1. Purpose of Implementation Plan

Australia’s primary industries are fundamentally dependent on the natural resources of the land and on weather conditions and climate. During their 200 year history Australian primary industries have developed innovative ways to cope with weather patterns that are highly variable and extreme.

Productivity of Australia’s primary industries over the past 30 years has continued to grow at an average of 2.8% per year, considerably higher than that achieved by the economy as a whole. These high rates of productivity improvement are derived from the innovation and inventiveness of producers, processors, and marketers, together with new knowledge and techniques derived from research. However, climate change now presents a new set of challenges and opportunities.
The National Climate Change Adaptation Research Facility (NCCARF) has developed the *National Climate Change Adaptation Research Plan: Primary Industries* (the Primary Industries NARP). This NARP identifies high priority research questions that will guide research investment and activity for the coming five to seven year period and will support effective adaptation by primary industries to climate change impacts.

The purpose of this Implementation Plan is to define the most effective way to build (and in some cases initiate) national investments to address the research priorities in the Primary Industries NARP. The focus is on:

- delivering research to address the objectives of the Primary Industries NARP;
- facilitating collaborative arrangements;
- maximising resources for priority research; and
- optimising the timing of research investments.

The Implementation Plan outlines opportunities to implement research now. NCCARF will update the Implementation Plan periodically to ensure that new opportunities are continually developed and harnessed.

## 2. The National Climate Change Adaptation Research Plan for Primary Industries

The Primary Industries NARP identifies critical gaps in the information needed to enable the primary industries sector to successfully adapt to the impacts of climate change and proposes priority research questions that will help fill these gaps. The five to seven year research program aims to enhance the capacity of primary industries, associated industries, rural communities, and governments at all levels to make sound decisions about adaptation responses.

The NARP was developed by a writing team expert in climate change and primary industries. The writing team used a process that involved understanding key information requirements and identifying gaps in the information available to key stakeholders. The writing team also took account of extensive industry and other stakeholder consultation during the past 5 years including:

- public consultation and workshops held during development of the Phase 1 report for the Climate Change Research Strategy for Primary Industries (www.ccrspi.com.au/node/21);
- development of the Australian Government research investments delivered through the Australia’s Farming Future (www.daff.gov.au/climatechange/australias-farming-future); and
- development of the agriculture component of the CSIRO Climate Change Flagship (www.csiro.au/science/AdaptivePrimaryIndustries.html).

A draft version of the NARP was subject to widespread national consultation between 13 February and 15 March 2010. This consultation was announced on the NCCARF and DCCEE websites and in a national newspaper, and over 550 emails and letters were sent out informing interested parties of the consultation and inviting responses. A public information session was held in Canberra on 23 February 2010. The draft NARP was also subject to independent international review to ensure it was aligned with the latest advances and thinking world-wide.

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1 The term *Primary Industries* comprises intensive and extensive agriculture, freshwater aquaculture and commercial forestry.
Forty eight formal responses were received from the full range of interest groups – government departments, research organisations, peak industry groups, the business sector, community groups, and individuals. All responses from the public consultation were considered by the writing team in preparing the final version of the NARP. The priority research questions which resulted from this process are provided in Attachment 1.

3. Developing the Implementation Plan

This Implementation Plan has been developed using information gained during consultation on the draft Primary Industries NARP (see Section 2) and further specific discussions with key stakeholders including prospective partners in investment and provision regarding:

- how their research objectives and priorities aligned with those of the NARP;
- the nature of their current or future research funding and activity programs;
- opportunities for collaborating in funding or undertaking research; and
- possible mechanisms for co-funding or research collaboration.

4. Relationship between this Implementation Plan and other national programs and initiatives

About $1 billion is invested annually in primary industries research and development by governments, Rural Research and Development Corporations (RDCs), higher education institutes, and the private sector. Half of this funding comes from the RDCs, supported directly by contributions from grower levies and by the Australian Government. An additional but unquantifiable amount of research undertaken by producers themselves contributes substantially to ongoing improvements in business and industry performance.

The main Australian research initiatives that address climate change in the primary industries sector are shown in Figure 1.
A key body that brings interested stakeholders together is the Climate Change Research Strategy for Primary Industries (CCRSPI), a collaborative network operating under a mandate from the Primary Industries Standing Committee (PISC) and the Council of Research and Development Corporation Chairs (CRDCC). The goals of CCRSPI are to:

- improve coordination of primary industries climate change research in both adaptation and mitigation,
- provide leadership and representation for the primary industries research community, and
- be a recognised point of communication for governments and the broader community.

