



Implementation Plan for Climate Change Adaptation Research: Emergency Management

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1. Purpose of Implementation Plan

This Implementation Plan for Emergency Management (2012) outlines implementation directions for the updated *National Climate Change Adaptation Research Plan for Emergency Management (2012)* (Emergency Management NARP). It takes account of changes to critical implementation factors for the research priorities identified for NCCARF's emergency management theme: research funding availability and research capacity for climate change adaptation for emergency management.

Since the first Implementation Plan for the original Emergency Management NARP, 11 research projects have been commissioned, using about \$1,770,000 of Adaptation Research Grants Program (ARGP) funds. The 11 research projects supported by this funding have a total value of about \$3,900,000 (cash and in-kind). These projects will be completed and reported by mid-2013.

Climate change poses significant threats to Australia. The National Climate Change Adaptation Research Facility (NCCARF) has developed nine *National Climate Change Adaptation Research Plans (NARPs)* to identify critical gaps in the information needed to address issues arising from the impacts of climate change on key theme areas. NARPS outline priorities for research for a 5-7 year period.

The purpose of an Implementation Plan is to define the most effective way to build national investments to address the research priorities identified by a NARP.

The focus is on:

1. delivering research, and the adoption of research outputs, to address the objectives of the research plan,
2. facilitating collaborative arrangements,
3. maximising resources for priority research, and
4. optimising the timing of research investments.

Implementation Plans consider opportunities for implementing research at a specific time, and so are not static documents. NCCARF updates Implementation Plans periodically to ensure that new opportunities are continually identified, developed and harnessed over time.

The focus of an Implementation Plan is on (1) delivering research and the adoption of research outputs to address the objectives of the NARP, (2) facilitating collaborative arrangements, (3) maximising resources for priority research, and (4) optimising the timing of research investments.

Additional opportunities for research investment may arise in this area over the next few years and in a next Phase of NCCARF. Hence, the Implementation Plan is not a static document - it will be updated periodically to ensure that new opportunities are developed and harnessed.

2. Background

2.1 Australia's Climate and Emergency Management

Extreme variability is a characteristic of the Australian climate, and this variability can directly result in emergencies, the scale of which may be unprecedented, and the locations and timing of which may be impossible to predict. Changed ambient temperatures and rainfall or combinations of climate conditions, other biophysical factors and individual and community responses to these changes can also lead to emergencies less immediately or directly, such as heat and drought contributing to bushfire risk and occurrence. All of these risks may be increased as a result of individual or community processes, such as housing or other development in potentially hazardous locations. In southern Australia the main risks and emergencies have resulted from heatwaves, drought and bushfire, while in northern Australia flooding, and major storms have resulted in emergencies. The health and emotional impacts of emergencies can be long term if not managed successfully, and there are also significant economic and financial costs.

2.2 The Emergency Management NARP

The Emergency Management NARP (Pearce et al 2009) was prepared for NCCARF in 2008 by a team with high expertise in climate change adaptation research and response for emergency management. In 2012 NCCARF revisited and updated the Emergency Management NARP to take account of developments after the original NARP was completed, including:

- research published,
- changes to stakeholder information needs, and
- research commissioned after the NARP was completed.

The revisit process resulted in the preparation of an updated Emergency Management NARP (Handmer et al. 2012a) and an Update Report (Handmer et al. 2012b), with amendments to the list of priority research questions identified in 2009. The new list of high priority research questions provided in Appendix 1.

2.3 Preparation of the Implementation Plan

NCCARF has updated the Emergency Management Implementation Plan in 2012 to take account of changes in:

- the capacity of Australian researchers to undertake climate change adaptation research for emergency management and
- the capacity of key potential research funding organisations to invest in research to address the updated research priorities in the Emergency Management research theme.

Australia has a long history of high-quality research that addresses Emergency Management, funded by both the public and private sectors. This research provided a good platform for the national focus on climate change adaptation research that resulted from the identification of research priorities in the Emergency Management NARP and research calls under DCCEE/NCCARF Adaptation Research Grants Program (ARGP) (see section 3.1.1).

3. Potential Sources of Research Funding

This section deals with potential sources of research funding available to address climate change adaptation in the area of emergency management, including current investment activities and opportunities for collaboration.

3.1 Key changes since 2009

- Eleven research projects have been commissioned using the Adaptation Research Grants Program (ARGP) funding available for the emergency management theme; this has fully allocated the ARGP funding available for this theme (see Section 3.2).
- All other ARGP funding has also been allocated (see Section 3.2.1).
- Griffith University, NCCARF and DCCEE are investigating options for further research funding for this theme and for an extension of NCCARF (see Section 3.3.1).

