers and practitioners working together to progress climate change adaptation knowledge. Established in 2008, there are eight Networks representing various themes. Each Network is convened at an Australian research institution, chosen through a competitive bidding process. In under four years, they have made a significant and growing contribution towards the advancement of climate change adaptation knowledge across the nation. With over 5000 members, the Networks effectively connect and rapidly communicate with researchers and research end users in government and vulnerable sectors and communities. In order to run activities nationally, Networks have partners across Australia. Network partners provide in-kind support for Network activities and often receive support from the Network hub to run regional events and activities. The Settlements and Infrastructure Network, convened by Associate Professor Ron Cox, is hosted by the University of New South Wales.

New South Wales network partners include:

- Emergency Management: Macquarie University; University of Western Sydney; NSW State Emergency Service; NSW Rural Fire Service
- Human Health: Macquarie University; The Climate Institute; University of Western Sydney
- Marine Biodiversity and Resources: Macquarie University; University of New South Wales
- Primary Industries: University of Sydney; University of Western Sydney; Charles Sturt University; NSW Department of Primary Industries
- Settlements and Infrastructure: University of New South Wales; NSW Department of Commerce; Sydney Water
- Social, Economic and Institutional Dimensions: University of New South Wales
- Terrestrial Biodiversity: Macquarie University
- Water Resources and Freshwater Biodiversity: Macquarie University

Collectively the Networks have also provided over $95,000 in travel and research grants for students and early career researchers in NSW:

- Nola Handcock: The role of plant provenance in restoration ecology under climate change
- Murray Scown: Vegetation and physical characteristics in vegetable patches throughout the Kimberley – Composition and biodiversity
- Christine Adams-Hosking: Regional conservation network planning for widely distributed species – A koala phascolarctos cinereus case study
- Claire O’Neil: An integrated approach to the development of climate change adaptation policy and management strategies in Torres Strait, QLD
- Stuart Melbourne: Developing adaptive responses to climate change by modelling two highly urbanised low inflow estuaries – Sydney Harbour and Botany Bay, NSW
- Allan Marsh: Vulnerability and adaptive potential of a threatened species in the Australian arid-zone system in light of climate change
- Gabriele Caccamo: Cross-scale analysis of the relationship between moisture and fire behaviour in the Sydney basin
- Rohan Wickramasuriya: Exploring habitat loss and fragmentation in amenity landscapes through agent-based land use modelling
- Thomas Oliver: Development of an integrated framework to assess the vulnerability and adaptive capacity of mangrove and saltmarsh to sea-level rise at Minnamurra, NSW
- Michelle Ho: Factors controlling floods and droughts in the Murray-Darling Basin
Projects in NCCARF’s research programs delivering useful results for New South Wales