CCRSPI does not have its own research investment program, but it does have the mechanism to facilitate discussions and agreements between its partners. CRRSPI’s partners include the major primary industries research funding bodies in Australia, including the Rural Research and Development Corporations, the Australian Government, all state governments and CSIRO. It is supported by the Australian Council of Deans of Agriculture.

The priority research questions in the Primary Industries NARP provide a strategic context for commodity-focussed research of the RDCs, the industry and regional concerns of state and territory government agencies and the national interests of DAFF and CSIRO.

Some priority research questions in the Primary Industry NARP are critical to the interests of all research stakeholders, such as those concerned with the nature of adaptive capacity, options for adaptation responses and transformation and integrated adaptation responses and initiatives.
The Adaptation Research Network for Primary Industries (PIARN) has an important role in facilitating research consortia and developing research capacity (see Section 6.5).

5. Potential Sources of Research Funding

This section outlines potential sources of research funding to address climate change adaptation in primary industries, including current investment activities and opportunities for collaboration.

A consistent message during consultation on the draft Primary Industries NARP was that key areas in the NARP – in particular areas of Transforming primary production (Area 5 – see Attachment 1) and Integrating, implementing, and reviewing adaptation (Area 6) - are not within the current interpretation of the mandate of most existing research funding mechanisms. Some responses to the draft Primary Industries NARP also expressed the view that, at least in the short term, funding for research into Area 5 and Area 6 should not be taken from current primary industries research and development programs. Under this view, additional funding sources would be needed to address some of the NARP priority research questions.

By contrast, there is already some research which addresses other priorities in the NARP – in particular Adjusting primary production practices and technologies (Area 3) and Changing production systems (Area 4). This research is likely to become increasingly ‘mainstreamed’ into the core mechanisms of primary industries research, planning and delivery. For instance, a central focus of primary industries research in Australia over many decades has been to increase the efficiency of production systems and resource use, to increase water-use efficiency, and to minimise adverse impacts of heat. This research is consistent with some climate change adaptation responses required by primary industries.

5.1 Australian Government

5.1.1 Department of Climate Change and Energy Efficiency – Adaptation Research Grants Program

The Department of Climate Change and Energy Efficiency (DCCEE) implements the Australian Government’s Adaptation Research Grants Program (ARGP), through which $27 million is being allocated as seed funding for research to address the priority research questions identified in the nine themes of the NCCARF program.

A requirement of the ARGP is that this funding is used to:

- fund high-quality end-use focussed research into climate change adaptation;
- support collaborative, cross disciplinary, cross institutional research where appropriate;
- build and harness the capacity of the research and end user communities;
- promote investment in climate change adaptation research, including through leveraging funds from other research funding vehicles; and
- develop information and knowledge products which specifically meet the needs of policy and decision makers and other end users.
The DCCEE may be able to allocate up to $2 million from the ARGP towards initiating research in key areas of the Primary Industries NARP provided it can be shown that these areas of research:

- are primarily the responsibility of the Australian Government;
- exhibit significant market failure requiring the Government to take a primary role in initiating this research;
- will provide information that decision makers and primary producers require; and
- will involve strong research partnerships with existing bodies in the primary industries sector.

In addition, the DCCEE will need to be confident that its seed investment will initiate further ongoing investment from this sector in the future.

The ARGP funding is available from 2010/11. Under current arrangements, the completion date for all projects funded through the ARGP will need to be completed by June 2012².

The DCCEE has identified three research areas which address priority research questions in the NARP that are currently important for the climate change adaptation agenda of the Australian Government, meet the criteria set out above and would contribute to the adaptation success of other key stakeholders including primary producers, associate industries, state and territory governments and others.

The DCCEE is keen to see the development of strong national consortia to deliver this research. There is an expectation that other parties should at least match the contributions allocated from the ARGP.

**Project Area 1. Adaptive capacity and options for adaptation response in Australia’s primary industries**

This research area, which has been identified by DCCEE as having national significance, would address research questions 1.1, 2.1, and 2.2 in the NARP. The research objective is to provide information and tools to assess the impacts of climate change on the social, economic, and environmental drivers of primary industries profitability and sustainability, and to understand the factors that enable or hinder individual primary producers, commodity groups, industries at regional and national levels, and governance systems to adapt to climate change.

In other words, the research would deliver a means for primary producers, industries or regions to better understand the relative advantages and risks of differing types of adaptation response (as outlined in Figure 2 of the Primary Industries NARP) and for governments and other stakeholders to better understand how they can support primary industries in determining and implementing effective adaptation responses in the shorter and longer terms.