3.2 Australian Government

3.2.1 Department of Climate Change and Energy Efficiency (DCCEE)

The Department of Climate Change and Energy Efficiency (DCCEE) allocated about \$1,770,000 as seed funding for research in climate change adaptation for emergency management through the ARGP. The 11 research projects supported by this funding have a total investment of about \$2,010,000 (cash) and about \$1,855,000 (in-kind) for a total research value of about \$3,900,000. These projects will be completed and reported by mid-2013.

ARGP-funded projects in other themes are also relevant to the NARPs priority research questions:

- 6 projects in the SEID theme with ARGP funding of \$1,245,000 and a total cash value of about \$1,310,000 (cash) and about \$1,910,000 (in-kind) for a total research value of about \$3,220,000. These projects will be completed and reported by mid-2013.
- 1 project in the Human Health theme with ARGP funding of about \$387,000 will be commenced in 2012.
- 3 projects in the Settlements and Infrastructure theme with ARGP funding of \$1,070,000 and a total cash value of about \$1,295,000 (cash) and about \$1,490,000 (in-kind) for a total research value of about \$2,785,000. These projects will be completed and reported by mid-2013.

All ARGP funds have now been allocated to research projects. DCCEE has an ongoing interest in research in the Emergency Management theme and may invest in research that addresses the NARP's research priorities as funding becomes available.

3.1.2 Attorney-General's Department (AGD)

The National Security Resilience Policy Division (NSRPD) within the AGD is responsible for policy, legislation, advice, and programs relating to developing resilience to all hazards.

The Natural Disaster Resilience Program (NDRP) is administered as a partnership with States and Territories which provide program administration through the National Partnership Agreement on Natural Disaster Resilience and individual implementation plans. Funding for projects is prioritised by States and Territories in the context of their natural disaster risk priorities. This recognises that different jurisdictions have different priorities, and that these may change over time. Each State and Territory administers projects funded under the NDRP and, when applications are called for, ascertains funding eligibility.

The key aim of the NDRP is to enhance Australia's resilience to natural disasters through mitigation works, measures and related activities that contribute to safer, sustainable communities that are better able to withstand the effects of disasters, particularly those arising from the impact of climate change.

The NDRP consolidates the former Bushfire Mitigation Program, the Natural Disaster Mitigation Program, and the National Emergency Volunteer Support Fund. Annual agreements between the Commonwealth and each State and Territory detail implementation arrangements.

Currently the NDRP has no research component. It is possible that a small proportion of program funding may eventually be directed to research activities, but a climate change

focus for any such investments is not guaranteed. Opportunities for collaboration stemming from the DRP over the next year or so are likely to be on a project-by-project basis, rather than at the program level, but even so opportunities appear limited.

The Critical Infrastructure Protection Branch, within the NSRPD, is responsible for developing Australian Government policy and initiatives relating to the protection and resilience of Australia's critical infrastructure.

Better information and tools are required to understand the vulnerabilities, consequences and adaptation options in critical infrastructure from extreme weather events. The Attorney-General's *Critical Infrastructure Protection Modelling and Analysis Program* (CIPMA) provides a whole-of-government capability to undertake research and analysis of the effects of extreme weather events on critical infrastructure. It is a key component of the Australian Government's efforts to enhance critical infrastructure protection and resilience. It can model vulnerabilities of critical infrastructure and test the business continuity planning of industry and government at all levels by assessing the interaction between biophysical, economic and social processes that expose industries and local communities to climate risk.

CIPMA helps strengthen Australia's economic and social resilience by providing 'virtual insight' into disruptions of essential services. Such analysis will assist owners and operators of critical infrastructure assets to better understand the costs and benefits of adaptation to climate change, and where and how much to invest in adaptation.

Through the Trusted Information Sharing Network for Critical Infrastructure Protection (TISN) and the Climate Change Community of Interest, the Attorney-General's Department will continue to develop its business-government partnership with the owners and operators of critical infrastructure, including helping to inform climate change adaptation policy and to support efforts to build organisational resilience.

The National Emergency Management Committee (NEMC), supported and co-chaired by the ADG, is Australia's national consultative emergency management forum, and works to strengthen the nation's disaster resilience by providing strategic leadership on nation-wide emergency management policy. The ADG has suggested that NCCARF and the NEMC should explore options to facilitate stronger engagement between the organisations. Linked to the NEMC is the National Emergency Management Projects program, under which research and other activities are commissioned to help strengthen Australia's disaster resilience by supporting measures to strengthen communities, individuals, businesses and institutions to minimise adverse effects of disasters on Australia.

Climate change is an ongoing issues for the AGD. NCCARF will discuss options for collaboration with the NEMC and other groups in or associated with the AGD.