<table>
<thead>
<tr>
<th>REGIONAL ADAPTATION STUDIES</th>
<th>Principal Investigator</th>
<th>Institution</th>
<th>Final report availability¹ ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supporting evidence-based adaptation decision-making in Australia’s states and territories – Synthesis and learning from research to date</td>
<td>Jennifer Cane</td>
<td>AECOM</td>
<td>30-Apr-2013</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NCCARF RESEARCH FUNDED IN NEW SOUTH WALES</th>
<th>Principal Investigator</th>
<th>Institution</th>
<th>Final report availability¹ ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptation lessons from Cyclone Tracy</td>
<td>John McAneney</td>
<td>Macquarie University</td>
<td>31-Jan-2010</td>
</tr>
<tr>
<td>East coast lows and the Newcastle-Central Coast Pasha Bulker storm</td>
<td>Garry Willgoose</td>
<td>University of Newcastle</td>
<td>1-Mar-2010</td>
</tr>
<tr>
<td>The institutional response and Indigenous experience of Cyclone Tracy</td>
<td>Katharine Haynes</td>
<td>Macquarie University</td>
<td>30-Apr-2010</td>
</tr>
<tr>
<td>Drought and the future of small inland towns</td>
<td>Anthony Kiern</td>
<td>University of Newcastle</td>
<td>1-Jun-2010</td>
</tr>
<tr>
<td>Biophysical impacts of climate change on Australia’s forests</td>
<td>Belinda Medlyn</td>
<td>Macquarie University</td>
<td>31-Aug-2010</td>
</tr>
<tr>
<td>Learning from experience: Historical case studies and climate change adaptation</td>
<td>Anthony Kiern</td>
<td>University of Newcastle</td>
<td>20-Dec-2010</td>
</tr>
<tr>
<td>Bridging the gap between end user needs and science capability – Dealing with uncertainty in future scenarios</td>
<td>Danielle Verdon-Kidd</td>
<td>University of Newcastle</td>
<td>31-Aug-2012</td>
</tr>
<tr>
<td>Cross-scale barriers to adaptation in local government in Australia</td>
<td>Natasha Kuruppu</td>
<td>University of Tech, Sydney</td>
<td>31-Aug-2012</td>
</tr>
<tr>
<td>Understanding end-user decisions and the value of climate information under the risks and uncertainties of future climates</td>
<td>Alan Randall</td>
<td>University of Sydney</td>
<td>31-Aug-2012</td>
</tr>
<tr>
<td>Australian food security: Impact of climate change for risk management – How prepared are food industry leaders?</td>
<td>David Michael</td>
<td>Wondo Business &amp; Technology Services</td>
<td>30-Sep-2012</td>
</tr>
<tr>
<td>Damage to buildings during the 2010–11 Eastern Australia flooding events</td>
<td>Matthew Mason</td>
<td>Macquarie University</td>
<td>30-Sep-2012</td>
</tr>
<tr>
<td>Past, present and future landscapes – Understanding alternative futures for climate change adaptation of coastal settlements and communities</td>
<td>Phil Morley</td>
<td>University of New England</td>
<td>30-Sep-2012</td>
</tr>
<tr>
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<td>Colin Woodroffe</td>
<td>University of Wollongong</td>
<td>31-Sep-2012</td>
</tr>
<tr>
<td>Ensuring that the Australian oyster industry adapts to a changing climate – A natural resource and industry spatial information portal for knowledge action and informed adaptation frameworks.</td>
<td>Andrew Davis</td>
<td>University of Wollongong</td>
<td>24-Dec-2012</td>
</tr>
<tr>
<td>Climate change adaptation for Australian minerals industry professionals – Best practice guidelines</td>
<td>Damien Giurco</td>
<td>University of Tech, Sydney</td>
<td>28-Feb-2013</td>
</tr>
<tr>
<td>Climate change adaptation in the boardroom</td>
<td>Gareth Johnston</td>
<td>Future Ready Pty Ltd</td>
<td>28-Feb-2013</td>
</tr>
<tr>
<td>Enhancing climate change communication – Strategies for profiling and targeting Australian interpretive communities</td>
<td>Donald Hine</td>
<td>University of New England</td>
<td>28-Feb-2013</td>
</tr>
<tr>
<td>Identifying low risk climate change mitigation and adaptation in catchment management while avoiding unintended consequences</td>
<td>Max Finlayson</td>
<td>Charles Sturt University</td>
<td>28-Feb-2013</td>
</tr>
<tr>
<td>Adaptive management of Ramsar wetlands</td>
<td>Richard Kingsford</td>
<td>University of New South Wales</td>
<td>31-Mar-2013</td>
</tr>
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<td>John McAneney</td>
<td>Macquarie University</td>
<td>31-Mar-2013</td>
</tr>
<tr>
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<td>Karl Mallon</td>
<td>ACOSS</td>
<td>31-Mar-2013</td>
</tr>
<tr>
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<td>Lesley Hughes</td>
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</tr>
<tr>
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</tr>
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</tr>
<tr>
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</tr>
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<td>University of Tech, Sydney</td>
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</tr>
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<td>31-Mar-2013</td>
</tr>
<tr>
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<td>Contact NHMRC¹</td>
</tr>
</tbody>
</table>

¹Completed final reports are available for download at www.nccarf.edu.au
²Availability dates are estimated using draft report due dates and time for the review process
³These projects are being managed by NHMRC who can advise on availability of outputs - www.nhmrc.gov.au
⁴These FRDC projects are funded by a partnership between the DCCEE and FRDC to address knowledge gaps identified by the NCCARF National Adaptation Research Plan for Marine Biodiversity and Resources
Supporting evidence-based adaptation decision-making in Australia's states and territories – Synthesis and learning from research to date
Jennifer Gane, AECOM
NCCARF has commissioned two institutions to produce eight reports, one for each state and territory, and strategies to address these challenges through adaptation.

