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# National Climate Change Adaptation Research Plan: Social, Economic and Institutional Dimensions

## Consultation Draft

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## 1 **Executive Summary**

2 This National Climate Change Adaptation Research Plan identifies the research that is needed  
3 to enhance understanding of the social, economic and institutional dimensions of climate  
4 change adaptation in Australia. It outlines priority areas for research that can better inform  
5 decisions about adaptation to ensure effective, efficient, and equitable outcomes.  
6 Identification of research priorities will enable local, state/territory and Australian  
7 governments and other research investors to fund research over the next five years that can  
8 deliver maximum benefit to the Australian community and provide a broad framework for  
9 longer-term research planning.

10 Social, economic and institutional considerations are central to adaptation to climate change  
11 in Australia, regardless of the sector, location, or social group concerned. Efficient and  
12 effective action to avoid projected impacts from climate change requires some knowledge  
13 about possible impacts on things that are valued by individuals and social groups, such as  
14 employment, good health, and the natural environment. It also requires information about  
15 what actions are possible to avoid these impacts, including their cost, potential effects on  
16 other people, places, industries, sectors and future generations, and the barriers to their  
17 implementation. Yet there is a paucity of knowledge about these and other human dimensions  
18 of adaptation. There is therefore a need for research that can develop a theoretical and  
19 empirical basis to inform decision-making about adaptation by households, businesses,  
20 community groups, and governments.

21 This Research Plan identifies three broad categories of information necessary to enhance  
22 decision-making about adaptation in Australia. There is a need for research that advances  
23 understanding of:

- 24 1. the vulnerability and adaptive capacity of individuals, communities, businesses and  
25 industries;
- 26 2. the barriers and limits to adaptation; and
- 27 3. the governance and institutional arrangements necessary to ensure that adaptation is  
28 as effective, efficient, and equitable as possible.

29 Within these broad categories, a number of specific research topics are identified in this  
30 Research Plan. The Research Plan encourages research that engages with stakeholders and is  
31 problem-oriented, as such characteristics are most likely to deliver the best outcomes for  
32 decision-makers.

33 As with all the National Climate Change Adaptation Research Plans, research topics were  
34 prioritised according to:

- 35 • the severity of the potential impact to be addressed,
- 36 • the immediacy of the response required,
- 37 • the degree to which research will lead to practicable interventions or responses,
- 38 • the potential for the research to produce benefits beyond informing climate adaptation  
39 strategies,
- 40 • the extent to which the research addresses more than one issue or sector, and
- 41 • the extent to which the research addresses needs of most vulnerable groups.

1 The following research questions were identified as high priorities through applying these  
2 criteria.

3 In the area of *Understanding vulnerabilities and adaptive capacity*:

- 4 • The development and application of methods for assessing vulnerability and  
5 adaptive capacity that engage and harness the knowledge and skills of individuals,  
6 communities, businesses, industries and governments.
- 7 • Understanding the equity dimensions of vulnerability and adaptation.

8 In the area of *Understanding and overcoming the barriers and limits to adaptation*

- 9 • Understanding the cognitive factors that enable or are barriers to adaptation,  
10 including:
  - 11 a) the knowledge and perceptions of people and groups about climate risks;
  - 12 b) the time horizons of people and groups who make decisions about  
13 adaptation; and,
  - 14 c) the degree to which people and groups feel empowered to adapt.
- 15 • Understanding enablers and barriers to cohesive and effective community  
16 responses to climate change, including:
  - 17 a) how shared symbols, beliefs and practices facilitate or obstruct adaptation;
  - 18 b) what differing types of decision makers consider to be the goals of  
19 adaptation (e.g. what defines 'successful' adaptation in their eyes);
  - 20 c) what and how differing types of decision makers know about the  
21 vulnerability of others; and,
  - 22 d) economic barriers, including distribution of capital and investment.
- 23 • *Measures to value adaptation.* Understanding how to cost adaptations to climate  
24 change, the value of the avoided damages and the costs of the residual impacts,  
25 including:
  - 26 a) reviewing and determining the suite of valuation methodologies that are  
27 most appropriate for use by Australian adaptation policy and decision-  
28 makers;
  - 29 b) identifying the limits to the use of these methodologies; and,
  - 30 c) testing the identified methodologies against relevant current policy in  
31 Australia.

32 In the area of *Understanding governance, institutions and decision-making*:

- 33 • Analysis of existing responses from public and private institutions to climate  
34 change risks, and assessment of proposals to improve the effectiveness of future  
35 responses, including:
  - 36 • analysis of responses in the public, private and third (civil society) sectors
  - 37 • analysis of the distribution of roles, responsibilities, and capacities of  
38 different levels of government
- 39 • Understanding how laws and legal institutions, including regulatory instruments,  
40 support or impede adaptation planning and practice, and identifying reforms  
41 needed to reduce obstacles.
- 42 • Assessing the potential for, and limits to, market-based adaptation measures,  
43 including insurance markets.

# 1. Context and objectives

## 1.1 Background

There is now widespread acceptance that human activities are causing climate change. Since 1950, Australia has experienced a warming of between 0.4 and 0.7°C, with more heatwaves, more rain in the north-west and less rain in the southern and eastern regions, and an increase in the intensity of droughts. It is generally acknowledged that the effects of climate change can already be observed, whilst more are inevitable and will become more severe if we do not modify our behaviour. Impacts from recent climate change include increasing stresses on water supply and agriculture. In the future, we may expect to face more severe extreme events, and their associated impacts: more intense and frequent heatwaves, droughts, floods and storm surges (Hennessy *et al.*, 2007).

Human responses to climate change broadly fall into two categories: mitigation and adaptation. Both contribute towards reducing the risks of climate change. Using the definitions of the Intergovernmental Panel on Climate Change (IPCC, 2007), the term *mitigation* describes actions to reduce human effects on the climate system; it includes strategies to reduce greenhouse gas sources and emissions, and to enhance greenhouse gas sinks. The term *adaptation* refers to the adjustment, in human or natural systems, in response to actual or anticipated climate changes or their effects. The goal of these adjustments is to moderate harm, or to exploit beneficial opportunities.

The focus of this National Climate Change Adaptation Research Plan (NARP) for Social, Economic and Institutional Dimensions is adaptation. This NARP identifies the research required to help Australian governments, organisations and communities better understand the social, economic and institutional dimensions of effective climate change adaptation responses. It differs significantly from the other NARPs, which are focussed on sector-specific research priorities. It takes an overarching view across all sectors to consider the social, economic and institutional context: the social, economic and institutional factors which lead to success or failure in adaptation responses.

The NARP for Social, Economic and Institutional Dimensions provides a framework to guide climate change adaptation research funding decisions, and key directions for the country's social, economic and institutional research community. Factors other than climate change will affect each sector, the interactions between sectors, and the social, economic and institutional systems which govern climate change adaptation responses. Within that wider context, this NARP focuses on identifying the research activities required to inform adaptation to climate change and guide funding priorities.

The aims of this NARP are to:

1. Identify important gaps in our knowledge of the social economic and institutional dimensions of adaptation to climate change; and,
2. Set adaptation research priorities based on these information gaps.

## 1.2 National policy context for this National Adaptation Research Plan

The National Climate Change Adaptation Framework (the Framework) was endorsed by the Council of Australian Governments (COAG) in April 2007 as the basis for government action on adaptation over five to seven years. The Framework identifies possible actions to assist vulnerable sectors and regions, such as water resources, human health, settlements and infrastructure, and coasts, to adapt to the impacts of climate change. It also identifies actions to enhance the knowledge base underpinning climate change adaptation and improve national coordination of climate change adaptation research. In 2007 the Australian Government provided \$126 million over five years towards implementing the Framework.

In addition to work at the national level, state and territory governments as well as local government authorities are beginning to consider the impacts of climate change on their core services and how

1 they are provided. Increasingly, professional and industry groups such as social service agencies and  
2 providers, investors and economic analysts, the legal profession and insurance companies are also  
3 taking into account climate change impacts in their ongoing operations.  
4

5 The Australian Government established the National Climate Change Adaptation Research Facility  
6 (NCCARF), hosted by Griffith University, to coordinate and lead the Australian research community  
7 in generating the biophysical, social and economic information and tools needed to facilitate  
8 adaptation to climate change. Research outputs will be focused on the needs of decision-makers in  
9 government, vulnerable industries and communities as they respond to the range of potential climate  
10 change impacts. A key role of the Facility is to coordinate development of National Climate Change  
11 Adaptation Research Plans (NARPs) across NCCARF's eight priority areas:

- 12 • Emergency Management
- 13 • Human health
- 14 • Marine biodiversity and resources
- 15 • Primary industries
- 16 • Settlements and infrastructure
- 17 • Social, economic and institutional dimensions of adaptation
- 18 • Terrestrial biodiversity
- 19 • Water resources and freshwater biodiversity

20  
21 NARPs identify critical gaps in the information needed by sectoral decision-makers and set national  
22 priorities for research to assist adaptation to expected impacts of climate change. Up to \$30 million  
23 will be invested in priority research for key sectors as identified in these NARPs. These research plans  
24 are being developed in partnership with governments, stakeholders and researchers.  
25

### 26 **1.3 Development of this National Adaptation Research Plan**

27 The development of this NARP is led by the writing team:

28 Dr Jon Barnett

29 Dr Florence Crick (NCCARF – Secretariat)

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36 Mr. Steve Waller (WA Office of Climate Change)

37 The writing team has developed this NARP following a national workshop for key stakeholders and  
38 researchers, held in December 2008, that took as its starting point a public Issues Paper.

39 Over 40 participants from a wide range of stakeholder groups attended this workshop, including:  
40 representatives from the Commonwealth, state and territory governments, local government,  
41 insurance companies, non-governmental organisations and researchers from universities and the  
42 CSIRO.

43  
44 Discussions during this workshop and feedback on the Issues Paper provided valuable insights into  
45 decision-makers' and stakeholders' information needs and research priorities, and are reflected in this  
46 Consultation Draft.  
47

## 1 1.4 The Scope of this National Climate Change Adaptation Research Plan

2 The NARP for Social, Economic and Institutional Dimensions of climate change adaptation identifies  
3 critical gaps in the information needed to address the full range of issues arising from potential  
4 impacts of climate change on Australia's social and economic systems and institutions. It takes an  
5 overarching view across all sectors to consider the social, economic and institutional factors which  
6 lead to success or failure in adaptation responses.