3.2 Australian Research Council (ARC)

The Australian Research Council (ARC) is a statutory authority within the Australian Government's Industry, Innovation, Science, Research and Tertiary Education (IISRTE) portfolio. The ARC's mission is to deliver policy and programs that advance Australian research and innovation globally and benefit the community.

In seeking to achieve its mission, the ARC supports the highest-quality fundamental and applied research and research training through national competition across all disciplines, with the exception of clinical medicine and dentistry. In addition, the ARC brokers

partnerships between researchers and industry, government, community organisations and the international community.

The ARC is currently providing funding of \$320,000 to support 1 research projects that is relevant to priority research questions in the Emergency Management NARP.

ARC funding programs come under the umbrella of the National Competitive Grants Program. The ARC *Discovery* programs fund individual researchers and projects. The ARC *Linkage* programs help to broker partnerships between researchers and industry, government and community organisations as well as the international community.

The *ARC Future Fellowships program* promotes research in areas of critical national importance by giving outstanding researchers incentives to conduct their research in Australia. The aim of *ARC Future Fellowships* is to attract and retain the best and brightest mid-career researchers and significantly boost Australia's research and innovation capacity in areas of national importance. Preference is given to researchers who can demonstrate a capacity to build collaboration across industry and/or research institutions and/or with other disciplines.

Over a five-year period (2009-2013), *ARC Future Fellowships* offer four-year fellowships to 1,000 outstanding Australian and international researchers in the middle of their career. In addition, each researcher's Administering Organisation will receive funding of up to \$50,000 per year to support related infrastructure, equipment, travel and relocation costs. The first 200 *Future Fellowships* were announced in September 2009.

Opportunities for funding emergency management climate research also exist at ARC within the *Centres of Excellence* scheme. Examples of existing Centres with relevance are:

- ARC Centre for Excellence for Climate System Science (UNSW);
 - The objective of this CoE is to resolve uncertainties in regional climate science to support for impacts and adaptation research, and thereby to deliver economic, social and environmental benefits by improving advice to all levels of Government and the broader community on the scale, speed and timing of regional climate change.
- ARC Centre of Excellence for Geotechnical Science and Engineering (U Newcastle)
 - The objective of this CoE is to provide engineers with new science-based tools for predicting the safety of offshore and onshore geostructures such as oil and gas platforms, roads, railways, tunnels, dams, and port facilities.

3.3 State, Territory and Local Government Organisations

All state governments and the Northern Territory government have departmental administrative arrangements and research capacity relating to emergency management.

NCCARF has regular meetings with representatives of state and territory governments through its Forum for NCCARF interaction with states and territories (FORNSAT) and involves state and territory representatives in developing and implementing research plans and programs. As a result of these discussions and interactions, key state and territory agencies and personnel are aware of the relevance of the priority research questions in the Emergency Management NARP for their adaptation information needs. While no opportunities for partnerships at the program level for a national investment portfolio have been identified, state-based research organisations can respond to research calls, either as

lead agencies or as partners on a project-by-project basis, and would also bring state-based support to any research call.

State governments have commissioned a number of reviews following large-scale natural disasters that caused significant damage. These investigated the causes of the disasters and responses to them, including the role of emergency management. Reviews include:

- the Victorian Bushfires Royal Commission (2010)
- the Review of the 2010–11 Flood Warnings and Response (2011)
- the Queensland Floods Commission of Inquiry (2012)
- the Perth Hills Bushfire Review (2011).

These inquiries found inadequacies in the delivery of emergency services during disasters, and made numerous recommendations for improving emergency management arrangements.

The Victorian Centre for Climate Change Adaptation Research (VCCCAR) was established by the Victorian Government in 2009 to support climate change adaptation research and thereby the development of strategies to implement effective adaptation measures. VCCCAR's research program involves multi-disciplinary and multi-institutional research teams to address priorities identified by the Victorian Government. VCCCAR's second round of funding is supporting a project that is relevant to priority research questions in the Emergency Management NARP (unknown value).

NCCARF will continue to explore possible opportunities with state, territory, and local governments.

3.4 Private Sector

The private sector has a very strong interest in emergency management and NCCARF will explore opportunities for partnership. Existing mechanisms such as the Attorney General's Trusted Information Network and the Insurance Council of Australia may be useful in contacting the right people and organisations.

3.5 Summary

The immediately available potential sources of funding to address climate change adaptation for emergency management primarily comprise opportunities associated with the Australian Research Council (ARC). CSIRO research often provides opportunities for collaborative activities.

Additional funding for climate change-related emergency management research (with a more distinct jurisdictional and regional focus) may come from state, territory and local governments, State and territory emergency services or social services agencies, where researcher interests and capacities align with agency priorities. Research funding could also be generated through strategic partnerships with non-government organisations, the private sector, and industry.