**Project Area 2. Transformational change in Australia’s primary industries as an adaptation response to climate change**

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² The end date for projects may be extended to June 2013 under revised arrangements that are currently being negotiated. The completion date for projects will be clarified by the time contracts are put in place for successful research proposals.
This research area would address research questions 5.1 and 5.2 of the NARP. The research objective is to provide information and tools for individual primary producers, commodity groups, industries at regional and national levels, and all levels of government to understand the characteristics of effective transformational change and to assess the benefits and costs of transformational change as an adaptation response to climate change. A key element is to identify the implications for infrastructure (both for stranded assets and new facilities), regional development, social and community change, national food security and trade.

Project Area 3. Integrated climate adaptation response at local, landscape, and regional scales

This research area would address priority research questions 6.1 and 6.2 of the NARP. The objective of this research area is to explore opportunities to address integrated adaptation planning and responses at the local, landscape and regional scales. This is synergistic to priority research questions in both the Terrestrial Biodiversity and the (draft) Freshwater Biodiversity NARPs.

This research area aligns with views strongly expressed during consultation on the Terrestrial Biodiversity NARP, the Primary Industries NARP and the Freshwater Biodiversity NARP that some critical aspects of climate change adaptation at the local, landscape, and regional scales should be integrated at least as far as the biophysical elements are concerned (i.e. terrestrial biodiversity, freshwater biodiversity and primary industries) and at the same time linked to social and economic adaptation responses. Such an approach would also provide opportunities for integrating priority research questions currently identified in the Social, Economic and Institutional Dimensions NARP and potentially with questions in other NARPs.

5.1.2 Department of Agriculture, Fisheries and Forestry (DAFF)

DAFF is the Australian Government Department with primary carriage of all policy and regulatory matters relating to the Australian primary industries. The two main programs with the potential to support adaptation research in primary industries are Australia’s Farming Future (AFF), and the Forest Industries Climate Change Research Fund (FICCRF).

Australia’s Farming Future (AFF)

AFF is one of the Australian Government’s key initiatives to help primary producers respond and adapt to climate change. The research component of this initiative allows for $46 million to be made available for research projects and on-farm demonstration activities that focus on reducing greenhouse gas pollution, improving soil management and adapting to climate change impacts.

In June 2009, $11 million was allocated from AFF to support 10 research projects addressing adaptation in Australia’s primary industries (www.daff.gov.au/adaptation). Consistent with DAFF’s industry responsibilities these projects have a commodity focus and are being delivered in partnership with industry.

DAFF is unable to provide additional resources from AFF to the priorities in the NARP at this stage.

Forest Industries Climate Change Research Fund (FICCRF)

In 2009, the Australian Government committed $5 million to address major knowledge gaps about the impact of climate change on forestry and forest industries. The program goals are:
forest industry stakeholders are better able to adapt to changed climatic conditions through the availability of new technologies and techniques which encourage different practices;

forest industry stakeholders are better equipped with the knowledge, tools and strategies to manage their emissions, including a greater ability to participate in the Carbon Pollution Reduction Scheme; and

forest industry stakeholders and forestry dependent communities better understand the range of climate change impacts and the future implications for their enterprise and region.

There is no opportunity for FICCRF funds to be re-directed to any new initiative addressing the priorities in the Primary Industries NARP.

5.1.3 Other Australian Government Departments

Some other Australian Government Departments, or Divisions within Departments, appear to have either a direct or indirect interest in climate change adaptation for primary industries. However, no opportunities for collaborative arrangements to fund research addressing the priorities in the NARP have been established at present. The Departments with main interest are:

- Department of Sustainability, Environment, Water, Population and Communities, particularly the Caring for our Country initiative delivered jointly with DAFF (www.environment.gov.au; www.nrm.gov.au),
- Department of Innovation, Industry, Science and Research (www.innovation.gov.au),

5.2 State and Territory Government Organisations

For many decades state and territory governments have strongly supported primary industries research. Climate change response (both mitigation and adaptation) is progressively being built into strategic planning and operations. Every state in Australia now has a published strategic plan for climate change in agriculture/primary industries that includes adaptation responses. The adaptation response of state-based research organisations emphasises integrating climate change adaptation into whole farm management, regional and industry sustainability and integrated regional and landscape management.

All state and territory governments have departmental administrative arrangements and research capacity in primary industries. A strength of state and territory research arrangements is that departments are able to respond to external research initiatives that align with existing research objectives by contributing state-based resources and support on a project-by-project basis.