7 The primary purpose of this NARP is to set the priority research agenda for the next 5-7 years to  
8 enable knowledge about the social, economic and institutional dimensions of climate change  
9 adaptation to contribute to adaptation decisions and investments by Australia's governments,  
10 communities, businesses, organisations and residents.

11 While past climate change research and policy development in Australia has largely focused on the  
12 biophysical dimensions of climate change, this NARP will expand the nation's research effort by  
13 generating information about:

- 14 (a) the risks posed to social and economic systems by climate change; and,  
15 (b) how social, economic and institutional factors can contribute to or hinder effective climate  
16 change adaptation responses.

17 The social, economic and institutional dimensions of climate change adaptation are critical for four  
18 reasons.

- 19 1. Effective decision-making about adaptation requires the identification of desired outcomes,  
20 either in terms of (negative) impacts avoided, or (positive) benefits achieved. This process of  
21 goal setting is an inherently social process: it entails understanding the way people value the  
22 things that are at risk from climate change, how those values come into being, how they  
23 change, how they conflict, and how conflicts can be resolved.
- 24 2. Climate change poses risks to people, places and important social systems. These risks, and  
25 their distribution across society, are still poorly understood and require further specification.  
26 Climate change decision-making itself can be a risk to people, places, and systems, and  
27 understanding these is also important. This identification of climate change and climate  
28 change policy risks is a key part of devising solutions to manage them.
- 29 3. Regardless of the sectoral domain or goal of any given adaptation decision or action, the  
30 changes that are made will fundamentally be changes in the behaviour of people and  
31 institutions. Improving adaptation responses involves:
- 32 ○ making decisions in a planned approach rather than in an *ad hoc* and reactive way;
  - 33 ○ harmonising the multitude of decisions that will be made across diverse sectors,  
34 industries, places, and scales so that none increase the vulnerability of other systems,  
35 industries, sectors or social groups (maladaptation);
  - 36 ○ identification of the capacity of various actors to make and implement decisions (adaptive  
37 capacity); and,
  - 38 ○ devising strategies to overcome barriers to making and implementing decisions about  
39 adaptation actions that are effective, efficient, equitable, and timely.
- 40 4. Adaptation efforts need to rest on a sound economic basis. From an economic perspective,  
41 adaptation options can be evaluated in terms of whether and by how much the benefits of  
42 such options exceed the costs incurred (Agrawala and Fankhauser, 2008). Assessments of  
43 adaptation costs and benefits are relevant at all spatial scales for decision makers to make  
44 investment decisions about adaptation. The analysis of the economic dimension of adaptation  
45 is, however, not limited to assessing the costs of adaptation measures but is also relevant for  
46 understanding and assessing the role of market and regulatory mechanisms and instruments in  
47 providing incentives for and facilitating adaptation.

48  
49 Thus, all adaptation activities touch on social, economic and institutional issues. To help provide a  
50 common language for this Plan:

- 1 • *social* refers to relationships between different people and groups, and patterns of behaviours,  
2 attitudes, and understanding reflected in (and transmitted by) culture;
- 3 • *economic* activity is embedded in this social landscape, and relates primarily to the  
4 production, distribution, and consumption of goods and services through markets;
- 5 • *institutions* refer to the formal and informal rules as well as organisational arrangements  
6 governing human interactions, including social and economic activities.

7  
8 This NARP will provide:

- 9 • further stimulus to future thinking about how best to study the risks to social and economic  
10 systems and institutions,
- 11 • approaches to developing effective adaptation responses, and
- 12 • consideration of how to include these issues into policy developments and adaptive strategies  
13 within other related sectors.

14  
15 There are many stakeholders who have a need for improved knowledge on just how, where and when  
16 the various components of climate change, acting singularly or in combination, will require the  
17 introduction of adaptation strategies that will remove or reduce adverse impacts on social and  
18 economic systems and institutions and how social, economic and institutional factors could support or  
19 hinder effective climate change adaptation responses.

20  
21 This NARP will support adaptation efforts by identifying research priorities that are most relevant to  
22 the needs of stakeholders. These priorities form a basis for improving decision making and adaptive  
23 capacity across all levels of government, the private sector, community groups, investors, insurance  
24 companies, lawyers and the professions. The NARP will reference past and current research into the  
25 impacts of climate change, including research on social and economic systems, institutions,  
26 governance and equity.

27  
28 This Research Plan recognises that climate change adaptation issues are important to Indigenous  
29 communities around Australia. We recognise that these issues are critical. They will be considered  
30 more fully through a separate process.

31  
32 Many research questions related to social, economic and institutional factors show close affinities  
33 between measures intended to reduce emissions and measures introduced to adapt to the impacts of  
34 climate change. While there has been no explicit attempt in this NARP to exclude mitigation issues  
35 where these interact with adaptation, the emphasis of this NARP is clearly on adaptation strategies.

36  
37 This NARP is structured around three clusters of challenges posed by the impacts of climate change.  
38 While there are overlaps between some research questions in each of the clusters, they individually  
39 offer scope for development of research priorities across sectoral interests, time scales, and,  
40 especially, spatial scales. The clusters are:

- 41 1. Understanding vulnerability and adaptive capacity;
- 42 2. Understanding and overcoming the barriers and limits to adaptation;
- 43 3. Understanding governance, institutions and decision making.

44 Each of these clusters involves inherently cross-cutting and integrated research challenges, as well as  
45 challenges that are more tightly defined.

46  
47 Overlaps and synergies between the scope of issues addressed in this NARP and those addressed in  
48 other NARPs are considered below. Section 2 outlines the knowledge and research challenges related  
49 to the social, economic and institutional dimensions of climate change adaptation, and identifies key  
50 stakeholders for this NARP and the research agenda it defines. Section 3 formulates research  
51 questions for the three clusters described above. Section 4 outlines the process and criteria used to  
52 prioritise those research questions and lists the research questions which emerge as high priority. The  
53 full prioritisation matrix for all research questions is in Appendix 1. Section 5 concludes this NARP  
54 by discussing implementation issues.



## 1.5 Links to and synergies with other National Adaptation Research Plans

Research initiatives and outcomes around the social, economic and institutional dimensions of climate change adaptation directly relate to research concerned with addressing the impacts of climate change on human health, biodiversity, primary industries, emergency management, water, and settlement and infrastructure. Some of the relationships and linkages between this NARP, for Social, Economic and Institutional Dimensions of climate change adaptation, and other NARPs, either completed or in preparation, are set out in Table 1. The implementation plans for these NARPs will ensure that the identified research priorities are complementary and mutually supportive and will seek to avoid duplication of research effort.

**Table 1: Links between the NARP for Social, Economic and Institutional Dimensions and other NARPs**

Theme	Relationship to the National Climate Change Adaptation Research Plan for Social, Economic and Institutional Dimensions
<b>Human Health</b> (completed December 2008)	<ul style="list-style-type: none"> <li>• Synergies between human health and the social environment that determine the level of resilience to the stress of changes in the climate, particularly within Indigenous, remote and coastal communities</li> <li>• Methods of community education and awareness to reduce health impacts from climate change</li> <li>• Economic costs of health impacts from climate change</li> <li>• Social equity dimensions of health impacts which may be exacerbated by climate change, especially for individuals and communities which may be already at risk of social or economic disadvantage</li> <li>• Models of linkage and knowledge exchange between climate change researchers and policy-makers to provide decision support in planning health sector responses</li> <li>• Healthcare system models to handle increased demands from extreme weather events and outbreaks of infectious diseases</li> </ul>
<b>Emergency Management and Emergency Services</b> (completed October 2009)	<ul style="list-style-type: none"> <li>• Economic analysis to assess vulnerability to and damage from extreme weather events</li> <li>• Practices and governance arrangements to promote community preparedness and resilience to the impacts of climate change</li> <li>• Regulatory strategies for promoting adaptation in disaster management</li> <li>• Stakeholder engagement strategies for disaster response and recovery</li> <li>• Impacts of climate change on the institutional capacity of disaster/emergency management sectors</li> </ul>
<b>Marine Biodiversity and Resources</b> (completed October 2009)	<ul style="list-style-type: none"> <li>• Understanding the social, economic and institutional barriers to conserving marine biodiversity and marine-dependent industries/communities</li> <li>• Adaptive capacity issues for marine-dependent communities that are affected by impacts of climate change, acting together with other stresses such as over-fishing</li> <li>• Integration of economic models/techniques into interdisciplinary decision-making frameworks for evaluating adaptation actions and strategies</li> <li>• Social and economic impacts of degradation of marine tourism attractions; and of fish stocks for commercial, recreational,</li> </ul>

	<p>subsistence and traditional uses</p> <ul style="list-style-type: none"> <li>• Institutional barriers to adaptation in the aquaculture and commercial fishing industries</li> <li>• Changes in governance of marine biodiversity in response to climate change impacts</li> </ul>
<p><b>Terrestrial biodiversity</b> (Consultation draft completed, final draft in preparation)</p>	<ul style="list-style-type: none"> <li>• Integrating conservation with regional socio-economic trends</li> <li>• New institutional architecture for biodiversity conservation and management under conditions of climate change</li> <li>• Development of market-based instruments and other incentive approaches to build synergistic approaches to biodiversity conservation and climate change mitigation</li> </ul>
<p><b>Water Resources and Freshwater Biodiversity</b> (Consultation draft in preparation)</p>	<ul style="list-style-type: none"> <li>• Methods to establish and structure water institutions that can operate across urban, rural, industry and environmental spheres under climate change</li> <li>• Water pricing mechanisms that improve the balance between supply and demand</li> <li>• Water planning that incorporates climate risk management, uncertainty and change</li> <li>• Institutional and legal structures required to enable effective water markets to operate and to enable environmental water managers to optimise the delivery of environmental benefits under climate change</li> </ul>
<p><b>Primary Industries</b> (Consultation draft in preparation)</p>	<ul style="list-style-type: none"> <li>• Social and economic consequences of climate change impacts on rural communities</li> <li>• Communication frameworks to translate climate change adaptation messages which resonate with primary industry stakeholders</li> </ul>
<p><b>Settlements and Infrastructure</b> (Consultation draft completed, final draft in preparation)</p>	<ul style="list-style-type: none"> <li>• Public education strategies to inform and prepare the public for the impacts of climate change, particularly within coastal and remote settlements</li> <li>• Understanding of the social, economic and institutional impacts of climate change on settlements, infrastructure and the built environment</li> <li>• The roles of local, state/territory and Australian governments in adaptive governance of Australian urban centres</li> </ul>