4. Potential Sources of Research Delivery

4.1 Key changes since 2009

- Recent climate related natural disasters afflicting many parts of Australia, including the 2009 heat waves in southern Australia, prolonged droughts across much of south-eastern Australia in the first decade of this century, the 2009 Black Saturday Bushfires in Victoria and the 2010/11 Queensland floods have highlighted the need for research about emergency management.
- The membership of the Adaptation Research Network for Emergency Management has increased from about 150 members to about 300 members and now comprises almost equal membership of research providers and research users (see Section 4.8).

4.2 Background

Emergency management research in Australia has always had a strongly applied basis. The implications of climate change, such as the potential for increased flooding, more frequent heatwaves, stronger cyclones and longer periods of drought with associated increased potential for bushfires, have highlighted the need for a greater research effort and focus.

Stakeholders at all levels of government, in the private sector in the service sector and in the community have a major interest in ensuring that emergency management is informed by the best available information.

4.3 Universities

Universities possess wide ranging capabilities for research across disciplines in humanities and in social and biophysical sciences - and from highly theoretical approaches which challenge the ways we think about and frame problems through to practical problem solving.

Much research in Australian universities is undertaken with limited external sources, so it is likely that research relevant to climate change adaptation is being undertaken in isolation using internal resources. The Adaptation Research Network for Emergency Management, hosted by RMIT University, provides a valuable mechanism to identify and publicise such research, and to build and coordinate research across a wide geographic spread.

There is also the opportunity for large groups of researchers across universities to tackle complex multi-faceted problems. Universities generally welcome partnership arrangements such as those with CRCs, other research groups (including those overseas) and agencies, but need to consider carefully costs and benefits on a case-by-case basis.

Three examples of university groups working in emergency management research are given below as indicative of the work currently underway. See websites for additional detail.

- *Risk Frontiers* at Macquarie University operates as a private company with some support from parts of the insurance industry. Among other resources and activities, it has fatality datasets for a wide range of Australian natural hazards, national data for types of vulnerability, and undertakes risk modelling.
- *The Centre for Disaster Studies* at James Cook University works closely with the fire and emergency management sector, especially in Queensland. It undertakes a range of social science research on resilience and natural hazards.
- *The Centre for Risk and Community Safety* at RMIT University works with fire and emergency service agencies and research groups including the Bushfire CRC. The

Centre examines disaster resilience and climate adaptation through research drawing on economics, law, geography and policy.

4.4 CSIRO

CSIRO Sustainable Ecosystems is the science home for CSIRO research in bushfire behaviour and interactions between people, fire and the built environment. Much of this research capability is deployed through the CSIRO Climate Adaptation Flagship, in particular through the Sustainable Cities and Coasts theme. The overall goal of the theme is to conduct research and build partnerships that contribute to the revitalisation of Australia's cities and coasts in response to changing climate, through new planning, design, infrastructure, management and governance solutions.

The intent of the research partnerships with Australian governments, communities, industry and research organisations is to provide examples of the knowledge required for effective urban and coastal climate adaptation and sustainable urban development. The theme is developing tools and processes for integrated urban planning, design and development including display projects that demonstrate the adoption of new practices, products and policies that respond to climate change.

Some examples of research projects include developing community adaptation options - energy rating systems and urban and coastal management strategies that take account of interactions between engineering, economic, social and ecological ways of thinking about people and their needs in buildings, neighbourhoods, communities, cities and vulnerable urban coasts.

The Sustainable Cities and Coasts theme has a deliberate focus on understanding the adverse effects of extreme events such as bushfires, storm surge, heat waves and cyclonic winds on people and infrastructure in the built environment. Engagement with governments, industry, researchers, and the community is developed through examining vulnerability to extreme events and then developing adaptation pathways to prepare for, or recover from, the adverse effects of extreme events in local communities and their built environments.

CSIRO considers partnerships on a case-by-case basis depending on the mutual alignment of interests. This could include long term partnerships in CRCs and other research ventures where the prospects of end-user engagement and research effectiveness are likely to be increased by partnering or through strategic short term consultancies depending on the nature and value of the opportunity. CSIRO is not a funding agency but does co-invest from time to time when and where there are distinct opportunities to align its research interests with the evidence-based outcomes of partner organisations.

4.5 Centre for Australian Weather and Climate Research

The Centre for Australian Weather and Climate Research (www.cawcr.gov.au) is a partnership between Australia's leading atmospheric and oceanographic research agencies: the Bureau of Meteorology and CSIRO. The Centre was established in 2007 to ensure that Australia remains a world leader in climate, weather and oceans research so that it can meet the severe weather and climatic challenges that continue to confront the nation.