There are no opportunities identified at present for program-level partnerships with states or territories to address the priority research questions in the NARP. However, state-based resources can be made available to research initiatives on a project-by-project basis.

Some of the key state and territory climate change adaptation programs for (or with relevance to) primary industries are shown in Table 1.
Table 1: Some of the main state and territory climate change adaptation programs for primary industries

<table>
<thead>
<tr>
<th>Jurisdiction and agency website</th>
<th>Key website reference for climate change adaptation programs</th>
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5.3 Research and Development Corporations

There are 15 Research and Development Corporations (RDCs) covering virtually all of Australia’s primary industries. All are funded by a combination of levies on production within the relevant commodity, matched about equally by the Australian Government up to a maximum of 0.5% of the gross value of agricultural production. Depending on seasonal conditions the total investments through the RDCs is generally between $400 million and $500 million.

RDCs form the hub of agricultural research in Australia. There is very little formal agricultural research conducted in Australia that is independent of funding from and collaboration or association with the RDCs. All state governments, CSIRO and other research providers have partnership arrangements, mostly on a project-by-project basis, with RDCs. A great strength of the RDCs is that they directly link to and involve levy-paying producers.

All RDCs are members of CCRSPI (see Section 4, above). At the moment, there is no formal mechanism for cross-RDC investment in climate change adaptation research, apart from the coordinating role played by CCRSPI.
However, the RDCs have demonstrated a willingness and intent to work collaboratively in areas (a) where collaboration provides added value, (b) that lie across commodities or (c) that require a whole-of-value chain approach. Examples of cross-RDC collaborative investment are the National Program for Sustainable Irrigation, Healthy Soils for Sustainable Farms, Grain and Graze, Feedgrains Partnership, Collaborative Partnership for Farming and Fishing Health and Safety, and Primary Industry Centre for Science Education. RDCs have also collaborated with Commonwealth agencies, such as in the DCCEE’s Greenhouse Action in Regional Australia program, and DAFF’s Australia’s Farming Future program.

The current Rural Research and Development Corporations are:

- Australian Egg Corporation Limited
- Australian Livestock Export Corporation
- Australian Meat Processor Corporation
- Australian Pork Limited
- Australian Wool Innovation
- Cotton Research Development Corporation
- Dairy Australia Limited
- Fisheries Research Development Corporation
- Forest and Wood Products Australia
- Grains Research Development Corporation
- Grape and Wine Research Development Corporation
- Horticulture Australia Limited
- Meat and Livestock Australia
- Rural Industries Research Development Corporation
- Sugar Research Development Corporation.

5.4 **Australian Research Council (ARC)**

The Australian Research Council is often the first port of call for many researchers and research institutions seeking additional support for research. Grants offered by the ARC under its National Competitive Grants Program (NCGP) include Discovery Project and Linkage Project grants. Through the NCGP, the ARC aims to support research and research training of national benefit. Responding to climate change and variability is identified as a priority goal under the national research priority of *An Environmentally Sustainable Australia*.

Another ARC scheme, ARC Future Fellowships, promotes research in areas of critical national importance by giving outstanding researchers incentives to conduct their research in Australia. The aim of ARC Future Fellowships is to attract and retain the best and brightest mid-career researchers and significantly boost Australia’s research and innovation capacity in areas of national importance. Preference will be given to those researchers who can demonstrate a capacity to build collaborations across industry, research institutions and other disciplines.

Over a five-year period (2009-2013), ARC Future Fellowships will offer four-year fellowships to 1,000 outstanding Australian and international researchers. In addition, each researcher’s Administering Organisation will receive funding of up to $50,000 per year to support related infrastructure, equipment, travel and relocation costs. Four hundred Future Fellowships have been announced so far (2009 and 2010).
Opportunities for funding primary industries climate research also exist within the ARC Centres of Excellence scheme. The main existing Centre with relevance to the Primary Industries NARP is the ARC Centre of Excellence in Plant Energy Biology that focuses on better understanding the way in which plants produce and use their energy systems in response to environmental change. The ARC Centre of Excellence in Plant Energy Biology has received extension funding until 2013. The ARC Centre of Excellence for Environmental Decisions, which commences in 2011, might address some key climate change adaptation decision issues relevant to Primary Industries.

5.5 Private Sector

A wide range of peak bodies for industry sectors, non-government organisations and advisory bodies are aware of the need to adapt to climate change. They may either have access to funds or could lobby for leverage across a range of program areas.

