



Implementation Plan for Climate Change Adaptation Research: Freshwater Biodiversity

November 2010

1. Purpose of Implementation Plan
2. Background
3. Potential Sources of Research Funding
4. Potential Sources of Research Delivery
5. Strategy for National Coordination
6. Impediments and Risks
7. Monitoring

Appendix 1: Priority Research Questions in the National Climate Change Adaptation Research Plan: Freshwater Biodiversity

1. Purpose of Implementation Plan

Climate change will alter the basic physical and chemical environment underpinning all life. Species will be affected differentially by these alterations, resulting in changes to the structure and composition of present-day freshwater ecological communities, with the potential to change the ways in which these ecosystems function and the services they provide.

The National Climate Change Adaptation Research Facility (NCCARF) has developed the *National Climate Change Adaptation Research Plan for Freshwater Biodiversity* (the Freshwater Biodiversity NARP) that identifies critical gaps in the information needed to address the issues arising from the impacts of climate change on freshwater biodiversity. It outlines the priorities for research for the next 5-7 years.

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 identified by the Freshwater Biodiversity NARP.

The focus is on:

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

The Implementation Plan considers opportunities for implementing research at the present time. It is not a static document. NCCARF will update the Implementation Plan periodically to ensure that new opportunities are continually identified, developed and harnessed over time.

2. Background

2.1 The Freshwater Biodiversity NARP

NCCARF appointed a team with high expertise in the area of freshwater biodiversity response strategies to climate change to develop the Freshwater Biodiversity NARP. The team was chaired by Prof Stuart Bunn from Griffith University. There was widespread national consultation during development of the Freshwater Biodiversity NARP, including a 4-week period of public consultation on a draft NARP. Submissions were received from a wide range of interest groups – government departments, research organisations, the business sector, community groups, and individuals. These submissions were taken into account in formulating the final version of the NARP.

The priority research questions identified in the Freshwater Biodiversity NARP are listed in Appendix 1.

2.2 Preparation of the Implementation Plan

NCCARF has undertaken a range of activities in formulating this Implementation Plan, including interviews with prospective research partners, and invitation for comment during national consultation on the NARP. NCCARF has approached key potential research funding organisations to scope the extent to which funding may be available to address the priorities in the NARP. NCCARF explored with these organisations:

1. the alignment of the priorities identified in the NARP with their own funding priorities,
2. the organisation's (current or future) programs for funding research,
3. opportunities for collaborating in funding research, and
4. possible mechanisms for co-funding.

In short, until now there has not been a clear national focus on research within Australia to address the effects of climate change on freshwater biodiversity, nor appropriate response strategies. Nevertheless, there is a long history of high-quality research about freshwater biodiversity, at national, regional, and local levels, funded by both the public and private sectors. This research provides a good platform for new initiatives to address the impact of climate change and development of adaptation response strategies. It is recognised, however, that new funding initiatives will be required to develop national-scale research in

this area. Funding to address the research priorities in the NARP is likely to grow substantially over the next few years. Over time, climate change may become 'mainstreamed' into freshwater biodiversity research, planning and delivery.

3. Potential Sources of Research Funding

This section deals with potential sources of research funding to address climate change adaptation for freshwater biodiversity.

3.1 Australian Government

3.1.1 Department of Climate Change and Energy Efficiency - Adaptation Research Grants Program

The Department of Climate Change and Energy Efficiency (DCCEE) is able to allocate up to \$2 million as seed funding for research in climate change adaptation for freshwater biodiversity through its Adaptation Research Grants Program (ARGP).

A key requirement of the program is that this funding is used to lever additional funds to support a nationally coordinated effort – bringing together available resources from the Australian Government, state, territory, and local governments, research organisations, community organisations, and industry.

The ARGP funding is available commencing 2009/10, and all projects funded through this program will need to be completed by June 2012.

There are a number of options for maximising the effectiveness of the DCCEE seed funding. The DCCEE, in partnership with NCCARF, may initiate one or more open research calls, may commission research projects, or may form strategic alliances with one or more funding partners.

The DCCEE will support research where sound projects align with the research questions in the Freshwater Biodiversity NARP.

4.1.2 Department of Agriculture, Fisheries and Forestry (DAFF)

DAFF is the Australian Government Department with primary responsibility for all policy and regulatory matters relating to the Australian land sector. The main Australian Government funding initiative delivered through DAFF with relevance to the priorities in the Freshwater Biodiversity NARP is *Caring for our Country*.

Caring for our Country seeks to achieve an environment that is healthy, better protected, well managed and resilient, and provides essential ecosystem services in a changing climate.

In the first five years, \$2.25 billion has been made available to improve national environmental outcomes across six priorities, three of which are relevant to freshwater biodiversity:

- The National Reserve System,

- Biodiversity and natural icons,
- Natural resource management in northern and remote Australia.