AECOM will deliver seven reports for the states and territories in mainland Australia. Through using a single provider, NCCARF expects a uniformity of approach and knowledge delivery, which should encourage knowledge adoption and meaningful interactions between states and territories to address common challenges.

NCCARF RESEARCH FUNDED IN NEW SOUTH WALES

Adaptation lessons from Cyclone Tracy
John McNeney, Macquarie University
This case study reviews the impact of the December 1974 Tropical Cyclone Tracy on the community and economy of Darwin, and examines the engineering, institutional and regulatory responses that it invoked and the relevance of these lessons for future events.

East coast lows and the Newcastle–Central Coast Pasha Bulker storm
Garry Willgoose, University of Newcastle
The storm that hit Australia’s east coast in June 2007 was one of the most significant weather events in Australian history, causing the fourth largest recorded insurance loss. Impacts included flash flooding in Newcastle city, general flood damage on the Hunter River, high winds and waves, the loss of electricity to 300,000 people for 4 days, a halt to coal export chain for two weeks and the loss of five lives. This project provides a wide range of support - government, business and community perspective on adaptation planning – being put in place because of knowledge gained from the experience during and immediately after the storm, and adaptation measures being put in place following subsequent reflection on ways of better preparing for such storms.

The institutional response and Indigenous experience of Cyclone Tracy
Katharine Haynes, Macquarie University
This project will examine how Indigenous community in and around Darwin were impacted by, responded to, and recovered from Cyclone Tracy in 1974. Through a combination of qualitative interviews and quantitative population data analysis, the project aims to determine whether Indigenous communities in the Darwin area are now more or less vulnerable to cyclones than they were in 1974.

Drought and the future of small inland towns
Anthony Kiem, University of Newcastle
Australia’s vulnerability to climate variability and change has been highlighted by recent droughts. Climate change may increase the frequency, intensity and duration of droughts, requiring robust adaptation strategies. This project assesses two rural Victorian case study sites that have been impacted by the current drought. The objective is to provide a quantitative understanding of the impacts of climate change on vegetation and the ecosystems services provided by forests. It reviews the evidence of impacts of climate change on Australian forests in relation to direct stresses (CO2, temperature and rainfall, indirect stresses (fire, pests, pathogens and weeds) and plant processes (growth, transpiration and phenology).

Biophysical impacts of climate change on Australia’s forests
Belinda Medlyn, Macquarie University
Forests and the industries associated with them are vulnerable to the impacts of climate change. Australia has 149 million hectares of forest managed for conservation and heritage areas and for production of forest products. This part of the project, “An assessment of the vulnerability of Australian forests to climate change”, discusses the impact of climate change on vegetation and the ecosystem services provided by forests. It reviews the evidence of impacts of climate change on Australian forests in relation to direct stresses (CO2, temperature and rainfall, indirect stresses (fire, pests, pathogens and weeds) and plant processes (growth, transpiration and phenology).

Learning from experience: Historical case studies and climate change adaptation
Anthony Kiem, University of Newcastle
This research program synthesises the results from a series of seven case studies of past extreme events. It examines management actions taken before, during and after the event including preparedness, immediate response, post-event response and policy changes implemented because of the events. It proposed a series of key lessons learnt for adapting management regimes to cope with future climate events.