An extensive commercial sector that supports and supplies Australia's primary industries has a strong history of supporting research that delivers to the prosperity of primary industries.

Collectively, these and similar bodies could influence and contribute to the adaptation research agenda through various innovative funding arrangements. NCCARF will continue to explore future funding opportunities in this area.

5.6 Summary

Resources to undertake projects focussed on the priority research questions in the Primary Industries NARP will be available immediately from DCCEE (under certain conditions) and potentially from RDCs and state government agencies where the research projects align with the goals, objectives and responsibilities of these bodies. As RDCs and State government agencies are members of CCRSPI, it is likely to be efficient to use CCRSPI’s mechanisms to facilitate the exploration of collaborative research investment options.

6. Potential Sources of Research Delivery

This section describes the main research organisations that could help implement the Primary Industries NARP. In many cases, these research organisations have access to resources that might be used to assist with funding the research.

6.1 State Departments and Agencies

Every state government in Australia has a long history of delivering research to improve productivity and prosperity of the primary industries in that state. In most cases achievements in research at the state level feed into benefits nationally. Over the past seven years or so, all states have formalised strategic plans to address climate change, both for mitigation and adaptation, and developed corresponding research investments.

Overwhelmingly, the research model used by primary industries state agencies is that resources provided at the state level can be directed on a project-by-project basis in partnership with an external provider (e.g. a Rural Research and Development Corporation) where the objectives of the project meet the state-based priorities. Often there are additional industry-based contributors. Such partnerships are highly valuable, ensuring strong stakeholder involvement in the project and potentially also in the way that the research outputs are used.
State departments and research agencies are likely to support partnership arrangements on a project-by-project basis to address the priority research questions in the Primary Industries NARP where the priorities align with their own strategic and operational plans and where the project meets the competitive funding arrangements in the department/agency.

6.2 Universities

Universities employ researchers with wide-ranging capabilities for research across disciplines relevant to primary industries - from highly theoretical approaches which challenge the ways we frame problems through to practical problem solving. Most university-based researchers collaborate closely with research clients such as RDCs, government departments, catchment management groups, CSIRO or industry.

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

6.3 Commonwealth Scientific and Industrial Research Organisation (CSIRO)

The Climate Adaptation Flagship provides the primary CSIRO focus for climate change adaptation research, and this includes research related to the Primary Industries NARP – particularly through CSIRO’s Sustainable Primary Industries theme. Within this Flagship, CSIRO is developing and delivering adaptation options to manage the risk of climate change impacts on Australia’s primary industries by:

- providing practical adaptation strategies that will ensure the long term viability of rural enterprises and communities threatened by climate change;
- exploring adaptation options and tools for agriculture, forestry and marine industries that can assist policy makers and industry to minimise negative consequences of climate change and take advantage of new opportunities; and
- developing new management techniques and technologies that enable industries and enterprises to adapt to climate change.

The Flagship’s Sustainable Primary Industries theme focuses on four key areas:

- quantifying the vulnerability of different agricultural industries and regions to climate change, assessing the likely limits to adaptation and understanding and influencing the pathways to adaptation;
- developing new technologies and practices that will enable responses to changed climate conditions and carbon dioxide levels and provide improved analysis and delivery approaches for better management of climate variability;
- identifying when transformational change may be needed, what the options are and their consequences and how to support decision making processes to foster effective transformation; and
- assessing the potential risks to greenhouse gas mitigation projects (such as tree plantations) from the impacts of a changing climate as well as ensuring that adaptation actions do not increase the national emissions footprint.
CSIRO considers partnerships in research investment on a project-by-project basis depending on the mutual alignment of interests. Examples include long-term partnerships in CRCs and other research ventures where the prospects of end-user engagement and research effectiveness are likely to be increased by partnering. CSIRO is not a funding agency per se but does co-invest from time to time when there are distinct opportunities to align its research interests with those of partner organisations.

6.4 Centre for Australian Weather and Climate Research (CAWCR)

The Centre for Australian Weather and Climate Research is a partnership between Australia’s leading atmospheric and oceanographic research agencies - the Bureau of Meteorology and CSIRO. The Centre was established in 2007 to ensure that Australia remains a world leader in climate, weather and oceans research so that it can meet the severe weather and climatic challenges that continue to confront the nation. The centre has five research programs:

1. Atmosphere and land observation and assessment
2. Ocean observation, assessment and prediction
3. Coupled earth system modelling
4. Weather and environmental prediction
5. Seasonal prediction, climate variability and climate change.