1  
2 The impacts of climate change, and our responses to these impacts, will change over time, and the  
3 body of associated research will grow. This being the case, this Research Plan and the research  
4 priorities it identifies will need to be revisited and updated as part of a continuous cycle of research  
5 planning and implementation.  
6

7 This Research Plan is important given the paucity of knowledge and the under-utilisation of existing  
8 knowledge and skills to inform decision making about adaptation to climate change at all scales, and  
9 the centrality of social, economic and institutional considerations in the endeavour to grow the  
10 knowledge base for decision making. The following section explains in more detail the nature of  
11 adaptation, the importance of information in the adaptation process, the role of research and the type  
12 of research required to help improve decision making about adaptation in Australia. It is followed by a  
13 section outlining the priorities for research on the social, economic and institutional dimensions of  
14 adaptation. This, in turn, is followed by an explanation of the way this Research Plan will be  
15 implemented.  
16

## 2. Researching the social, economic and institutional dimensions of adaptation

This section explains the practical and intellectual context in which this Research Plan is situated. It explains climate change adaptation, defines key terms, discusses the importance of information in the adaptation process, and describes the role for and type of research required to help improve decision-making about adaptation in Australia.

### 2.1 The social, economic and institutional dimensions of adaptation

Climate change poses significant risks to Australia because of our location, climate, and economic profile (Garnaut 2008). The driver of risks is emissions of greenhouse gases, which have caused and will increasingly cause changes in atmospheric and oceanic conditions, notably: increases in average annual temperatures, increases in average sea level and average sea temperatures, decreases in average annual precipitation in Southern Australia, increasingly intense extreme air and sea-surface temperature events, increasing intensity of storms, increasing acidification of oceans, and increasing variability in rainfall (Hennessy et al. 2006, Hennessy et al. 2007). There is some uncertainty about the magnitude of the changes, because they take place embedded within natural climate variability.

These changes in the atmosphere and oceans have implications for ecosystems and resource based industries, including tropical reefs and rainforests, alpine areas, livestock and cropping systems in southern areas, heathland systems in southwest Western Australia, rangelands, coastal mangroves and wetlands, fisheries, and freshwater ecosystems in southern areas. Other identified problems include increasing cyclone damages in northern areas, increasing energy demands, increasing infrastructure costs, rising costs to businesses and households, coastal flooding, decreasing supply of water to urban areas, increasing damage from bushfire, increasing deaths from heat stress, and expansion of the range of a number of disease vectors (Allen Consulting 2005, Garnaut 2008, Hennessy et al. 2007, Preston and Jones 2006).

Australia is already experiencing impacts from climate change (Hennessy et al. 2007). Further impacts are inevitable, regardless of future efforts to reduce greenhouse gas emissions, and it is important to begin now to plan for these. Such early action is likely to bring considerable advantages, including minimising the social and economic costs of climate change in the future, and early realisation of the gains that may come from new and transformative opportunities.

It is widely assumed that the things that people in Australia value are susceptible to damage from (i.e., vulnerable to) the impacts of climate change. In this Research Plan we adopt the definition of vulnerability offered by the Intergovernmental Panel on Climate Change, which is “the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity” (Parry et al. 2007: 883).

These three elements of vulnerability – exposure, sensitivity, and adaptive capacity – mean that vulnerability is not simply determined by climate alone. Communities and industries that are highly exposed to climate change may not be vulnerable to it because they are highly adapted to it, or have a high degree of intrinsic capacity to adapt in the future. Other communities and industries may lack adaptive capacity, but be very unlikely to be exposed to

1 significant climate change. Research that ignores these multiple dimensions of vulnerability  
2 can result in poor or incorrect assessments of the level and causes of community and industry  
3 vulnerability (Nelson et al. 2009a).

4 In this Research Plan we define adaptation as ‘actions taken to avoid actual or anticipated  
5 impacts from climate change, or to attain potential benefits arising from climate change’.  
6 This is a shorter version of the definition offered by the Intergovernmental Panel on Climate  
7 Change (see IPCC, 2007: 869). In practice, climate change adaptation will arise through  
8 multiple public and private decisions about adjustments in investment, business practice, land  
9 use, building design, crop and livestock choice, water management, technology, insurance,  
10 education, health care, decision making processes, and social networks and bonds.

11 There is a difference between knowing what could be done to adapt to climate change and  
12 having the ability to take action. The ability to act is called ‘adaptive capacity’. Adaptive  
13 capacity is context specific and changes over time. Resources contributing to adaptive  
14 capacity include diverse forms of human, social, natural, physical and financial capital that  
15 are unequally distributed across society. Access to these resources is influenced by a range of  
16 social, cultural, institutional and economic factors. Information about climate risks and  
17 options to adapt to them are themselves important determinants of adaptive capacity, as is  
18 awareness of the need to adapt.

19 Knowledge about what adaptation actions to take, coupled with a high degree of adaptive  
20 capacity nevertheless does not mean adaptation will happen (Adger and Barnett 2009,  
21 Repetto 2009). There are economic, political, and cultural barriers to action, and important  
22 among these is the way decision makers perceive their own and others’ climate risks,  
23 vulnerabilities and adaptive capacities. There may also be disincentives to take action, and  
24 there may be individuals and groups who benefit from inaction.

25 Because the impacts of climate change are uncertain and will be felt across multiple sectors,  
26 industries, scales, and populations, and because vulnerability means different things to  
27 different people, actions taken to adapt to one risk may increase the vulnerability of other  
28 sectors’ actions. This possibility of “an adaptation that does not succeed in reducing  
29 vulnerability but increases it instead” is called maladaptation (McCarthy et al., 2001: 990).

30 Adaptation to the impacts of climate change may bring social or economic benefits to some  
31 communities or industries. Some adaptations can be driven by market processes where  
32 properly functioning markets exist, for example the increased production of rainwater tanks  
33 in response to urban water shortages. Where there is existing knowledge and skills relevant to  
34 adaptation, such as in the emergency management or insurance sectors, for example,  
35 harnessing and augmenting these may lead to co-benefits (for the sector concerned and for  
36 adaptation). However, where markets and institutions are lacking, the planning, investment  
37 and capacity necessary to realise benefits may not occur. Furthermore, actions to increase  
38 beneficial returns in one sector may cause negative outcomes in others (i.e., they may be  
39 maladaptive).

## Definitions

- Adaptation: actions taken to avoid actual or anticipated impacts from climate change, or to attain potential benefits arising from climate change (after IPCC, 2007: 869)
- Adaptive capacity: the ability to take action to adapt to climate change
- Maladaptation: an adaptation that does not succeed in reducing vulnerability but increases it instead (McCarthy et al., 2001: 990)
- Vulnerability: the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity (IPCC, 2007: 883)

## 2.2 The importance of research for effective adaptation

Planned adaptation (i.e. a response to an anticipated impact) is not possible without information. Efficient and effective action to avoid or minimise the anticipated impacts from climate change requires some knowledge about possible impacts, and to some extent the better the knowledge the more purposeful the adaptation can be (although uncertainty cannot be eliminated, improved knowledge about risks probably has diminishing returns to policy effectiveness, and it may indeed lead to *analysis paralysis* (Nelson et al. 2008)). Among other things, it also requires information about what actions are possible, their cost (especially relative to the costs of inaction), their potential effects on other people, places, industries, sectors and future generations, and the barriers to their implementation. A key way to avoid climate change exacerbating inequality in Australia is to ensure that asymmetries in information about vulnerability and adaptation are minimised.

This Research Plan is concerned with the production and communication of the social and economic information that will be essential to support decision makers as they plan for the future impacts of climate change. Traditionally, research on vulnerability and adaptation to climate change has sought to demonstrate the links between greenhouse gas concentrations, the dynamics of atmospheric systems, resultant changes to regional climate conditions and consequent biophysical impacts. A major goal has been to garner consensus on the need for mitigation of greenhouse gas emissions. Little of this research has focussed on informing actions that could be taken to reduce vulnerability to changes in climate (i.e. to inform adaptation). While a better quantification of the climate drivers of biophysical risks is important, many key drivers of vulnerability lie in the social realm – in the processes that expose people to risks, that make them sensitive to changes in environmental conditions, and which influence their capacity to adapt and avoid impacts.

For adaptation, there is a requirement for research that can develop a theoretical and empirical basis to inform decision-making by households, businesses, community groups, and government. The diversity of decision makers across sectors and scales implies that there will be widely varying audiences for, and users of, adaptation research outputs; each with different issues, existing knowledge, adaptive capacities and skills.

The societal problems of climate change should therefore be matched with the appropriate investment in the types of research best able to support adaptation. This will entail

1 considerable effort directed towards understanding the concerns of exposed groups and their  
2 information needs.

3 The different information needs of diverse kinds of decision makers will challenge the  
4 capacity of Australian research institutions, although it is important to recognise that there is  
5 much that is already known about effective responses to climate given the long history of  
6 climate variability research and policy experience in Australia, in particular in agriculture,  
7 natural resource management, and emergency management (Dovers 2009).

8

### 9 **2.3 Stakeholder engagement and mission-oriented research**

10 The value of research on adaptation is enhanced when it is targeted to meet the needs of  
11 specific groups of decision makers throughout society (Sarewitz and Pielke 2007). There is a  
12 need then, for science-policy and decision-support research that focuses on eliciting  
13 stakeholder needs through participatory processes, and using these needs as design criteria for  
14 research programs and projects.