The Centre has five Research Programs:

1. Atmosphere and Land Observation and Assessment

2. Ocean Observation, Assessment and Prediction
3. Coupled Earth System Modelling
4. Weather and Environmental Prediction
5. Climate Variability and Climate Change.

These research activities will improve observational databases, our understanding of observed climate variability, and the delivery of seasonal to decadal climate predictions for use in risk assessments. Improved accuracy and resolution of the prediction of future climate and its extremes are particularly relevant to emergency management.

CAWCR could provide a collaborative foundation for the range of selective research projects addressing the Emergency Management NARP.

4.6 Cooperative Research Centres (CRCs)

Cooperative Research Centres (CRCs) bring together researchers from universities, CSIRO, other Australian and state government research organisations, private industry, and/or public sector agencies in long-term collaborative research arrangements. CRCs are funded to support research, development, and education activities to achieve real outcomes of national economic and social significance.

4.6.1 Bushfire CRC

The Bushfire CRC is a partnership between major fire and land management research agencies, The Australian Government has announced an additional \$15 million (over the period 2010/11 to 2012/13) as supplementary funding for the Bushfire CRC to address issues arising from the Victorian bushfires in February 2009. The CRC was not funded beyond 2013 and any partnerships and co-funding opportunities will be short term.

Risk assessment is one of the four proposed areas of research for the new CRC, with a considerable emphasis on modelling and future scenarios of climate change. .

4.6.2 Other CRCs

The research activities of a number of other CRCs are relevant, but not central, to climate change and emergency management, including: Antarctic Climate and Ecosystems (ACE) CRC, CRC for Aboriginal and Torres Strait Islander Health, CRC for Spatial Information, CRC for Smart Services, and CRC for Wound Management Innovation CRC.

NCCARF continues to explore opportunities with these CRCs in relation to collaboration to fund national level research into climate change and emergency management.

4.7 Geoscience Australia (GA)

Geoscience Australia (GA) is a prescribed agency within the Department of Resources, Energy and Tourism. It conducts research to inform government policy, including development of fundamental data and information products that are needed for climate change adaptation, and assessment of community safety issues such as natural hazard risk.

GA's Risk & Impact Analysis Group develops risk assessment models, tools and databases to assess the risk to a range of natural and human-caused hazards. Climate-related hazards of interest include tropical cyclone, storm surge, flood, landslide and coastal erosion. An

example of climate change adaptation research is the assessment of physical and socio-economic vulnerability of coastal communities to the consequences of sea-level rise and potential changes in storm frequencies and magnitudes.

GA develops fundamental spatial data which is of value for emergency management applications. The National Mapping & Information Group develops topographic maps and coordinates spatial data infrastructure initiatives such as the National Elevation Data and Information System – information that is critical to understanding stream flows and flood hazard. The National Earth Observatory Group (NEOG) within GA acquires and processes remotely sensed data from satellites which can be used for assessing disaster footprints such as bushfire scars and flood inundation areas. NEOG also operates Sentinel, a national bushfire monitoring system that provides timely information about bushfire hotspots to the public and to emergency services across Australia.

GA's research and policy advice is done in large part through the agency's appropriated budget, and through collaborative or co-funded projects with the Australian, state and local governments, CRCs, universities, and industry partnerships. GA seeks partnerships to develop and maintain geoscience information and to value-add this information to inform government policy and the public in the national interest. GA is not a funding agency, but does co-invest in areas of interest to the Resources, Energy and Tourism portfolio, including community safety issues where geoscience information is required.

The Australian Government is establishing a single portal, hosted by Geoscience Australia, to make all government-held flood maps (including those of state, territory and local governments) publicly available. This initiative is expected to be expanded over time to cover other natural hazards. Where feasible, the guidelines are to take into account the potential impacts of climate change.

4.8 NCCARF Adaptation Research Network for Emergency Management

The NCCARF Adaptation Research Network for Emergency Management, hosted by RMIT University, has about 300 members from universities, government, other research institutions, community groups, and industry. Collectively, the Network membership have access to a wide range of research facilities, and have knowledge of the pathways to public and private sector research investment funds. Direct cash investment is unlikely to be secured through these sources, but in-kind research time may be possible.

5. Strategy for National Coordination

There is a broad recognition that adaptation will become an increasingly important factor in government, industry, business and community planning and decision-making. A significant amount of research has been commissioned since the original Emergency Management NARP was completed and is now being undertaken. Much of the research into areas identified as high priority in the Emergency Management NARP has been funded by the ARGP funds (see Section 3.1.1 and Appendix 2). Research is also being funded and / or conducted by a variety of other providers (e.g., ARC) and research organisations (e.g., CSIRO).