These research activities will improve observational databases, improve understanding of observed climate variability, and deliver climate predictions (seasonal to decadal) for use in risk assessments. Improved accuracy and resolution of the prediction of future climate are particularly relevant for adaptation responses in Australia’s primary industries.

CAWCR could provide contextual climate change information to underpin research projects that address priorities in the NARP, in particular outputs from the physical models used to make future climate projections.

6.5 Adaptation Research Network for Primary Industries

The NCCARF Adaptation Research Network for Primary Industries (PIARN), hosted by the University of Melbourne, has a membership of almost 300 researchers from universities, government research institutions, and industry. Collectively, the members have access to a wide range of field and laboratory research facilities and have knowledge of the pathways to public and private sector research investment funds.

PIARN has the following objectives:

- Promote collaborative funding of NARP priorities with key funding agencies;
- Engage with network members, primary industries stakeholders (including CCRSPI) and the regional communities to support the development of productive and sustainable adaptation strategies;
- Build adaptation research capacity within the primary industries research community; and
- Engage with network members, primary industries stakeholders (including CCRSPI) and the regional communities to support the development of productive and sustainable adaptation strategies.

The capacity of the Network to develop appropriate high quality research groups to address the research priorities in the NARP is based on the following qualities:
The Network convener, co-conveners and theme leaders collectively represent the leading climate change researchers in the primary industries sector;

- The member institutions of the Network have access to a very wide researcher base;
- The Network has collaborative relationships with other NCCARF research networks that can provide considerable expertise to this research as appropriate (e.g. Terrestrial Biodiversity, Freshwater Biodiversity, and Social, Economic and Institutional Dimensions); and
- The Network partners and members have considerable expertise in developing integrated cross-disciplinary research programs.

The Network plays a key role in building national consortia to address the research priorities, and it supports the NCCARF knowledge adoption team’s efforts to communicate the outputs of research to end users.

### 6.6 Cooperative Research Centres (CRCs)

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

The following is a listing of the CRCs most relevant to the priority research questions in the Primary Industries NARP.

- Australian Seafood CRC (2014)
- Cotton Catchments Communities CRC (2012)
- CRC for an Internationally Competitive Pork Industry (2012)
- CRC for Beef Genetic Technologies (2012)
- CRC for Forestry (2012)
- CRC for National Plant Biosecurity (2012)
- CRC for Sheep Industry Innovation (2014)
- CRC for Australian Poultry Industries (2017)
- Dairy Futures CRC (2017)
- Future Farm Industries CRC (2014)
- Invasive Animals CRC (2012)

Opportunities for collaboration with these CRCs to deliver and potentially fund national level research into climate change and primary industries are still to be fully explored. Opportunities are likely to exist on a project-by-project basis. NCCARF will continue to explore future opportunities for collaboration with these CRCs and others that may be established during the life of this NARP.

### 6.7 Geoscience Australia (GA)

Geoscience Australia is a prescribed agency within the Department of Resources, Energy and Tourism. It conducts geoscience research to inform government policy, including development of fundamental data and information products needed for climate change adaptation.
GA provides a national dynamic mapping system that places current land cover status and changes into a historical context at a national, regional and local scale. This mapping system is designed to support and facilitate natural resource management decision-making, and to act as a national standard baseline for change detection and environmental reporting.

GA’s research and policy advice is supported in large part through the agency’s appropriated budget, and through collaborative or co-funded projects with the Australian, state and local governments, CRCs, universities, and industry partnerships. GA seeks partnerships to develop, maintain, and value-add to geoscience information to inform government policy and the public with an emphasis on resilience. GA is not a funding agency, but does co-invest in areas of interest to the Department’s resources, energy and tourism portfolio – including in primary industries where geospatial and geoscience information underpins vulnerability and risk analysis.

6.8 Regional and Local Partnerships

There are a great number of regional and local partnerships across Australia between universities, other research organisations, and state, regional, and local agencies that have research interests in adaptation in primary industries. Primary industries have long provided the economic base for most of regional Australia, and the implications of climate change are increasingly being considered within regional and local organisations. These organisations create a valuable research resource across Australia that could be harnessed to address the priorities in the NARP. Community groups, conservation councils, and extensive regional and local networks of experienced and knowledgeable citizens, add to the richness of regional and local research capacity.

6.9 Private sector and commercial research organisations

Private sector and commercial organizations may also be interested in undertaking research where the topic is relevant to their objectives. Some possible private sector research collaborators include:

- Sacron Innovations Pty Ltd (formerly the CRC for Sugar Industry Innovation Through Biotechnology) and
- Grain Foods Innovations Pty Ltd (formerly the CRC for Innovative Grain Food Products)

NCCARF has yet to fully investigate collaborations with private sector research organizations, but will continue to seek collaborations where they appear to hold promise.