15 There is a broad range of stakeholders with an interest in research addressing the social,  
16 economic and institutional dimensions of climate change adaptation including:

- 17 • Communities, including community organisations and service providers;
- 18 • Indigenous communities;
- 19 • Industry organisations, firms, and professional associations, including those in the  
20 following sectors:
  - 21 – insurance
  - 22 – finance and banking
  - 23 – infrastructure
  - 24 – primary industries and downstream sectors that rely on natural resources
  - 25 – tourism
  - 26 – land use planning and development
  - 27 – natural resource management,
  - 28 – manufacturing;
- 29 • Trade Unions;
- 30 • Local, state, territory and Australian governments;

31 These and other groups have differing and conflicting concerns about the impacts of climate  
32 change on their activities and interests. They, and the individuals associated with them, will  
33 have varying degrees of awareness of climate change impacts, the need to adapt, and  
34 potential adaptation strategies (see Gardner et al., 2009).

35 *Communities, community organisations and service providers* may benefit from information  
36 about how climate change will affect employment, ecosystem goods and services,  
37 demographic trends, and quality of life. They will also benefit from understanding the  
38 distribution of vulnerability within and between communities, including the distribution of  
39 adaptive capacity. Impacts may be more severe for individuals and communities that are  
40 already at risk of social or economic disadvantage. Community service providers may also  
41 benefit from information about the way climate change will change demands on community

1 services and the assets they have to provide them. Information about climate change impacts  
2 and community vulnerability needs to be tailored towards identifying adaptation responses,  
3 barriers to potential responses, the distributional outcomes of such strategies, and the limits of  
4 adaptation responses in minimising climate impacts.

5 Many *Indigenous communities* in remote areas have inadequate infrastructure, health services  
6 and employment, and consequently show features of social disadvantage which may reduce  
7 or restrict their capacity to adapt to climate change (Hennessy et al. 2007: 522). Direct  
8 biophysical impacts may result in significant indirect impacts on the social and cultural  
9 cohesion of affected communities (ibid: 523). However, it is important to recognise that the  
10 risks that climate change poses to Indigenous people will vary according to location and  
11 socio-economic status. The adaptation research needs of Indigenous communities will be  
12 addressed through a separate Research Plan.

13 Information needs among *industry organisations, firms and professional associations* will  
14 vary widely. Manufacturers require information, for example, on changing seasonal demand  
15 for goods, and on changing storage requirements for raw materials and finished articles.  
16 National and international patterns of trade, especially in primary produce, will change in  
17 response to climate change, with implications for manufacturers, and for finance and banking  
18 houses. Insurance providers require information about the vulnerability of insured assets to  
19 climate risks, and individuals, communities and businesses will need to be able to assess the  
20 costs and benefits of insuring against climate change impacts. Climate change seems likely to  
21 compound the problem of underinsurance, and so the barriers to insurance require further  
22 investigation. Firms in the finance and banking sector will require information about the risks  
23 climate change poses to their and their clients' investment portfolios (including risks to  
24 lending activities), as well as about identifying new investment opportunities. Infrastructure  
25 providers will require information to cost, prioritise and integrate climate risk management  
26 into strategic planning. This information will be particularly relevant to the energy,  
27 communication, water and transport industries.

28 While the adaptation information needs of primary producers will be addressed through the  
29 Research Plans on Primary Industries, and Marine Biodiversity and Resources, the  
30 information needs of providers of goods and services to the primary industries, and of food  
31 and fibre processors and retailers, is a cross-cutting concern. The risks climate change poses  
32 to these activities are partly a function of changes in the resource, but also of changes in the  
33 factors that determine competitiveness in local and international markets. These factors are  
34 many and varied, and some, such as trade barriers and fuel costs, may change due to climate  
35 change impacts and climate-related policy responses. Decision makers will need to  
36 understand climate change impacts in the context of other stressors such as land degradation,  
37 drought and long-term socio-economic trends.

38 Climate change is projected to have severe potential impacts on Australia's biodiversity, its  
39 natural and built environment, and the scenic value of several iconic Australian landscapes  
40 that support tourism activities. Decision makers need to understand the potential influence of  
41 climate change on the social and cultural perceptions of Australian tourist destinations. They  
42 also need to assess the capacity they have to adapt, for example by diversifying tourism  
43 products. These risks to demand, coupled with changing transport costs, the impacts of  
44 extreme events on demand and supply, changes in visitor perceptions and behaviours, and  
45 competition in international markets, all require further investigation.

46 Analysis of the barriers to climate change adaptation within planning governance frameworks  
47 will be useful to decision makers in the public and private sectors. Understanding the

1 assumptions of individuals, communities and businesses about property ownership and  
2 design will be essential for the successful implementation of adaptation strategies.

3 Land use planning and development decision makers will need to assess risks, benefits and  
4 costs of investments in the context of current and future climate change impacts. Local and  
5 state/territory government planning regimes and practices significantly influence the  
6 vulnerability and adaptive capacity of individuals, communities and businesses. It will be  
7 important to understand how legal frameworks, including regulatory instruments and liability  
8 principles, support or impede adaptation planning and practice.

9 Managers will need to incorporate community perspectives through the use of participatory  
10 tools in order to set priorities and influence behavioural change. Targeted communication  
11 approaches, risk assessment tools and governance frameworks will be needed to integrate  
12 climate change adaptation initiatives into best practice models. The identification of “no  
13 regrets” actions will be a productive first step to enhancing the adaptive capacity of the  
14 natural resource management sector.

15 *Trade unions* will require information about the effects of climate change and climate change  
16 policies on labour markets. There is a need for understanding about adaptation strategies that  
17 are not detrimental to employment and wages, or to communities dependent on key sectors  
18 that are vulnerable to climate change or, indeed, to the impacts of mitigation strategies.  
19 Alternatively, where adaptation decision-making produces outcomes that are detrimental to  
20 sectoral or regional employment, a greater understanding of labour market impacts, and  
21 ameliorative policies is required. Information about the distribution of the costs and benefits  
22 or responses across sectors and groups is also necessary.

23 Climate change is already affecting the diverse functions and responsibilities of Australian  
24 *governments*, and will increasingly do so in the future. Decisions about land use planning, for  
25 example, are already proving controversial (McDonald 2007), and increases in the frequency  
26 and severity of extreme weather events also pose challenges to governments. Adaptation to  
27 climate change has implications and thus responsibilities in virtually all government portfolio  
28 areas, hence the importance of integration into policy, or “mainstreaming” of adaptation  
29 activities.

30 There is a need for research that identifies, amongst other things: the risks that climate change  
31 poses to government functions and responsibilities; the way climate change may require  
32 changes in the delivery of government services; ways in which governments can harmonise  
33 decision making on adaptation to maximise effectiveness, efficiency, equity and timeliness,  
34 as well as to avoid maladaptations; the relative costs of adaptation; and the policy instruments  
35 – including but not restricted to market mechanisms – that are best able to achieve  
36 implementation of government adaptation policy goals.

37 For all these and other user groups, trusted, credible and influential sources of information  
38 will be essential for effective decision making, and to ensure that climate change adaptation  
39 messages resonate with stakeholders. It is also important the relevant knowledge and skills  
40 they already have are included in research and decision-making.



### 3. Research topics

Climate change adaptation has not received much attention in Australia to date, and therefore research capacity needs to be developed. However, there are several sectors and fields of research where climate variability has been a focus of past research. An early challenge is to identify opportunities to use existing theory, methods and applications, as well as areas where adopting past thinking could be misleading. Research guided by this Research Plan should draw significant learning from areas including, but not limited to, agriculture, rural and regional development, tourism, water management, fisheries, as well as disaster and emergency management.

As discussed in the previous section, adaptation research needs to connect to policy and decision making, and so will call increasingly on the social sciences. Disciplines of particular relevance will include anthropology, economics, geography, law, political science, psychology, public policy and sociology. Collaboration between researchers, policy makers and stakeholders will be crucial in designing research programs and projects that meet rigorous academic standards and stakeholder needs.

Given the cross-sectoral and pervasive nature of climate impacts, and the interconnections between sectors in the economy, multi- and inter-disciplinary approaches will be needed to analyse adaptation in a systematic and cohesive way. This means understanding and building the incentives and institutional arrangements that support interdisciplinary collaboration, and drawing on areas of research where cross-disciplinary interaction has already been developed. Opportunities for shared learning could emerge from cross fertilisation of research from sectors as diverse as primary health care and natural resource management.

In this section we identify 3 key clusters of challenges for research that seeks to improve the information basis for decision making about adaptation, namely: enhancing understanding of vulnerability and adaptive capacity; understanding and overcoming the barriers and limits to adaptation; and understanding the governance and institutional arrangements necessary to ensure that adaptation is as effective, efficient, and equitable as possible. This section is structured around these three key clusters of challenges rather than around the three dimensions of adaptation – social, economic and institutional – to enable the development of more cohesive and integrative research priorities. Research addressing the social, economic and institutional dimensions of adaptation is therefore included under each cluster of challenges. Within each cluster we identify key research topics.

#### 3.1 Understanding vulnerability and adaptive capacity

This theme concerns research that conceptualises and assesses vulnerability and adaptive capacity in ways that facilitate adaptation throughout society. Its overarching research questions are:

- who is vulnerable to climate change?
- why are they vulnerable?
- what are their sources of adaptive capacity, and how can these be improved?

We identify specific research aims that pertain to three key issues associated with assessing vulnerability and adaptive capacity. First, we highlight the need for stakeholder-driven approaches to research. Second, we highlight the need to enhance understanding of exposure and sensitivity to climate change, and ways to alter these so that vulnerability is reduced.

1 Third, we highlight the need for better understanding of the capacity of individuals,  
2 communities, businesses and industries to adapt to climate change.

3  
4 An emerging priority for adaptation research and policy development is assessments of  
5 vulnerability to climate change at scales that are meaningful to decision makers, which would  
6 include assessments of other social, economic, and environmental drivers of change. It will  
7 also be important to document examples of successful adaptation wherever they occur,  
8 analyse the determinants of success, and disseminate the lessons to communities, businesses,  
9 industries and regions at risk.

10  
11 Because vulnerability and adaptive capacity are emergent properties of complex human-  
12 environment systems, and can be both generic to diverse drivers of change, and risk specific,  
13 they cannot be meaningfully understood using any single proxy, or centralised, aggregate  
14 measures. Thus, in general, the research being called for here should be inductive in nature -  
15 that is, it should build theory and inform decisions makers through the collection and analysis  
16 of evidence (rather than seeking evidence based on general theories). In other words, this plan  
17 calls for bottom-up and stakeholder-driven processes to understand vulnerability and adaptive  
18 capacity.

