Climate change adaptation knowledge for infrastructure

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.

Projects in NCCARF’s research programs delivering useful results for infrastructure

The National Climate Change Adaptation Research Facility manages two research areas, the Adaptation Research Grants Program (ARGP) and the Synthesis and Integrative Research Program (SIRP). Together, these seek to address knowledge gaps and deliver the information decision-makers need to successfully adapt Australia to climate change.

The thematic ARGP, with a $36 million budget (including cash leveraging) and 96 projects, addresses knowledge gaps identified in National Adaptation Research Plans (NARPs). There are programs in terrestrial, marine and freshwater biodiversity, primary industries, human health, emergency management, settlements and infrastructure, the social, institutional and economic dimensions of climate change, and Indigenous communities and adaptation.

The SIRP, with a $6 million budget and 40 projects, builds on existing research to directly address knowledge needs of practitioners. The SIRP synthesises across thematic topics and integrates NCCARF learnings with the wider field of adaptation research to deliver timely and specific information tailored to the needs of practitioners. These practitioners are engaged in projects at all stages of development, implementation and delivery.

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 addresses the challenge of adaptation for Australia’s infrastructure.
### Projects relevant to infrastructure in NCCARF’s research portfolio

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¹ Completed final reports are available for download at [www.nccarf.edu.au](http://www.nccarf.edu.au)
² Availability dates are estimated using draft report due dates and time for the review process
Enhancing the resilience of seaports to a changing climate
Darryn McEvoy, RMIT University
This project aims to better understand the vulnerability of critical seaport infrastructure (structural and functional), and to develop new knowledge and methodologies for enhancing port resilience to future climate change. The research will address three research objectives: to gain a better understanding of the complex mix of climate and non-climate drivers that are likely to affect port operations; to assess the vulnerability of core port infrastructure and identify appropriate adaptation measures for enhancing resilience; and to assess the vulnerability of other elements at risk in the wider port environment and identify adaptation measures. Close engagement with policy and practitioner stakeholders will ensure the deliverables will be ‘fit for purpose’.

Analysis of institutional adaptability to redress electricity infrastructure vulnerability due to climate change
John Foster, University of Queensland and Deepak Sharma, University of Technology, Sydney
This project will examine the capacity of Australia’s National Electricity Market (NEM) to adapt to existing and predicted climate change conditions. It will identify potential issues and analyse climate change impacts on reliability in the market under different climate change scenarios to 2030, particularly what adaptation strategies the power generation and supply network infrastructure will need.

EFFECTS OF EXTREME EVENTS

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

Impacts and adaptation response of infrastructure and communities to heat waves: the southern Australian experience of 2009
Jim Reeves, Queensland University of Technology
This study details the impact, vulnerability and adaptation responses, at state and local government level, to the unprecedented heatwave that struck Victoria and South Australia in early 2009. It focused on the failures in utilities and related infrastructure, and on emergency management and human health impacts. It analyses institutional responses and identifies lessons learnt for sectors, regions and communities.

Adaptation of the built environment to climate change-induced increased intensity of natural hazards
David King, James Cook University
This project will examine the likely impacts on the built environment of increased intensities in weather-related natural hazard events, and identify possibilities for the adaptation of regulatory mechanisms in building construction, housing and planning. It will analyse climate change impacts on the built environment, and review existing regulatory mechanisms and their effectiveness. It will then model policy recommendations that provide for improved emergency management preparations and response capabilities across a wide range of agencies and organisations.

Flooding in Australia: Damage to buildings during the 2010-2011 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 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.

Robust optimization of urban drought security for an uncertain climate
George Kuczsera, University of Newcastle
Recent experience with drought and a shifting climate has highlighted the vulnerability of urban water supplies to ‘running out of water’ in Perth, south-east 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.

A framework for adaptation of Australian households to heat waves
Wasim Saman, University of South Australia
What is the likely impact of heat waves on Australian homes and on the electricity infrastructure in Australia’s various climate regions? This project will plan for a national framework that would: develop new summer design conditions for 2030 and 2050 for up to 100 Australian climate zones; establish new thermal comfort criteria for buildings; evaluate the impact of climate change on annual household cooling energy use and peak power demand; examine householder behaviour during heat waves; develop design options to ensure safety and comfort during heat waves; and develop affordable new design options for buildings to avoid heat stress.