6.10 Summary

Research capacity to undertake projects focussed on the priority research questions in the Primary Industries NARP will be available from a wide range of providers, including state agencies, universities, CSIRO and CRCs. Primary producers individually or as groups already undertake considerable relevant and useful research. Since most research providers are members of PIARN, this body is well-placed to facilitate the formation of the type of integrated research consortia that will be necessary to meet the challenges of climate change adaptation research for primary industries. However, as some research providers may not be members of PIARN, it will also be necessary to ensure that any call for research proposals is widely publicised in the relevant media and webpages.
7. **Strategy for National Coordination**

While there are currently few funding sources available to support the priority research questions in the Primary Industries NARP, the climate change adaptation research agenda within this sector is evolving rapidly. The long history of high-quality research and coordinated research delivery in primary industries, at national, regional, and local levels, provides a good platform for developing research in this area. Implementing the Primary Industries NARP provides an opportunity to influence the current and developing research and development agendas within primary industries.

Funding for primary industries climate change adaptation research is likely to increase substantially over the next few years, including through review and targeting of existing research objectives and programs.

7.1 **Alignment of the Interests of Different Funding Groups with Key Areas in the NARP**

Analyses of potential sources of research funding (Section 5) and potential sources of research delivery (Section 6) show that a wide range of different interest groups and organisations have the potential to become involved in research to address the priorities in the NARP. Moreover, the separate interests of these groups lie in clearly defined areas of the NARP.

Figure 2 shows the three main types of climate change adaptation for primary industries:

- adjusting practices and technologies,
- changing systems and
- transforming industries and regions.
The research area Adjusting Primary Production Practices and Technologies (Research Area 3 in the Primary Industries NARP) is the accepted domain of the RDCs and their main research partners. These organisations have been investing in this type of research over a substantial period of time, albeit with a focus on resource management for productivity and environmental protection. Many of the same principles that have driven past research investments now apply to this adaptation research area.

RDCs also support research concerned with Changing Systems (Research Area 4 in the NARP).

The DAFF AFF program, state-based research organisations, CSIRO and many industries and primary producers individually or in groups also have a focus on research areas 3 and 4 and are likely to continue to invest in them.

DCCEE has identified three broad research needs (Section 5.1), each of which integrates several priority research questions that are of specific and immediate interest to the Australian Government. These research needs are concerned with the following research areas in the NARP:

- Area 1 Understanding and expanding adaptive capacity;
- Area 2 Levels of adaptation;
- Area 5 Transforming primary production; and
- Area 6 Integrating, implementing and reviewing adaptation.

The mandate, role, and statutory requirement of primary industry research funding organisations has not been interpreted as including these four research areas. As a result, these research areas are receiving limited research funding through existing channels.

However, as these research areas are critical to the medium to long term profitability of all components of Australia’s primary industries sector and to the production of all commodities it is inevitable that they will need to become engaged in them.

### 7.2 Immediate investment

The only program-level funding immediately available to initiate new research addressing priority research questions in the Primary Industries NARP is the ARGP, from which DCCEE is able to allocate up to $2 million provided a number of criteria are met (see Section 5.1.1). An immediate implementation initiative is therefore to identify and implement research projects that address these needs and that involve all interested stakeholders.

The effectiveness of investments made through the ARGP could be maximised by DCCEE and NCCARF initiating one or more open research calls, commissioning research projects, or forming strategic alliances with one or more funding partners. In this instance an open research call is proposed, with the following process to be followed:

1. NCCARF and the DCCEE will investigate with CCRSPI as a group and with members individually what specific investment partnerships could be formed to implement the three research projects identified in Section 5.1.

2. NCCARF and the DCCEE will request CCRSPI and PIARN to facilitate the development of research collaborations focused on the three research project areas identified in Section 5.1.
3. NCCARF will instigate an open research call to address the three defined project specifications. NCCARF will oversee project selection in collaboration with DCCEE.

4. DCCEE will administer and manage the research projects under current arrangements.

5. NCCARF and the DCCEE will investigate with CCRSPI as a group and with members individually their capacity to identify current and prospective research priorities for NARP Research Areas 3 (Adjusting Primary Production Practices and Technologies) and 4 (Changing Production Systems). This part of the program would be determined by the interests and funding capacity of CCRSPI partners. CCRSPI might choose to engage NCCARF in any aspect of the development or management of investments made in these research areas.