Bridging the gap between end user needs and science capability – Dealing with uncertainty in future scenarios
Danielle Verdon-Kidd, University of Newcastle
This project will work with climate scientists and government and business practitioners to bridge the disconnect between what decision makers need and what climate science can provide. Researchers will survey decision makers to identify what climate information they most need, and in what format. They will conduct workshops to connect climate scientists with decision makers to discuss ways of presenting evidence effectively within the limitations of climate science. The team from the partner Uncertainty project to deliver products for practitioners including a masterclass, handbook and decision support tool.

Cross-scale barriers to adaptation in local government in Australia
Natasha Kurupp, University of Technology Sydney
Many climate change impacts will be experienced at the local level and many local governments have initiated adaptation plans. The pathway to planning and implementation of adaptation strategies is not a barrier free process, as local governments are embedded in a larger governance context that has the potential to limit the effectiveness of adaptation initiatives on the ground. This study will identify barriers that limit planned adaptation at the local government level. It will identify factors that give rise to these barriers, for example, process and governance structures, and suggest options for how barriers can be overcome.

Understanding end-user decisions and the value of climate information under the risks and uncertainties of future climates
Alan Randall, University of Sydney
This project aims to understand how real people make decisions under conditions of climate uncertainty, how optimal climate change adaptation decisions can be made, and how to provide practical guidance to end users. It will review current literature to establish the nature of the uncertainty facing decision makers and the existing decision frameworks available. It will test the efficacy of selected methods, and then refine the results to develop a decision support tool to help decision making under conditions of climate risk and uncertainty.

Australian food security: Impact of climate change for risk management – How prepared are food industries? How can industries respond?
David McAneney, University of Wollongong
The combination of a drier and more volatile climate, limited arable land, subsidised competition from biofuel crops and a growing population suggests food availability and prices will become more volatile in Australia and offshore. The project examines the preparedness of food industry leaders for riskier operating scenarios, and the implications of climate change for risk management.

Damage to buildings during the 2010–11 Eastern Australia flooding events
Matthew Mason, Macquarie University
Insured losses from the 2010-11 floods approached $3 billion. When accounting for damage to essential infrastructure, lost productivity and the under- or non-insured, the true cost is several times this value. Many affected properties have a history of flood damage, which shows there are clear deficiencies in our ability to adapt to or mitigate the impact of this hazard. This research will detail the extent of the damage to buildings during the recent Eastern Australia flooding and explore the role planning and design/construction regulations played in these failures. It will highlight weaknesses in the current systems and propose effective solutions to mitigate future damage and financial loss under current or future climates.

Past, present and future landscapes – Understanding alternative futures for climate change adaptation of coastal settlements and communities
Phil Morley, University of New England
A critical gap in many climate change vulnerability and adaptation studies is that predicted climate impacts are being assessed on current landscape, land-use and settlement patterns. This project aims to develop spatial analysis and visualisation tools to examine future trends of settlement and social patterns. It will provide a quantitative understanding of the impacts of climate change on coastal landscapes or regions.

A model framework for assessing risk and adaptation to climate change on Australian coasts
Colin Woodroffe, University of Wollongong
Coastal planners and managers urgently need improved methods to forecast how coastal areas will respond to climate change. This project will develop a modelling framework to provide guidance to the most appropriate adaptation strategies, such as suitable setback lines, more focused dune management, or beach nourishment and/or protection works. The researchers will implement innovative methods incorporating economic cost-benefit analysis with physical probability modelling to derive economically optimal strategies for adapting coastal zones to present or future conditions.

Ensuring that the Australian oyster industry adapts to a changing climate – A natural resource and industry spatial information portal for knowledge access and informed adaptation frameworks
Andrew Davis, University of Wollongong
With the onset of climate change, the predominantly estuarine and ocean oyster industry faces unprecedented, unknown and unpredictable challenges. Climate change threats to the industry must be better informed to manage risks and reduce potential for infrastructure failure and economic losses. This project will deliver a pilot, online, spatially-referenced, natural resource and industry information portal for resource managers and the industry that makes use of extensive spatial data sources. Researchers will identify pathways for this spatial information portal to inform governance and statutory authorities, strategies and planning policies.