The Australian Government has recently announced projects totalling \$403 million in Caring for our Country funding during 2009-10 to a wide range of organisations to undertake environmental and sustainable farming projects.

The funding includes:

- \$293 million for 56 regional organisations, more than 1200 community groups and more than 12,000 landholders to protect and conserve Australia's natural resources – our farming land, water, coasts, plants and animals;
- \$57.5 million to support 57 significant projects across Australia, including targeting weeds such as blackberry and lantana; pests such as rabbits and protecting Ramsar wetlands.

DAFF through Caring for our Country is not in a position to partner with the DCCEE in a program that addresses the research questions in the Freshwater Biodiversity NARP on a program-to-program basis. However, the funding investment through Caring for our Country will assist to build the research capability and infrastructure to aid delivery of the DCCEE investments.

4.1.3 Department of the Sustainability, Environment, Water, Population and Communities (SEWPaC)

SEWPaC is the Australian Government Department with prime responsibility for developing and implementing national policy, programs, and legislation to protect and conserve Australia's environment and heritage. The Commonwealth Environment Research Facilities (CERF) initiative is the main funding mechanism in SEWPaC with the potential to address the priorities in the Freshwater Biodiversity NARP.

CERF has a public good and multi-disciplinary focus. Social and economic issues are of increasing importance, and climate change adaptation is beginning to emerge more prominently in forward planning.

The CERF initiative also contributes to the effort behind the Australian Government's national research priorities, including *An environmentally sustainable Australia* that targets water, soil loss, salinity, sustainable use of biodiversity, and responding to climate change. Elements of the CERF initiative also address the recommended research outlined in the *National Biodiversity and Climate Change Action Plan*.

One of the mechanisms for delivering the national research requirements of the CERF initiative is the formation and support of *Research Hubs*. The Taxonomy Research and Information Network (TRIN) is particularly relevant. TRIN aims to identify and name Australia's biodiversity, and to address gaps in knowledge of Australia's biodiversity. Research focuses on small freshwater mammals, reptiles, selected insects, aquatic invertebrates, ants, and weeds of national significance – all key elements of ecosystems with susceptibility to climate change. The research hub aims to deliver web-based information on taxonomy and be a one-stop-shop for assessing key information on Australia's biodiversity.

The research directly complements the *Atlas of Living Australia* project funded under the National Collaborative Research Infrastructure Strategy (NCRIS) (see below).

Other research hubs relevant to delivery of the priorities in the Freshwater Biodiversity NARP are:

Environmental Economics Research Hub – addresses a number of the major challenges in environmental management in Australia with integrated economic research – including biodiversity loss and adaptation to climate change.

Applied Environmental Decision Analysis – develops tools and tests methods to support decision-making for environmental management, and provides guidance for the use of these tools.

Landscape Logic Research Hub – assisting natural resource managers to invest in vegetation conditions of ecosystems by developing evidence-based tools to assess the technical and social feasibility of proposed interventions.

Marine and Tropical Sciences Research Facility – with a focus which includes risks and threats to the tropical rainforests of northern Australia.

SEWPaC is currently scoping the possible next phase of the CERF initiative, with a view to commencing this phase in July 2010. Any new program will be required to align with the overall climate change strategy of SEWPaC.

The CERF initiative is not currently able to partner with other potential funding bodies to address the priorities in the Freshwater Biodiversity NARP. However the CERF initiative is seeking to work collaboratively on a project-by-project basis in any research call through the existing mechanisms of the research hubs. The priorities outlined in the Freshwater Biodiversity NARP will guide development of the next phase of the CERF.

4.1.4 National Collaborative Research Initiative Infrastructure (NCRIS)

NCRIS is an Australian Government initiative, announced in the 2004-2005 Budget, to develop and fund national research infrastructure projects to deliver strategic and collaborative approaches to invest in world-class research facilities, networks and infrastructure that are accessible to researchers and meet their long-term needs. No funding is currently available for new projects through NCRIS. Priority capabilities were identified in the 2006 NCRIS Road Map, and twelve priority investment areas were announced in 2006.

A review of the initial 2006 NCRIS Roadmap was undertaken in 2008. This provided a statement of research infrastructure requirements over the next 5-10 years, and included recognition of the need for national investment in research infrastructure to prepare for and respond to natural man-made disasters and hazards. However, no funding has yet been identified to implement this capability.

In the event that funding becomes available, it is expected that further scoping of the requirements for research infrastructure will be needed. There is a possibility that research projects identified in the Freshwater Biodiversity NARP may in future influence development of research infrastructure consistent with priorities identified in the 2008 Roadmap.

There are two main NCRIS investments with relevance to the Freshwater Biodiversity NARP.