### 19 ***Stakeholder-driven applications***

21 There is growing agreement that vulnerability and adaptive capacity cannot be understood  
22 independently of the perspectives of the individuals, communities, businesses and  
23 governments that vulnerability research is designed to support. Therefore, this theme calls for  
24 the development and application of methods for assessing vulnerability and adaptive capacity  
25 that engage and harness the knowledge and perspectives of stakeholders.

#### 26 *Research topic 1*

27 *The development and application of methods for assessing vulnerability and adaptive*  
28 *capacity that engage and harness the knowledge and skills of individuals,*  
29 *communities, businesses, industries and governments.*

### 30 31 ***Exposure & sensitivity***

32 This theme also calls for research that provides an integrated perspective of the biophysical,  
33 economic and social impacts of climate change. Integration here does not necessarily imply  
34 the use of modelling approaches. Exposure and sensitivity to climate change are most often  
35 analysed using hazard/impact models and/or nested groups of simulation models. Yet such  
36 approaches have historically encountered institutional and empirical problems. Institutionally,  
37 they have been expensive and tended to alienate groups identifies as 'vulnerable'. Empirically,  
38 they can lead to entirely erroneous conclusions about vulnerability (Nelson et al, 2009b).

#### 39 *Research topic 2*

40 *Understanding the ways in which interacting biophysical, economic and social*  
41 *processes expose individuals, communities, businesses and industries to climate risks,*  
42 *and identify options to alter this exposure to reduce vulnerability.*

#### 43 *Research topic 3*

44 *Understanding the ways in which interacting biophysical, economic and social*  
45 *processes make individuals, communities, businesses and industries sensitive to*  
46 *climate risks, and identify options to reduce sensitivity to climate change.*

## 1 *Adaptive capacity*

2 This theme also calls for research into the characteristics (both latent and realised) of society  
3 on which the capacity to adapt to climate change depends. Adaptive capacity can be both  
4 generic and task specific (that is, capacity to adapt to a variety of changes *versus* the capacity  
5 to implement a specific adaptation such as installing and maintaining a rainwater tank).  
6 Research into both is necessary.

### 7 *Research topic 4*

8 *Identification of the capacity of individuals, communities, businesses and industries to*  
9 *adapt to climate change, and identify options to enhance this capacity.*

10

## 11 *Equity issues*

12 The IPCC Fourth Assessment identified certain groups of people as being particularly at risk  
13 from climate change (IPCC, 2007). It stated that ‘even [in places] with high incomes, some  
14 people can be particularly at risk (such as the poor, young children and the elderly) and also  
15 some areas’. Within the affluent society of Australia, such inequalities exist. From an ethical  
16 standpoint, it is important to understand them, but there is also self-interest - the inability of  
17 parts of society to adapt will place a brake upon the whole. There is a need therefore to  
18 understand which groups are at particular risk, why they are at risk, the geographical  
19 characteristics of their exposure, and the options available to improve their resilience and  
20 adaptive capacity.

21

22 The corollary of this statement from the IPCC is that social groups will be differently  
23 impacted by climate change. Thus, this theme calls for research into the equity considerations  
24 of climate change:

- 25 a) how and why different social groups are differently impacted by climate change, and  
26 b) the ways climate change may alter the distribution of goods and services and  
27 opportunities within society, including considering the distribution of benefits and costs  
28 from what may be considered ‘successful’ adaptation strategies,.

### 29 *Research topic 5*

30 *Understanding the equity dimensions of vulnerability and adaptation*

31

## 32 **3.2 Understanding and overcoming the barriers and limits to adaptation**

33 This section focuses on the difference between the capacity to adapt to climate change (as  
34 dealt with in Section 3.1) and the translation of this capacity into action by individuals and  
35 groups. In this section we focus on some of the social barriers to action that might otherwise  
36 be initiated by individuals and groups.

37 This section is also concerned with the limits to adaptation. These are ecological, economic  
38 and technological thresholds, beyond which adaptation fails to achieve its goal. Limits also  
39 include the value-based judgements individuals and groups make when determining what is  
40 (and is not) effective ‘adaptation’ (Adger et al. 2009a). Considering limits helps to determine  
41 which responses to climate change are both practicable and legitimate, and the time scales  
42 over which adaptation may be considered to be effective.

43 This section identifies specific research aims that relate to the following four key issues  
44 associated with understanding and overcoming the barriers and limits to adaptation:

- 1 • cognitive barriers to adaptation.
- 2 • barriers to collective action in adaptation to climate change.
- 3 • the limits to adaptation.
- 4 • social and economic costs of adaptation to climate change.
- 5

## 6 *Cognitive barriers*

7 Understanding the cognitive (that is issues such as perception, knowledge and reasoning)  
8 barriers that impede individual actions towards adaptation includes understanding the  
9 determinants of individual perceptions of climate risks, and how those risks are weighted  
10 alongside other risks. This includes, among other things, issues relating to what and how  
11 individuals know about climate change and the effects of different kinds of messages and  
12 media. It also includes personal experience with climate variability and change, and  
13 emotional engagement with entities that are at risk from climate change. Values and beliefs  
14 about climate and the environment, and the material and social challenges that individuals  
15 face, can also influence risk perception.

16 The way people understand the future is also important in understanding individual action.  
17 How individuals perceive the timing of potential impacts, conceptualise the future, and weigh  
18 up the need to prepare for future climate risks vis-à-vis other risks will influence the extent to  
19 which decisions about adaptation are deferred. This relates to the problem of uncertainty  
20 about climate impacts and about the range and efficacy of potential responses, which also  
21 tend to lead individuals and groups to defer adaptation (see Grothmann and Patt 2005,  
22 Lorenzoni et al. 2007, O'Neill in press).

23 A more recently identified barrier to adaptation is the degree to which individuals and groups  
24 feel empowered to take action relative to their ability to adapt (see Grothmann and Patt 2005,  
25 Moser 2005). Some may feel that they already have the capacity to adapt to climate change,  
26 which may impede adaptation in situations where their perceived efficacy is overstated.  
27 Others may feel powerless to act, and this can constrain action unnecessarily as there may be  
28 fewer barriers to adaptation than are perceived.

### 29 *Research topic 6*

30 *Understanding the cognitive dimensions of adaptation, including:*

- 31 a) *the knowledge and perceptions of people and groups about climate risks;*
- 32 b) *the time horizons of people and groups who make decisions about adaptation;*
- 33 c) *the degree to which people and groups feel empowered to adapt.*
- 34

## 35 *Barriers to collective action*

36 Collective, cooperative and coordinated action on adaptation minimises the risks of  
37 maladaptation, and ensures equitable and efficient outcomes. There are many determinants of  
38 collective responses to social problems. Included among these are the degree to which  
39 symbols, beliefs and practices are shared: when these elements of culture are common,  
40 adaptation is more likely to be a collective process. This includes, amongst other things, the  
41 way people identify with places and their iconic elements and value their communities and  
42 assets, and their beliefs about desirable lifestyles and behaviours (including consumption).  
43 Culture influences people's perceptions about the goals of adaptation and their criteria for  
44 determining the success of adaptation. Included here is the way in which people and groups

1 view the legitimacy of other groups and actors that are and will make decisions about climate  
2 change. Legitimacy includes issues of trust, competence, and authority.

3 Shared understanding of the problem of climate change and the purpose of adaptation is also  
4 important. This includes overcoming biases in the perception of the vulnerability of various  
5 groups. Groups that may commonly be perceived to be highly vulnerable, such as remote  
6 rural communities, may be the focus of unwanted responses if their vulnerability is not high  
7 for reasons of either low exposure, low sensitivity, or high adaptive capacity. Evidence-based  
8 assessments of vulnerability, such as are called for in the previous section, are therefore  
9 important, as is understanding how decision makers perceive the vulnerability of others.

10 How decisions about adaptation get made and implemented is also critical for collective  
11 action. These issues of governance are addressed in the following section, suffice to note here  
12 that there is an emerging body of evidence which points to the need for full participation of  
13 all stakeholders in decision making about adaptation, as the failure to ensure this can shift the  
14 distribution of vulnerability towards those excluded from decision making (Few et al. 2007).

#### 15 *Research topic 7*

16 *Understanding enablers and barriers to collective action, including:*

- 17 a) *how shared symbols, beliefs and practices facilitate or obstruct adaptation;*
- 18 b) *what differing types of decision makers consider to be the goals of adaptation*  
19 *(e.g. what defines 'successful' adaptation in their eyes);*
- 20 c) *what and how differing types of decision makers know about the vulnerability*  
21 *of others; and*
- 22 d) *economic barriers, including distribution of capital and investment.*

23

#### 24 ***The limits to adaptation***

25 The IPCC Fourth Assessment recognised that a portfolio of adaptation and mitigation  
26 measures are required to address climate change (IPCC, 2007). If no effort were made to  
27 address climate change through mitigation actions, then eventually the impacts of climate  
28 change would become so great that adaptation would be impossible, i.e., the limits to  
29 adaptation would be reached. These limits are imposed not only by the amount of climate  
30 change, but also by the context in which climate change impacts are experienced –  
31 demographic, economic, social and political factors all act to determine the point at which the  
32 limits to adaptation are reached.

33 The limits to adaptation are the points at which potential adaptation actions are no longer able  
34 to avoid the negative impacts of climate change. These limits are typically conceived of as  
35 thresholds in ecological or economic systems, or in the ability of engineering solutions to  
36 avoid adverse changes (Adger et al. 2009a). Assessments of these limits are usually made by  
37 experts associated with the systems concerned. However, the judgement of what constitutes  
38 an undesirable outcome is a subjective social process determined by the plural values within  
39 communities of concern (Adger et al. 2009a, Adger et al 2009b).

40 Thus, there is a need to understand the way people value the things that are at risk of damage  
41 or loss from climate change, how those values come into being, and how people may respond  
42 to damage to, or the loss of, these things. These things of value may include elements of the  
43 natural environment such as species, ecosystems and sites of significance (for example the  
44 potential loss of coral species in the Great Barrier Reef or seawater incursion into Kakadu  
45 wetlands). They may include elements of the built environment such as settlements and

1 buildings (for example the loss of the 27 mountain huts in the Victorian Alps destroyed by  
2 the 2003 bushfires). They may also include important social values, such as a sense of  
3 community, lifestyle and identity, and widely held values such as equity and justice.