Climate change adaptation for Australian minerals industry professionals – Best practice guidelines
Damian Giurco, University of Technology, Sydney
The minerals industry generates 50% of Australia’s export earnings, yet research
This project aims to educate stakeholders by creating a tool to demonstrate climate change impacts and adaptation in their decision-making processes by increasing climate awareness and capacity at the executive level. It will explore climate change risks to the supply chain to help inform directors about possible impacts on their business, and will develop and disseminate a climate change adaptation guide for the boardroom.

Enhancing climate change communication – Strategies for profiling and targeting Australian interpretive communities
Donald Hine, University of New England
Survey indicates that Australians differ in their understanding of, and response to, climate change threats. Effective climate change communication must consider these differences, and tailor messages to specific audiences. This project will identify how people from different groups and sectors of Australian society respond to different types of messages, to enable communications about climate change adaptation to be better designed and targeted.

Identifying low risk climate change mitigation and adaptation in catchment management while avoiding unintended consequences
Mark Hyland, Charles Sturt University
Some climate change adaptation and mitigation measures proposed for water resources can be considered ‘maladaptation’ as they may have negative or unintended consequences for other elements of the catchment. This project will focus on three catchments in the Murray Darling Basin and examine the practicalities of a range of complementary measures for managing rivers and wetlands that have the potential to enhance the resilience of catchments to biophysical and economic impacts. It will deliver a plain-English guide to the risks, costs and benefits of different mitigation and adaptation options for southern Australian rivers.

Adaptive management of Ramsar wetlands
Richard Kingsford, UNSW
The Macquarie Marshes are iconic Australian wetlands, recognised for their international importance providing habitat for waterbird breeding, as well as complex and extensive flood-dependent vegetation communities. The Marshes are predicted to be increasingly affected by climate change impacts. This project brings together current management and available science to help develop an adaptive management framework. It will take a generic approach to enable the framework to be used with other wetlands, ranging from highly regulated to free flowing rivers and their wetlands.

Assessing the potential for, and limits to, insurance and market-based mechanisms for encouraging climate change adaptation
John McNeney, Macquarie University
Insurance provides a means of helping communities recover from natural disasters. It is clear, however, that many people afflicted by flooding in Southern Queensland in 2011 lacked the insurance cover, making recovery difficult and prolonged. This project seeks to understand why cover for riverine flood was so limited when damage from other natural hazards like bushfire, earthquake, tropical cyclone and hail storms are explicitly covered and routinely dealt with in home and contents policies. The project will test potential solutions to align the incentives necessary at various levels of government to reduce the risk to Australian communities.

Climate change and the welfare sector – Risk and adaptation of Australia’s vulnerable and marginalised
Karl Mallon, Australian Council of Social Services (ACOSS)
Services provided to disadvantaged individuals by community welfare service organisations and communities comprise a critical component of social infrastructure. These people are least resilient to adverse changes in circumstance, and will be affected first and worst by climate change impacts to infrastructure and the built environment. This project will research the sectors in society most vulnerable and least able to adapt to climate change in urban, regional and remote settlements, the nature of these vulnerabilities, the underlying causes of vulnerability and the measures that can be taken to increase adaptive capacity and manage climate change related risks of infrastructure failure.

Determining future invasive plant threats under climate change – An interactive decision tool for managers
Leslie Hughes, Macquarie University
This project will provide the first comprehensive, national assessment of the risks of weeds emerging from naturalised plant species, in Australia, invasive plants cost the economy at least $4 billion annually, not including the cost to terrestrial biodiversity. As many new species may be advantaged by climate change, this figure will increase significantly. Of the 29,000 introduced plant species in Australia, approximately 400 have become significant weeds and a further 2,700 have become ‘naturalised’ - established self-sustaining populations in the wild. With around 15 species added to this list each year, these species represent a ticking time bomb of future weed problems.

Developing an Excel spreadsheet tool for local governments to compare and prioritise investment in climate adaptation
Stefan Trueck, Macquarie University
This project aims to educate stakeholders by creating a tool to demonstrate the influence of various parameters on the investments they make. Users will be able to enter details regarding extreme events and the tool will show relevant charts and graphs to enhance visualisation. The tool will be particularly useful to local governments, but can also be used to understand the impact of extreme events on sectors such as health, agriculture and the insurance industry.