5.1 Immediate investment (2012-13)

NCCARF has undertaken a range of activities to formulate this Implementation Plan, including interviews with prospective research partners and meetings with key players.

The Australian Government's *Climate Change Adaptation Research Grants Program (ARGP)* funding is now fully allocated. No further funding for climate change adaptation research is currently available from this source. Further program level research funding relating to emergency management and climate change adaptation will need to be sourced elsewhere.

Some Australian Government Departments have an interest in climate change adaptation research for emergency management, including (1) Attorney-General's Department, (2) Department of Infrastructure and Transport, and (3) Department of Innovation, Industry, Science, Research and Tertiary Education. None of these Departments appear to be in a position to invest now in research to address the priorities in the Emergency Management NARP. However, NCCARF will continue to discuss potential investment opportunities with these and other Australian Government Departments.

The ARC has regular calls for research, including research relating to climate change adaptation. The ARC is currently investing in 1 research projects relevant to the research priority of the Emergency Management NARP research priorities, and there is every reason to presume that further sound research proposals are likely to be successful.

Several CRCs undertake research relevant to the Emergency Management NARP research priorities.

NCCARF will continue to investigate with these and other research investors options for developing coordinated research programs that will advance Australia's climate change adaptation knowledge base for the emergency management theme.

NCCARF is also developing an on-line hyperlinked source-page of potential climate change adaptation funding sources available to Australian researchers. When this page is live it will be announced at www.nccarf.edu.au and all Adaptation Research Network members will be advised.

The NCCARF Climate Change Adaptation Research Network for Emergency Management (hosted by RMIT University) is well placed to work with NCCARF to build research consortia and secure additional resources for new research programs.

5.2 Building Future Programs

A next Phase of NCCARF is being proposed to commence from 2013. NCCARF is seeking to establish a new round of core funding for further climate change adaptation research, with additional funds available for emergency management theme.

NCCARF will continue to investigate with all potential research investors and interested stakeholders how further coordinated research programs could be developed to advance Australia's capacity to respond effectively to climate change adaptation challenges and opportunities. This dialogue will involve State and Local Government, private industry or other groups. The NCCARF Adaptation Research Network for Emergency Management will continue to monitor the interests of stakeholders with a view to developing and enhancing opportunities for research investment and collaboration.

6. Impediments and Risks

6.1 Impediments

Australia's climate change adaptation research community has increased during the 2009 – 2012 period, but remains relatively small in comparison with the scope of the research required to deliver the national research program outlined in the research priorities in the Emergency Management NARP (2012).

With current economic and budgetary conditions and the large scope of the research agenda, implementing the research program set out in the Emergency Management NARP will require considerable funding over an extended period. A key focus will need to be on increasing the size of the research funding directed to this research agenda – across a wide variety of organisations and stakeholder groups - while at the same time utilizing the resources available immediately for carefully targeted and effective research. It will be useful to integrate research focussed on the research priorities in the Emergency Management NARP with research commissioned under other themes, such as SEID, Human Health and Settlements and Infrastructure.

Since the original NARP was completed several extreme weather events have affected Commonwealth, State and Local Government funding priorities, while also highlighting the value of research that better enables them to anticipate, prepare for and respond to emergencies that occur at their scale of interest. This may help to garner support for research on a project-specific and location-focussed basis.

6.2 Risks

The investment in NCCARF-managed research projects focussed on the research priorities in the Emergency Management NARP comprises about \$1,770,000 of ARGP funds, and a total research value of about \$3,900,000 (cash and in-kind). NCCARF must collaborate closely with other relevant organisations to ensure that the outcomes from the research are managed and communicated so that decisions about climate change adaptation concerning emergency management are able to effectively use the information generated by this research program.

7. Monitoring

NCCARF monitors research being conducted across Australia that implements the research priorities identified in the Emergency Management NARP, and reports annually on this research and remaining research gaps.

NCCARF also reports regularly on the progress of research investments from the ARGP.

The Emergency Management NARP and Implementation Plan are updated periodically to take account of changes in the information base available, current research being undertaken and changes in stakeholder information needs.

NCCARF also has a Synthesis and Integrative Research Program which synthesises research outcomes in the area of climate change and emergency management and other relevant thematic areas to increase their availability to decision makers and other stakeholders..

The Adaptation Research Network for Emergency Management is a useful partner in many of these NCCARF activities, and also develops independent reports and collaborations.