4 This type of research can help refine the intentions of adaptation strategies, and the  
5 communities that will be served by them. It may also help prioritise adaptation strategies and  
6 better identify losses for which there may, in some cases, be substitutes or ameliorating  
7 policy measures.

8 *Research topic 8*

9 *Understanding the limits to adaptation, including:*

10 *a) how people value the things that are at risk of loss or damage;*

11 *b) the effectiveness of adaptation strategies to sustain the things that are of*  
12 *value; and*

13 *c) the consequences of the loss of or damage to the things that are of value.*

14

### 15 ***Social and economic costs of adaptation to climate change***

16 A better understanding of the costs and benefits of adaptation to climate change is important  
17 for policymakers who need to make decisions about whether, how much and when to invest  
18 in adaptation (Agrawala and Fankhauser, 2008). Policy makers will seek to minimise the total  
19 costs of climate change, including the cost of adaptation measures and the cost of residual  
20 damages. Costs can also be used as one of the key criteria for selecting amongst competing  
21 adaptation options.

22 The assessment of the costs and benefits of adaptation to climate change is a relatively new  
23 area of analysis and faces many analytical and policy challenges. For example, the  
24 boundaries of adaptation measures are not clearly defined and there is no clear agreement on  
25 what should be included as adaptation. Should measures to increase baseline adaptive  
26 capacity, such as investment in health and education, be included as adaptation? In addition,  
27 separating the costs of adapting to climate variability and adapting to climate change adds  
28 another layer of complexity.

29 Anticipatory adaptation actions, particularly over the long-term, have to account for high  
30 levels of uncertainty (of climate projections and associated impacts) and entail significant  
31 cost. Conventional cost-benefit analysis methodologies may not perform well under such  
32 conditions and are highly contested in the environmental economics literature. A need exists  
33 to determine which suite of methodologies may be used with confidence by Australian policy  
34 makers and what are the inherent limits and boundaries of such methodologies. These  
35 methodologies should be applicable to different sectors of human activity, welfare and the  
36 natural environment and should be capable of comparison across multiple sectors and scales.

37 *Research Topic 9*

38 *Measures to value adaptation. Understanding how to cost adaptations to climate*  
39 *change, the value of the avoided damages and the costs of the residual impacts,*  
40 *including:*

41 *a) reviewing and determining the suite of valuation methodologies that are most*  
42 *appropriate for use by Australian adaptation policy and decision-makers;*

43 *b) identifying the limits to the use of these methodologies;*

1           c) *testing the identified methodologies against relevant current policy in*  
2           *Australia.*

3           *Research Topic 10*

4           *Evaluation of the costs. Valuing the relative costs of adaptation strategies and the*  
5           *avoided damages for different sectors of human activity and welfare, and for the*  
6           *natural environment.*

8           **3.3 Understanding governance, institutions and decision making**

9           The effectiveness of adaptation is a function of existing and potential new institutions of  
10          governance, and associated policy processes, legal settings, organisational arrangements and  
11          administrative procedures. The concept of governance recognises that transactions within  
12          society of various kinds (such as economic, informational, legal and social exchanges), and  
13          the maintenance of order and collective action, are a matter for government in cooperation  
14          with the commercial and civil sectors of society (Rhodes 1996, Stoker 1998).

15          Institutions are central to responding to new challenges, such as climate change. They are the  
16          *rules of the game*, including the underlying structures, norms and processes governing  
17          decision making in society (Dovers 2005). Given that adaptation is relevant to a wide range  
18          of human activities, the implications of assessing the suitability of new or existing  
19          institutional and governance settings is firmly a whole-of-government and cross-sectoral  
20          issue.

21          This theme includes issues around decision-making structures, the distribution of  
22          responsibilities for action, and forms of communication and engagement within and among  
23          communities, governments, civil society and the private sector. In past and current  
24          discussions of climate change adaptation (e.g., the review by Adger et al 2007), ‘institutions’  
25          are recognised as a crucial element. However, there has been little detailed investigation as to  
26          what institutions are important, how these may limit or enable adaptation, or what specific  
27          institutional, governance and policy process reforms might be needed. Therefore, the  
28          particular focus of this theme is to push towards greater specificity in understanding of the  
29          roles of institutions and governance in adaptation.

30          This section identifies specific research aims that relate to six key issues associated with  
31          understanding governance, institutions and decision making, as follows:

- 32                 • The distribution of responsibility for adaptation.
- 33                 • The role of laws and legal instruments.
- 34                 • Measures for mainstreaming adaptation in decision and management processes .
- 35                 • the potential for market-based solutions
- 36                 • the need for frameworks for managing transitions and
- 37                 • processes to support decision making

39          ***The distribution of responsibility for adaptation***

40          Research is needed to improve understanding about how institutions have responded to  
41          climate change and what lessons can be learnt from different institutional arrangements. An  
42          example might be how well local governments and Catchment Management Authorities have  
43          responded to climate change issues and how they would cope with additional roles and  
44          responsibilities. . Issues to be investigated here include:

- 1           • the delineation of public and private goods at risk, and the distribution of  
2           responsibility between the public and private sectors for responding to these risks;  
3           • the scale at which public and private decisions relevant to adaptation are currently  
4           made, and the scale at which they might best be made;

5 Research on these issues could include synthesis, assessment and communication of  
6 assessment approaches, best practice strategies, and decision systems that are available  
7 currently at these scales of decision-making.

#### 8           *Research Topic 11*

9           *Analysis of existing responses from public and private institutions to climate change*  
10          *risks, and assessment of proposals to improve the effectiveness of future responses,*  
11          *including:*

- 12           a) *analysis of responses in the public, private and third (civil society) sectors*  
13           b) *analysis of the distribution of roles, responsibilities, and capacities of different*  
14            *levels of government*

15

#### 16          ***The role of laws and legal instruments***

17 Laws underpin decision-making in societies, whether directly or indirectly. They give  
18 expression to institutional rules, shape processes of policy formulation, regulate behaviours,  
19 define liabilities and responsibilities, and determine access to decision-making processes. It  
20 is, therefore, essential to understand how the legal system, including both Common Law and  
21 relevant statutory frameworks, and associated institutions, can support adaptation planning  
22 and practice among individuals, businesses and communities.

23 This includes:

- 24           • understanding how aspects of our current legal framework (for example, planning  
25           and development control regulations) can facilitate adaptation or operate as  
26           barriers to effective and timely adaptation, and the reforms needed to promote  
27           adaptation and/or remove or reduce barriers;  
28           • understanding the role of legislative mandates and agency functions as  
29           institutional barriers and/or aids to adaptation.

#### 30          *Research Topic 12*

31          *Understanding how laws and legal institutions, including regulatory instruments,*  
32          *support or impede adaptation planning and practice, and identifying reforms needed*  
33          *to reduce obstacles.*

34

#### 35          ***Measures for mainstreaming adaptation into policy and planning processes***

36 Mainstreaming (or fully integrating) adaptation actions into policy and planning is widely-  
37 recognised as likely to result in the most successful climate change response strategies.  
38 Successful mainstreaming requires an understanding of how current policy and planning  
39 approaches and processes may facilitate or impede the inclusion or integration of climate  
40 adaptation considerations and priorities. This understanding includes identifying structures  
41 and processes in policy, planning and administrative systems that can serve to incorporate  
42 adaptation considerations across sectors and agencies.



1 Research in this area could draw on existing, relevant work in environmental policy  
2 integration (Ross and Dovers 2008; Habib 2009). It can consider traditional mechanisms of  
3 policy and planning integration and coordination in other sectors (for example task forces),  
4 and also the need for new mechanisms. These issues will differ across sectors, and across  
5 community organisation, private sector and public sector spheres.

#### 6 *Research Topic 13*

7 *Understanding the factors that facilitate or impede inclusion or integration of climate*  
8 *adaptation considerations and priorities into policy and planning.*

9  
10 *Understanding what kinds of advice and measures need to be incorporated into*  
11 *planning processes to ensure plans and policies incorporate climate change*  
12 *adaptation.*

- 13     ○ *What would be the most appropriate avenues for ensuring uptake of climate*  
14 *change adaptation considerations into policy?*  
15

#### 16 ***The potential for market-based solutions***

17 Market mechanisms are often perceived to offer flexibility in allocating access to resources  
18 and services over time in a dynamic and efficient fashion. This attribute has driven an  
19 increased uptake of market mechanisms and property rights instruments in a range of sectors  
20 relevant to adaptation (e.g. tradable water rights, individual transferable rights in fisheries,  
21 carbon trading). Climate change is likely to influence the operation of markets in many  
22 sectors. This suggests a need to better understand the ways in which markets support or  
23 restrict adaptation in specific sectors, and ways in which markets can be engaged to promote  
24 adaptation.

#### 25 *Research Topic 14*

26 *Assessing the potential for, and limits to, market-based adaptation measures,*  
27 *including insurance markets.*  
28

#### 29 ***The need for frameworks for managing transitions***

30 In the future there may be a need for planned transformations of sectors, industries, or  
31 communities so that they become more resilient to climate change. If so, processes for  
32 identifying and engaging stakeholders in issue identification and deliberation will be  
33 essential. There is a need for a cautious approach to discussions about changes to local  
34 economies or sectors to reduce vulnerability, and there is a need for forward thinking about  
35 the governance of transformation. Issues of concern include:

- 36     • when and why such transformations may be required (and who identifies them);  
37     • processes for identifying alternative pathways for change, and the distribution of  
38     their benefits and costs (and who is engaged in this process);  
39     • processes for deciding what changes are required;  
40     • processes for financing; and  
41     • processes for managing, monitoring and evaluating changes.

1 Research of this kind may learn from similar changes in the past, both in Australia and  
2 internationally, such as major reorganisations of industries and community resettlement  
3 schemes.