Enhancing the adaptive capacity of Small-to-Medium Enterprises (SMEs) to climate change and variability
Natasha Kuruppu, University of Technology, Sydney
Small-to-Medium Enterprises (SMEs) comprise 96 per cent of all private businesses in Australia and are the largest employer and contributor to GDP. The capacity of SMEs to adapt to climate change and variability will be vital to the resilience of communities, government agencies and other sectors. Climate change may result in business interruptions, increased investment or insurance costs and declining financial value. SMEs face greater losses after a natural disaster and may have lower adaptive capacity than larger businesses. This research aims to identify the extent to which SMEs consider and integrate adaptation into business planning, key barriers and opportunities to adaptation for SMEs in different sectors, and strategies to adapt in anticipation of climate change.

Heat-ready – Adapting aged care facilities to prevent premature death in elderly Australians
Deborah Black, University of Sydney
This project will investigate the capacity of aged care facilities to adapt to increasing periods of extreme heat. It will examine policies, procedures, knowledge and environmental factors such as building design and cooling equipment used in aged care facilities in three Australian states and recommend ways they can adapt to prevent premature death from extreme heat in elderly residents.

Rental housing, climate change and adaptive capacity – A case study of Newcastle, NSW
Lesley Instone, University of Newcastle
This project will produce best-practice guides for landlords and tenants to enhance the capacity of the 27% of Australians who live in rental accommodation to adapt to climate change. Research indicates that there is a low take-up of retrofitting rental properties for climate change, as there are disincentives for landlords to install modifications that primarily financially benefit tenants. Low-income renters are particularly vulnerable to climate change, and already face significant housing and utility stress. This project will work with both renters and housing managers/ landlords to develop more effective ways of facilitating adaptation to climate change in the rental sector.

Robust optimization of urban drought security for an uncertain climate
Gregory Huczynska, University of New England
Recent experience with drought and a shifting climate has highlighted the vulnerability of urban water supplies to “running out of water” in Perth, southeast Queensland, Sydney, Melbourne and Adelaide. This has triggered major investment in water infrastructure. With the prospect of rapid population growth in cities, drought security will become more pressing particularly in the face of climate uncertainty. This project will develop and illustrate an urban drought security method that identifies solutions that are both optimal in a triple-bottom-line sense and robust against uncertain knowledge about future climate change.

Understanding the Pacific’s adaptive capacity to emergencies in the context of climate change
Juliet Willets, University of Technology, Sydney
This project will assess Australia’s current emergency response systems, the Pacific Islands’ current systems, and their future needs in order to enable better preparedness in the event of disaster. This project aims to gather in-depth information from experts in the Pacific across four sectors: healthcare, food and nutrition, water and sanitation and the psychosocial needs of populations.

Will primary producers continue to adjust practices and technologies, change production systems or transform their industry – An application of real options
Gregory Hertzler, University of Sydney
This project aims to determine the climate change thresholds for transformational change in wheat-dominated agriculture across Australia. Researchers will communicate with producers who are managing wheat-dominated farms, then mathematically model options for how they may choose to transform the industry as the climate changes. Once the decisions of growers are understood, they will draw implications for stranded assets, regional economies, new technologies and the resilience of agriculture undergoing climate change.

Health impacts of climate change on Indigenous Australians – Identifying climate thresholds to enable the development of informed adaptation strategies
Donna Green, University of New South Wales
This project will provide decision makers with clear, robust, policy-relevant evidence that identifies the connections between climate and the health and wellbeing of Indigenous people in Australia. This project is the first major comparative study to test the hypothesis that Indigenous people are likely to be disproportionately vulnerable to the future health impacts of climate change. Overall, the researchers aim to enable policy-makers to develop effective adaptation strategies to increase the resilience of Indigenous Australians, in both urban and remote communities, to the health impacts of climate change.