8. References

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Appendix 1

Research Priorities in the *National Climate Change Adaptation Research Plan: Emergency Management (2012)*

| | |
|--|---------------------------------|
| 1. Understanding risk | |
| 1.1 Where and how are changes in climate going to put us at greatest risk? | Medium |
| 1.2 What tools are needed to enable decision-making under future climate uncertainty? | High |
| 2. Community and organisational resilience to disasters | |
| 2.1 What does community resilience mean in a changing climate? | Very High |
| 2.2 What practices and processes promote community preparedness and preventive strategies in a changing climate? | |
| 2.3 What are the most effective strategies to ensure that individuals, governments and the private sector adopt better practices in preparing for the increased risk to communities, business operations or critical infrastructure arising from climate change? | Very High Very High–High |
| 3. Adaptive strategies | |
| 3.1 How will climate change affect the emergency management sector's capacity to support preparedness, response and recovery? | Very High–High |
| 3.2 What is the role of the private sector in adaptation through emergency management? | High |
| 4. Regional implications | |
| 4.1 How will climate change affect the capacity of emergency management systems in Australia and the Pacific region to interact for mutual benefit and support? How can these systems best support adaptation? | Medium |

Appendix 2 Current NCCARF (ARGP) Research for Emergency Management

| Project Title | Lead Organisation | Lead Investigator |
|--|------------------------------|--------------------------|
| A spatial vulnerability analysis of urban populations to extreme heat events in Australian capital cities | Monash University | Margaret Loughnan |
| <p>This study will; identify threshold weather conditions for mortality in Australian capital cities; describe spatial distributions of human vulnerability to extreme heat, and provide information to target emergency responses during heat waves. Baseline risk will be used to predict changes in vulnerability in relation to predicted changes in climate extremes associated with climate change.</p> | | |
| Public understandings, risk perceptions, and responses to climate change and associated natural disasters | Griffith University | Joseph Reser |
| <p>This project aims to: examine public understandings, risk perceptions, concerns, and adaptations to climate change and natural disasters in Australia, as part of an international collaboration invitation and a national database initiative; To identify ways in which public understandings and responses to the threat and impacts of climate change differ across population sub-groups defined in terms of gender, age, urban/peri-urban/rural residence, and other demographic considerations; To examine the extent to which public understandings of climate change and perceived current and future impacts for Australia include natural disaster events and increased intensity and magnitude of such events and their impacts; To examine the relative salience and importance of climate change and natural disasters as interrelated risk domains vis-a-vis other risk domains and areas of public concern; To examine the extent to which natural disasters that have taken place in Australia over the past decade are understood as reflecting the unfolding impacts of climate change; To examine the extent to which risk perceptions and responses alter with systematically varied item framings relating to temporal (present, near future, far future) and spatial (local, national, global) 'distance'; To examine the extent to which direct personal experience with events perceived to be associated with the impacts of climate change mediates or otherwise influences risk perceptions, understandings and adaptation responses; and To provide a baseline from which the nature, direction, and extent of changes in these community risk perceptions, understandings, and adaptation responses over time can be prospectively examined and documented.</p> | | |
| Recovery from disaster experience: its effect on perceptions of climate change risk and on adaptive behaviours to prevent, prepare, and respond to future climate contingencies | James Cook University | Helen Boon |
| <p>The aims of this project are to Identify private and public sector groups' beliefs, behaviours and policies that have supported community resilience to a disaster event and construct a model with findings to help implement appropriate and equitable emergency management policies and mitigation strategies for climate change events.</p> | | |

| Project Title | Lead Organisation | Lead Investigator |
|---|---------------------------------------|--------------------------|
| Harnessing private sector logistics for emergency food and water supplies in flood prone areas | Australian National University | Leo Dobes |
| <p>Based on the expectation of increased frequency and/or intensity of cyclonic events due to climate change, carry out a nationally-applicable scoping study using the Cairns community to: Estimate the economic benefits of continuity of supply of water and fresh food to isolated communities; Based on the stated alimentary preferences of residents, estimate the additional economic costs of supplying water and food using conventional public sector Emergency Services; and harnessing potential private sector logistical arrangements as an alternative; and to Compare the relative efficiency of public and private sector arrangements, and estimate any additional government subsidies justified by cost-benefit analysis.</p> | | |
| Adaptation of the built environment to climate change induced increased intensity of natural hazards | James Cook University | David King |
| <p>This project will examine the likely impacts on the built environment of increased intensities in weather-related natural hazard events, and will identify the possibilities for the adaptation of regulatory mechanisms in building construction, housing and planning. An analysis of the impacts of climate change on the built environment, and a review of the existing regulatory mechanisms and their effectiveness, will be followed by further modelling of industry best practices and policy recommendations that provide for improved emergency management preparations and response capabilities across a wide range of agencies and organisations.</p> | | |
| Agent based simulation framework for improved understanding and enhancement of community and organisational resilience to extreme events | RMIT University | Lin Padgham |
| <p>The aims of this project are to develop a modular agent based simulation platform, that allows emergency management stakeholders to explore complex multi-scalar, multi-actor, emergency management interactions under uncertain future conditions, in order to promote more effective governance arrangements. The platform is also intended to be a long term decision support tool suitable for the development of agent based simulations which address a range of extreme events, such as coastal flooding, heat stress, etc.</p> | | |