4 *Research Topic 15*

5 *Identifying frameworks and approaches to facilitate transitions to reduce vulnerability*  
6 *under climate change, including learning from non-climate change related experiences.*

7

8 ***Processes to support decision-making***

9 As explained in Section 2.2, research priorities have historically focused on basic climate  
10 research and hazard/impact modelling. This was essential to demonstrate that global climate  
11 was changing, and that this was induced by greenhouse gas pollution from human activities.  
12 However, this approach has tended to promote technical solutions to climate change impacts  
13 that can overlook opportunities for more transformative change (Nelson et al. 2009a). The  
14 disciplinary perspectives of scientists involved in adaptation research, and the institutional  
15 arrangements in which they carry out their research, strongly influence their ability to support  
16 adaptation activities throughout society. As we gradually come to better comprehend the  
17 nature of vulnerability and adaptive capacity, it is clear that we must span the boundary  
18 between the biophysical and social sciences in order to understand and frame research to  
19 address these issues.

20 Past experience with risk management in climate variability and other fields shows that  
21 converting interdisciplinary research into adaptation actions throughout society does not  
22 necessarily follow from funding basic research. Specific research effort is required to assist  
23 communities, industries, businesses, and governments to develop and embed the results of  
24 climate science research into the decision-making and policy processes, through which  
25 adaptation to climate change actually occurs. This implies that the goals, methods and outputs  
26 of this research should be co-evolved through participatory processes with stakeholders, and  
27 judged against societal relevance as well as against scientific excellence. It also means  
28 thoughtful evaluation and redesign of research organisations, cultures and practices to ensure  
29 the evolution of applied research that directly supports adaptation actions.

30 Further, decision-making about adaptation, particularly with respect to public goods, will  
31 have to contend with multiple and often contesting values that vary across space, class,  
32 sectors, and time, as well as uncertainty about impacts and the effectiveness of responses.  
33 There are many tools to support decision-making under such circumstances, such as benefit-  
34 cost analysis, multi-criteria analysis, and cost-effectiveness analysis. None of these tools are  
35 perfect, and further research is needed to understand ways in which non-market social values  
36 and preferences can be taken into account in decision-making processes (Hatfield-Dodds  
37 2005).

38

39 *Research Topic 16*

40 a) *Developing adaptation decision support and evaluation tools and resources that*  
41 *include diverse values and preferences.*

42 b) *Comparative analysis and evaluation of different criteria and decision-making*  
43 *frameworks for prioritising adaptation actions.*

44 c) *The design and evaluation of research organisations, cultures and practice to support*  
45 *adaptation throughout society.*

## 4. Research priorities

### 4.1 Criteria and considerations for prioritising research activities

Actions aimed at addressing the likely impacts of climate change span a wide spectrum of sectors. The COAG National Climate Change Adaptation Framework 2007 identifies eight sectoral areas, including biodiversity, for implementing adaptation actions. Since resources and capacity currently available in Australia for adaptation research are limited, the National Climate Change Adaptation Research Facility has developed a set of five criteria to be used for prioritising research topics within each theme area (see Appendix 1 for details). These criteria are being used in all the research plans being developed by the Facility. The criteria are:

1. Severity of potential impact or degree of potential benefit (essential)
2. Immediacy of required intervention or response (essential)
3. Need to change current intervention and practicality of intervention (essential)
4. Potential for co-benefit (desirable)
5. Cross-sectoral relevance (desirable)
6. Equity considerations (desirable).

A number of issues need to be considered when assessing priorities for research into the social, economic and institutional dimensions of climate, in order to achieve the ‘best’ outcomes. An essential front-end need is for information about the (likely) magnitude of adverse impacts due to climate change, to guide decisions about the choice of adaptive interventions. It is relevant to seek evidence of actual impacts of climate change, particularly in vulnerable sectors, communities, industries, or locations; although other factors will affect the amount of evidence required to guide decision-making. For example, less evidence may be needed to justify a relatively low-cost undertaking that will be useful in both current and future situations in any event. Research into adaptation and adaptive strategies must also address both short- and long-term time horizons.

A crucial task is to determine who is at the greatest risk of adverse effects of climate change. In general, adaptive strategies should pay particular attention to the needs of these subgroups.

### 4.2 Prioritising research activities related to the social, economic and institutional dimensions of climate change adaptation

Ranking areas for research into high and low priority is difficult, given that many aspects of research are not directly comparable and timeframes for research vary. Nonetheless, an attempt has been made to apply the six prioritisation criteria to the lists of research topics identified under each of the three sub-themes in Section 3.

Applying the prioritisation criteria, research priorities were ranked from low to high. The full assessment matrix is in Appendix 1. From this, the following list of high priority topics emerged.

1 **Table 1. High Priority Research Topics for the Social, Economic and Institutional**  
 2 **Dimensions**

<b>Understanding vulnerabilities and adaptive capacity</b>
<ul style="list-style-type: none"> <li>• The development and application of methods for assessing vulnerability and adaptive capacity that engage and harness the knowledge and skills of individuals, communities, businesses, industries and governments.</li> <li>• Understanding the equity dimensions of vulnerability and adaptation.</li> </ul>
<b>Understanding and overcoming the barriers and limits to adaptation</b>
<ul style="list-style-type: none"> <li>• Understanding the cognitive enablers and barriers to adaptation, including:           <ul style="list-style-type: none"> <li>○ the knowledge and perceptions of people and groups about climate risks;</li> <li>○ the time horizons of people and groups who make decisions about adaptation; and,</li> <li>○ the degree to which people and groups feel empowered to adapt.</li> </ul> </li> <li>• Understanding enablers and barriers to collective action, including:           <ul style="list-style-type: none"> <li>○ how shared symbols, beliefs and practices facilitate or obstruct adaptation;</li> <li>○ what diverse types of decision makers consider to be the goals of adaptation (e.g. what defines 'successful' adaptation in their eyes),</li> <li>○ what and how diverse kinds of decision makers know about the vulnerability of others; and</li> <li>○ economic barriers, including distribution of capital and investment.</li> </ul> </li> <li>• Measures to value adaptation. Understanding how to cost adaptations to climate change, the value of the avoided damages and the costs of the residual impacts, including:           <ul style="list-style-type: none"> <li>○ reviewing and determining the suite of valuation methodologies that are most appropriate for use by Australian adaptation policy and decision-makers;</li> <li>○ identifying the limits to the use of these methodologies; and</li> <li>○ testing the identified methodologies against relevant current policy in Australia.</li> </ul> </li> </ul>
<b>Understanding governance, institutions and decision-making</b>
<ul style="list-style-type: none"> <li>• Analysis of existing responses from public and private institutions to climate change risks, and assessment of proposals to improve the effectiveness of future responses, including:           <ul style="list-style-type: none"> <li>• analysis of responses in the public, private and third (civil society) sectors</li> <li>• analysis of the distribution of roles, responsibilities, and capacities of different levels of government</li> </ul> </li> <li>• Understanding how laws and legal institutions, including regulatory instruments, support or impede adaptation planning and practice, and identifying reforms needed to reduce obstacles.</li> <li>• Assessing the potential for, and limits to, market-based adaptation measures, including insurance markets.</li> </ul>

3

## 5. Implementation Issues

A detailed Implementation Plan is being developed in parallel to the development of this National Climate Change Adaptation Research Plan on the Social, Economic and Institutional Dimensions of adaptation. This section provides a broad overview of the resourcing issues that are likely to arise in the implementation of this Research Plan.

### 5.1 Engagement

It is essential that the needs of research end-users be taken into account early in the design of research priorities to ensure that research outputs are useful, and of value to a variety of stakeholders. Much of this research involves issues where problem identification and research framing are substantial research issues in their own right: working out the right question is often more important than working out the answer. This frequently involves strong participatory engagement between researchers and end users or research partners.

These participatory or ‘action research’ approaches seek to engage key stakeholders in helping to define the research questions to be addressed (such as through advisory groups or steering committees), rather than looking within the research community to define the research agenda. Such approaches have been shown to generate highly innovative research projects and outcomes, in part because they inject new ideas and encourage cross fertilisation between disciplines in order to address these externally-defined challenges.

Early genuine engagement and a continuing partnership ethic are seen as valuable central features of the research. This engagement also provides an important platform for identifying what insights are useful or of interest to different stakeholder groups, and assisting the communication of these ideas and tools to relevant constituencies.

Understanding the context and manner in which research will be used will help determine what modes of dissemination and uptake are most appropriate. Very few end users will access primary research directly through traditional academic publications, preferring instead toolkits, presentations and workshops, interactive web-based material, CDs, DVDs and so on. The expected beneficiaries of adaptation research are, in general, secondary consumers of research outputs.

A critical starting point in deciding how best to disseminate information and promote uptake will be to identify relevant primary and secondary end-users for particular research priorities and clarify the uses to which research outputs will be put. For example, will research results be used to assist individual responses to climate change ‘from the bottom up’, or primarily used to inform ‘top down’ policy, legislative and regulatory responses? Some work, for example, may directly inform business decisions. Other research may speak directly to policy-makers, informing their choice of policy intervention.

There are already several key industry groups and peak bodies supporting the work of the stakeholders who will need to use the research outputs of this Plan. NCCARF will work with these groups as well as the Adaptation Research Network for the Social, Economic and Institutional Dimensions of climate change adaptation to ensure that existing mechanisms are used as much as possible but supplemented where necessary to enhance the prospects that research outputs will be applied.

## 5.2 Additional funding sources

It will be necessary to look for funding sources additional to those made available through the Adaptation Research Grants Program to fully address the key research objectives outlined in this NARP and to undertake essential research programs.

The Australian Research Council grants program is likely to be the first port of call for many researchers and research institutions that seek additional support. Relevant grants offered by the ARC include

- Discovery Projects. A variety of fellowships are offered under the scheme to nurture the talents of Australia's most promising early-career researchers and support established researchers.
- Discovery Future Fellowships. Future Fellowships are offered to promote research in areas of critical national importance by giving world class researchers incentives to conduct their research in Australia.
- Linkage Infrastructure, Equipment and Facilities. The scheme fosters collaboration through its support of the cooperative use of national and international research facilities. Essentially, the scheme provides funding for large-scale cooperative initiatives so that expensive infrastructure, equipment and facilities can be shared by researchers in partnered organisations. However, the ARC may fund single-organisation proposals in some circumstances.
- Linkage Projects. The scheme supports collaborative research and development projects between higher education organisations and other organisations, including within industry, to enable the application of advanced knowledge to problems. In recommending funding for proposals under Linkage Projects, the ARC may take into consideration the likely benefit of the research to Australian regional and rural communities.
- Various ARC programs provide support for international research activities.