LEGAL AND REGULATORY FRAMEWORKS

Reforming Planning Processes Trial: Rockhampton 2050
Penelope Fry, Rockhampton Regional Council
Rockhampton Regional Council will form an alliance of neighbouring small regional councils to determine and demonstrate how existing urban planning principles and practices could accommodate climate change and the uncertainty of climate impacts for a ‘seachange’ region. It will develop and apply spatial information to trial planning approaches in a ‘real world’ situation involving all levels of government and community engagement. It aims to influence other Councils to take action by producing a mechanism and process to enable the mainstreaming of climate change adaptation within local government.
SETTLEMENTS AND HOUSING

**Limp, leap or learn?: Developing a legal framework for adaptation planning in Australia**
Jan McDonald, University of Tasmania
This project will look at the role of law in driving and enabling urban climate change adaptation. It will compare and contrast the legal frameworks for planning for coastal impacts of climate change and those for the increased risks of bushfire. This analysis will consider formal planning laws, coastal and emergency management laws, property law, liability and insurance regimes.

**Pathways to climate adapted and healthy low-income housing**
Guy Barnett, CSIRO Climate Adaptation Flagship
This project aims to model the vulnerability of public housing assets and tenants to selected climate change impacts. It will scope the potential co-benefits of climate adaptation action for human health and well-being and identify and evaluate key engineering, behavioural and institutional climate adaptation pathways applicable to other low-income housing.

**Australia’s country towns 2050: What will a climate adapted settlement pattern look like?**
Andrew Beer, Flinders University
The project will test the hypothesis that many inland rural and remote communities are vulnerable to the impacts of climate change and that this vulnerability varies by location, industry structure, environment, and remoteness. It will assess whether public sector and community planning and action can reduce the impacts of climate change on the sustainability of settlements and whether some forms of intervention will be more effective than others.

**What would a climate-adapted Australian settlement look like?**
David Griggs, Monash University
This project will use two study sites in Gippsland, Victoria, Inverloch and Sandy Point, to forecast what a small urban coastal settlement in Australia will look like in 2030. These communities will be asked to envision how they would like their locality to be in 2030. They will be presented with information on how the climate may be in 2030 and where their township is heading given the present trends, then given various choices that could change these trajectories. The outcomes will be used to develop a national framework for decision-making for small urban settlements as a guide for local communities to build and create their own futures within a climate-changed world.

**Living Change: Adaptive housing responses to climate change in the town camps of Alice Springs**
Ralph Horne, RMIT University
This project will investigate how residents in Alice Springs’ town camps have adapted their living practices in response to the delivery of new and refurbished houses. Working with the Tangentyere Council the research will focus on how people maintain comfort levels in the houses and employ healthy-living practices involving water and energy use. The aim of the project is to identify areas where energy and water use can be made more sustainable, and provide a framework that supports residents and tenancy management organisations to develop and promote resilient community practices that are capable of adapting to the effects of climate change.

**Strata Title in a world of climate change: Managing greater uncertainty in forecasting and funding common property capital expenditure**
Chris Guilding, Griffith University
This project will determine the extent to which uncertainty of climate change-induced building damage is built into strata and community title capital expenditure forecasts, and whether insurance specialists are equipped with tools that can factor in uncertainty and flexibility when projecting capital expenditure.

**Development of tools that allow local governments to translate climate change impacts on assets into strategic and operational financial and asset management plans**
Jacqueline Balston, University of South Australia
This project aims to identify key council assets vulnerable to climate change; determine the likely impacts of climate change on council assets; undertake an extensive financial risk modelling exercise including full life-cycle economic analysis of options for councils to reduce climate change asset risk and develop the necessary modifications to asset management and financial sustainability tools so councils may evaluate climate change action scenarios at the management planning level.

**TOOLS FOR ADAPTATION DECISION MAKING**

**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 coasts will respond to sea-level rise. 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.

**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 current settlement trends and their future trajectories and design and test several alternative landscape futures as adaptive strategies to reduce the vulnerability of settlements and communities to predicted climate change events. Using northern coastal NSW as a case study, researchers will demonstrate how the tools can be applied and transferred to other contexts, landscapes or regions.

**What’s in this series cover?**

**Tools for Adaptation Decision Making**
- Local Councils
- Coastal Management
- Water Resources
- Agriculture
- Vulnerable Communities
- Emergency Management
- Business and Industry
- Policy and Regulation for Effective Adaptation
- Decision Support Tools
- Natural Ecosystems
- Research Investment in States and Territories

For more information on NCCARF research, visit: www.nccarf.edu.au