6. Outputs from all projects would
   - be delivered to end-users (policy- and decision-makers at all levels, industry, farmers, governments) through the communication programs of NCCARF, CCRSPI, the RDCs, and PIARN; and
   - be fed back into an on-going process of review to determine the next investments to address the priorities in the Primary Industries NARP.

7. The Primary Industries NARP will be reviewed before 2012.

   7.3 Building the Program

CCRSPI, NCCARF and PIARN will continue to play a key role in building the research program nationally by promoting the research priorities in the NARP and providing opportunities for researchers and end users to share information and resources related to this research.

A research program instigated immediately may encourage other funding organisations to identify and allocate funds towards the priority research questions in the NARP. NCCARF, CCRSPI and the DCCEE will explore options to build the national research base, such as through a workshop of potential funding organisations in the second half of 2011 to review current climate related research investments and to scope the way forward including by ensuring that the funding opportunities that are developing across a range of Australian Government departments are coordinated and take into account the initial ARGP investments.

8. Impediments and Risks

Australia has a small research community relative to the challenges of building and delivering a national research program to address the priorities in the Primary Industries NARP. While existing research capacity in primary industries will provide a good platform, building further research capacity will be necessary, but neither easy nor straight-forward.

An ongoing challenge will be to increase research funding directed to the Primary Industries NARP research agenda while engaging the resources available immediately in carefully targeted and effective research.

9. Monitoring
NCCARF will monitor the progress of research commissioned through the proposed research call to identify emerging gaps and further research needs. It will also continue dialogue with key stakeholders and the research community. The Implementation Plan will be updated periodically.

Success in developing and implementing research directed towards priorities in the Primary Industries NARP will be measured in terms of the extent to which:

- End users are engaged throughout the research cycle;
- The capacity of the Australian research community is expanded;
- Research products are adopted by end users, primarily policy and decision makers;
- Research collaboration and coordination occurs;
- The research budget is built nationally;
- Financial resources are leveraged to address the priority research questions; and,
- The Primary Industries NARP promotes further adaptation research.

10. Communication and Engagement

The communication of research outcomes will take into account the information needs of end users and an appreciation of the most appropriate mechanisms to deliver that information. In order to better understand the information needs of end users, NCCARF and its Adaptation Research Networks have established a number of mechanisms for engaging with key stakeholders, for example by including end users in the research planning process, and through symposia and stakeholder workshops. The communication of research outputs will be tailored to suit the information needs of priority stakeholders. NCCARF, through a dedicated program, will also synthesise research outcomes as they evolve in the area of climate change and primary industries.
### 1. Understanding and expanding adaptive capacity

1.1 What is adaptive capacity in the primary industries sector and how can it be measured and increased at individual, industry, regional and national level?

### 2. Levels of adaptation

2.1 What factors define the effectiveness of different levels of adaptation response: adjusting practices, changing production systems, and transforming enterprises, industries and regions?

2.2 What information, knowledge, tools, programs and policies are necessary for primary producers and industries to identify the range of potential climate change adaptation responses and understand their benefits, costs, risks and opportunities?

### 3. Adjusting primary production practices and technologies

3.1 What types of improvements to production practices and technologies exist or could be developed to increase the adaptive capacity of Australia’s primary industries, and what practical issues need to be addressed for implementation?

3.2 What adaptations could yield benefits from changing atmospheric and climate conditions, such as increased atmospheric CO₂ and changes to temperatures and water availability?

### 4. Changing production systems

4.1 What characteristics of production system change in primary industries are likely to provide advantage under changed climate conditions?

4.2 What information, knowledge, tools, programs and policies are needed to support effective changes in primary production systems?

### 5. Transforming primary production

5.1 What characteristics of transformational change in primary industries are likely to provide advantage under changed climate conditions?

5.2 What information, knowledge, tools, programs and policies are needed to support effective transformative adaptation in primary production systems?

5.3 How can the well-being of individuals and communities unable to undertake transformational changes be maintained?

### 6. Integrating, implementing and reviewing adaptation

6.1 How can integrated climate change adaptation response plans be developed at the local, landscape and regional scales?

6.2 How can climate change adaptation requirements, options, benefits and costs be integrated with other information critical to primary producers and industries and communicated to support successful adaptation being determined and implemented?

6.3 How can adaptation by primary industries be monitored and measured, including assessing synergies, maladaptation and interactions with other sectors, to support ongoing improvements to adaptation approaches and initiatives?