There are a range of other research funding possibilities that reflect the cross-disciplinary and cross-sectoral nature of adaptation as a research (and policy) challenge, which may be relevant to social, economic and institutional aspects of adaptation. These include the rural R&D corporations, philanthropic organisations, state/territory government agencies and programs, private firms and industry associations. One challenge for the future is for the importance of research to inform adaptation to be more widely recognised in the programs of funding across relevant sectors.

Opportunities for further funding will be explored during the stakeholder consultation process for this NARP.

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## Appendix 1 Research Prioritisation Matrix

The criteria listed below will guide the research planning process to set research priorities.

### Essential

#### 1. Severity of potential impact/ or degree of potential benefit

What is the severity of the potential impact to be addressed or benefit to be gained by the research? Potentially irreversible impacts and those that have a greater severity (in social, economic or environmental terms) will be awarded higher priority.

#### 2. Immediacy of required intervention or response

Research will be prioritised according to the timeliness of the response needed. How immediate is the intervention or response needed to address the potential impact or create the benefit? Research that must begin now in order to inform timely responses will receive a higher priority than research that could be conducted at a later date and still enable a timely response.

#### 3. Need to change current intervention and practicality of intervention

Is there a need to change the intervention used currently to address the potential impact being considered. If yes, what are the alternatives and how practical are these alternate interventions? Research that will contribute to practicable interventions or responses will be prioritised. Does research into the potential impact of the intervention being considered contribute to the knowledge base required to support decisions about these interventions?

### Desirable

#### 4. Potential for co-benefit

Will the research being considered produce any benefits beyond informing climate adaptation strategies?

#### 5. Potential to address multiple, including cross-sectoral, issues

Will the research being considered address more than one issue, including cross-sectoral issues?

#### 6. Equity considerations

Will research priorities recognise the special needs of particular groups in Australia?

	RESEARCH TOPIC	Severity Or Benefit	Essential Immediacy	Need to change intervention / Practicality	Potential co-benefits	Desirable Cross-sectoral relevance	Equity considerations	Overall Priority Ranking
	<b>Understanding vulnerability and adaptive capacity</b>							
1	<i>The development and application of methods for assessing vulnerability and adaptive capacity that engage and harness the knowledge and skills of individuals, communities, businesses, industries and governments.</i>	<b>High</b> This speaks to the core of this NARP, looking at the social, economic and institutional dimensions	<b>High</b>	<b>Medium</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>High</b>
2	<i>Understanding the ways in which interacting biophysical, economic and social processes expose individuals, communities, businesses and industries to climate risks, and identify options to alter this exposure to reduce vulnerability.</i>	<b>High</b>	<b>Medium</b> This topic is identified in many of the sector-specific NARPs, and is evaluated as better dealt with at that level	<b>Medium</b>		<b>Yes</b>		<b>Medium</b>
3	<i>Understanding the ways in which interacting biophysical, economic and social processes make individuals, communities, businesses and industries sensitive to climate risks, and identify options to reduce sensitivity to climate change.</i>	<b>High</b>	<b>Medium</b> This topic is identified in many of the sector-specific NARPs, and is evaluated as better dealt with at that level	<b>Medium</b>		<b>Yes</b>		<b>Medium</b>
4	<i>Identification of the capacity of individuals, communities, businesses and industries to adapt to climate change, and identify options to enhance this capacity</i>	<b>High</b>	<b>Medium</b> Generally sufficiently well understood to inform decision-making at its current levels of complexity and sophistication	<b>Medium</b>		<b>Yes</b>		<b>Medium</b>
5	<i>Understanding the equity dimensions of vulnerability and adaptation.</i>	<b>High</b> Inabilities of social groups to adapt, or unequal impacts of climate change on social groups, will inhibit national development	<b>High</b>	<b>Medium</b>	<b>No</b>	<b>Yes</b>	<b>Yes</b>	<b>High</b>

	RESEARCH TOPIC	Severity Or Benefit	Essential Immediacy	Need to change intervention / Practicality	Potential co-benefits	Desirable Cross-sectoral relevance	Equity considerations	Overall Priority Ranking
	<b>Understanding and overcoming the barriers and limits to adaptation</b>							
6	<p><i>Understanding the cognitive dimensions of adaptation, including:</i></p> <p>a) <i>the knowledge and perceptions of people and groups about climate risks;</i></p> <p>b) <i>the time horizons of people and groups who make decisions about adaptation; and</i></p> <p>c) <i>the degree to which people and groups feel empowered to adapt.</i></p>	<p><b>Medium or High?</b></p> <p>Individuals' understanding of the future, perceptions of impacts, and perceptions of ability to respond are key factors affecting individuals' propensity to act and adapt</p>	<p><b>High</b></p> <p>Many adaptation measures do not work or get adopted because of a lack of understanding of these issues</p>	<p><b>Medium</b></p>	<p><b>No</b></p>	<p><b>Yes</b></p>	<p><b>Yes</b></p>	<p><b>High</b></p>
7	<p><i>Understanding enablers and barriers to collective action, including:</i></p> <p>a) <i>how shared symbols, beliefs and practices facilitate or obstruct adaptation;</i></p> <p>b) <i>what differing types of decision makers consider to be the goals of adaptation (e.g. what defines 'successful' adaptation in their eyes);</i></p> <p>c) <i>what and how differing types of decision makers know about the vulnerability of others; and</i></p> <p>d) <i>economic barriers, including distribution of capital and investment.</i></p>	<p><b>High</b></p> <p>A better understanding of the barriers to collective action should help minimise maladaptation</p>	<p><b>High or Medium?</b></p>	<p><b>Medium</b></p>		<p><b>Yes</b></p>		<p><b>High</b></p>
8.	<p><i>Understanding the limits to adaptation, including</i></p> <p>a) <i>how people value the things that are at risk of loss or damage;</i></p> <p>b) <i>the effectiveness of adaptation</i></p>		<p><b>Medium</b></p> <p>Important over the long term, as limits to adaptation are unlikely to be reached in the short term</p>			<p><b>Yes</b></p>		<p><b>Medium</b></p>

	RESEARCH TOPIC	Severity Or Benefit	Essential Immediacy	Need to change intervention / Practicality	Potential co-benefits	Desirable Cross-sectoral relevance	Equity considerations	Overall Priority Ranking
	<p><i>strategies to sustain the things that are of value; and</i></p> <p><i>c) the consequences of the loss of or damage to the things that are of value</i></p>							
9	<p><i>Measures to value adaptation. Understanding how to cost adaptations to climate change, the value of the avoided damages and the costs of the residual impacts, including:</i></p> <p><i>a) reviewing and determining the suite of valuation methodologies that are most appropriate for use by Australian adaptation policy and decision-makers;</i></p> <p><i>b) identifying the limits to the use of these methodologies; and</i></p> <p><i>c) testing the identified methodologies against relevant current policy in Australia.</i></p>	<p><b>High</b></p> <p>A better understanding of the costs of adaptation can help policymakers decide whether, how much and when to invest in adaptation</p>	<p><b>Medium or High?</b></p>	<p><b>High</b></p> <p>Assessment of the costs of adaptation is a relatively new area of research; development of methods to assess cost of adaptation still faces many challenges</p>		<p><b>Yes</b></p>		<p><b>High</b></p>
10	<p><i>Evaluation of the costs. Valuing the relative costs of adaptation strategies and the avoided damages for different sectors of human activity and welfare, and for the natural environment.</i></p>	<p><b>High</b></p> <p>Costs can be used as one of the key criteria for selecting amongst competing adaptation measures</p>	<p><b>Medium</b></p>	<p><b>Medium</b></p>		<p><b>Yes</b></p>		<p><b>Medium</b></p>
	<b>Understanding governance, institutions and decision making</b>							
11	<p><i>Analysis of existing responses from public and private institutions to climate change risks, and assessment of proposals to improve the effectiveness of future responses, including:</i></p> <p><i>a) analysis of responses in the public, private and third (civil society) sectors</i></p>	<p><b>High</b></p> <p>Better defined responsibilities for adaptation will lead to more effective and better adaptation responses</p>	<p><b>High</b></p>	<p><b>High</b></p>	<p><b>No</b></p>	<p><b>Yes</b></p>	<p><b>No</b></p>	<p><b>High</b></p>

	RESEARCH TOPIC	Severity Or Benefit	Essential Immediacy	Need to change intervention / Practicality	Potential co-benefits	Desirable Cross-sectoral relevance	Equity considerations	Overall Priority Ranking
	<i>b) analysis of the distribution of roles, responsibilities, and capacities of different levels of government</i>							
12	<i>Understanding how laws and legal institutions, including regulatory instruments, support or impede adaptation planning and practice, and identifying reforms needed to reduce obstacles.</i>	High	High	High	No	Yes	No	High
13	<i>Understanding the factors that facilitate or impede inclusion or integration of climate adaptation considerations and priorities into policy and planning.</i>  <i>Understanding what kinds of advice and measures need to be incorporated into planning processes to ensure plans and policies incorporate climate change adaptation.</i> <i>a) What would be the most appropriate avenues for ensuring uptake of climate change adaptation considerations into policy?</i>	High	High	Medium	No	Yes	Yes	Medium
14	<i>Assessing the potential for, and limits to, market-based adaptation measures, including insurance markets.</i>	<b>High</b> Important to understand potential for market mechanisms to facilitate adaptation, as majority of adaptation actions will be undertaken by private actors and public budgets will not be able to meet the full costs of adaptation	High	High	No	Yes	Yes	High

	RESEARCH TOPIC	Severity Or Benefit	Essential Immediacy	Need to change intervention / Practicality	Potential co-benefits	Desirable Cross-sectoral relevance	Equity considerations	Overall Priority Ranking
15	<i>Identifying frameworks and approaches to facilitate transitions to reduce vulnerability under climate change, including learning from non-climate change related experiences.</i>	High	Medium	Medium	No	Yes	Yes	Medium
16	<p>a) <i>Developing adaptation decision support and evaluation tools and resources that include diverse values and preferences.</i></p> <p>b) <i>Comparative analysis and evaluation of different criteria and decision-making frameworks for prioritising adaptation actions.</i></p> <p>c) <i>The design and evaluation of research organisations, cultures and practice to support adaptation throughout society.</i></p>	Medium	Medium	Medium		Yes		Medium