| Project Title | Lead Organisation | Lead Investigator |
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| Developing an Excel spread sheet tool for local governments to compare and prioritise investment in climate adaptation | Macquarie University | Stefan Trueck |
| <p>The analysis of climate extremes is particularly important because of their high impact nature. Unfortunately, often end users do not understand the range of uncertainties surrounding the research outputs they use for extreme events. This project will design a tool to equip end users to analyse and prepare for extreme events in a less predictable, complex world. The project will use a combination of quantitative and qualitative methods to frame the decision making tool. The tool will allow users to conduct sensitivity tests, examining the impact of uncertain parameters ranging from climate impacts to discount rates. The final product will include a user-friendly decision tool in the form of an excel sheet together with a user manual booklet which will demonstrate sample worked out projects. The tool will also be made flexible enough to be contextualised to suit decision making under uncertainty for sectors such as human health, agriculture, water sector, tourism or insurance. This will be achieved by inviting stakeholders from various sectors and refining and adding on to the tool's capacity.</p> | | |
| Changing Perceptions about Climate Change | Griffith University | Joseph Reser |
| <p>To analyse a second national survey to benchmark public risk perceptions, understandings and adaptation response to climate change, and to document these changes over time with the same respondents (see <i>Public understandings, risk perceptions, and responses to climate change and associated natural disasters</i> above for further details)</p> | | |
| The Right Tool for the Job: Achieving climate change adaptation outcomes through improved disaster management policies, planning and risk management strategies | Griffith University | Michael Howes |
| <p>This project is designed to produce tangible outcomes that can be used by policymakers, planners and risk managers across the public sector and is strongly supported by our partner organisations. Effective responses to climate change adaptation in Australia have been hamstrung by growing antipathy from sections of the general public and government uncertainty about the most appropriate policies, plans and decision making tools. This is despite the fact that proposed climate change adaptation actions are based on the best available science and have followed rational decision-making processes that include significant public consultation. While climate change is forecast to have substantial long term impacts on many natural disasters in Australia, there is considerable uncertainty about when and how to undertake adaptation and the level of priority to be assigned compared to other problems. The objective of this project is to develop a nationally consistent approach supported by a set of risk-context analysis tools that will enable government disaster management organisations and decision-makers to: (i) Better understand the relative significance and timing for actions to address climate change; (ii) Analyse the social, political, economic and environmental context of communities at risk from natural hazards that will be exacerbated by climate change at national, state and local scales; (iii) Identify potential barriers to achieving context-appropriate climate change adaptation outcomes; and, (iv) Facilitate</p> | | |

| Project Title | Lead Organisation | Lead Investigator |
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| <p>the effective incorporation of climate change adaptation outcomes into existing disaster management and resilience building initiatives in ways that avoid or minimise impediments. This may include, for example, proposed refinements to the existing National Emergency Management Risk Assessment Guidelines.</p> | | |
| <p>Understanding the Pacific’s adaptive capacity to emergencies in the context of climate change</p> | <p>University of Technology, Sydney</p> | <p>Juliet Willetts</p> |
| <p>This project aims to: (i) Provide recommendations to policy makers & practitioners in the Australian and Pacific disaster and emergency response sectors on current adaptive capacity of the Pacific Island Countries (PICs) to climate related disasters (e.g. tropical cyclones, floods, droughts, storm surge), & what resources are likely to be needed in the coming years to enhance this capacity; focusing on the immediate humanitarian needs post-disaster, including health care; food/nutrition; water; sanitation and psychosocial needs, and (ii) To understand the Australian emergency services & related organisations' capacity and obligations to assist PICs in times of disaster & whether there is adequate capacity to service future needs due to a changing climate, allowing for better planning & thus more effective response in times of disaster.</p> | | |
| <p>Exploring the adaptive capacity of emergency management using agent-based modelling</p> | <p>RMIT University</p> | <p>Lin Padgham</p> |
| <p>This project aims to fo further explore, in close collaboration with the City of Port Phillip (CoPP) and end-users from across the Prevention, Preparedness, Response, Recovery (PPRR) spectrum: (i) the use of agent-based modelling to support an understanding of the emergency management sector's capacity to support PPRR under a changing climate, and (ii) to support informed decision making about policy and governance issues for adapting to the changing climate (see <i>Agent based simulation framework for improved understanding and enhancement of community and organisational resilience to extreme events</i> above for further details).</p> | | |