Terrestrial Ecosystem Research Network (TERN)

TERN was established in mid 2009 to provide national, collaborative infrastructure to facilitate enhanced ecosystem research. The University of Queensland is the lead institution. One activity in TERN is to develop a nationally-consistent approach to collecting and managing the time-series datasets required to meet the needs of terrestrial ecosystem research and natural resource management in Australia. TERN's work is also concerned with freshwater ecosystems and species.

TERN has expressed a willingness to work collaboratively with DCCEE and NCCARF in addressing the priority research questions in the Freshwater Biodiversity NARP, although it is not able to partner with research funding on a program basis in any new research call.

Atlas of Living Australia

The *Atlas of Living Australia* is a five-year project that commenced in 2006 to develop a biodiversity data management system to link Australia's biological knowledge with its scientific and agricultural reference collections and other custodians of biological information. It will provide a valuable reference point to address priorities in the Freshwater Biodiversity NARP.

The project aims to:

- integrate information on all Australian species, including data on specimens held by Australia's natural history collections and data from field observations of living organisms,
- support the management and integration of biological data from all areas of research (molecular to ecological),
- develop search interfaces and web services to facilitate discovery of biological information resources and to support the use of biological data in scientific research, policy-making and education, and
- ensure that data relating to Australian organisms are well-managed for present needs and organised to meet future information requirements.

4.1.5 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 freshwater biodiversity. The main ones are the Department of Education, Employment and Workplace Relations (DEEWR), Department of Innovation, Industry, Science and Research (DIISR), Department of Resources Energy and Tourism (DRET), Parks Australia and the Environmental Research Institute of the Supervising Scientist (ERISS). Opportunities for collaborative funding with these bodies will be explored further by NCCARF in the context of future partnerships in research investment.

4.2 State and Territory Government Organisations

All state and territory governments have departmental administrative arrangements and/or research capacity in the area of freshwater biodiversity. NCCARF has held discussions with representatives of some state and territory government agencies to explore collaborative arrangements. These discussions have not yet identified opportunities for partnerships at the program level to lever funding towards a national investment portfolio for research in climate change and freshwater biodiversity. NCCARF will continue to explore possible opportunities with state, territory, and local governments. State-based research organisations are able to respond to research calls with the possibility of attracting some state-based support on a project-by-project basis.

4.3 Australian Research Council (ARC)

The Australian Research Council grants program is often the first consideration for many researchers and research institutions that seek additional support. 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 recent 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 and/or research institutions and/or with 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 the middle of their career. In addition, each researcher's Administering Organisation will receive funding of up to \$50,000 per year to support related infrastructure, equipment, travel and relocation costs. The first 200 Future Fellowships were announced in September this year.

Opportunities for funding freshwater biodiversity climate research also exist within the ARC Centres of Excellence scheme. Examples of an existing Centre with relevance to the Freshwater Biodiversity 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.

4.4 Private Sector

A wide range of peak bodies for industry sectors, non-government organisations and advisory bodies, that may either have access to funds or could lobby for leverage across a range of program areas, is increasingly becoming aware of the need to adapt to extreme weather and changing climatic conditions. The corporate sector could include climate change adaptation research in its environmental research, management, and monitoring programs.

Collectively, these and similar bodies demonstrate that there is a diverse range of potential players who could influence the emerging research agenda and there are likely to be a number of pathways for innovative funding arrangements. NCCARF will continue to explore future funding opportunities in this area.

4.5 International

A range of international organisations could interface with research in Australia to address the research priorities in the Freshwater Biodiversity NARP. While no immediate opportunities for program-to-program collaboration have been identified with these organisations, opportunities remain for scientific exchange and collaboration on a project-to-project basis.

During consultation on the NARP, a number of international experts provided a comprehensive and strategic review of the identified key research priorities. This ensures that the NARP is aligned with, and informed by, international research initiatives and developments in this area, and hence is positioned to attract international collaboration in research delivery.

5. Potential Sources of Research Delivery

This section describes the main research organisations that might be involved in implementing the Freshwater Biodiversity NARP. In many cases, these research organisations have access to resources that might be used to assist with funding the research.

Agencies with an existing focus on freshwater research provide a strong research platform to address the priorities in the NARP within a collaborative approach to ecosystem-focussed management.

5.1 State and Territory Government Conservation Agencies

Every state and territory government in Australia has a long history of delivering research to conserve its freshwater biodiversity. In many cases research findings at the state or territory level can also contribute to conservation in other jurisdictions.

Research undertaken by state and territory agencies may be directly funded by the relevant department, or jointly funded such as through a CRC program, an ARC-supported project, or CSIRO activity. Joint funding and research arrangements are highly valuable, as they ensure potential users of the research findings are involved in a research project, and so understand the potential application and limits of its findings. Jointly generated research outputs are thus more likely to be effectively communicated, understood and used.

State departments and research agencies are likely to support partnership arrangements on a project-by-project basis to address the updated priority research questions for freshwater biodiversity where the priorities align with their own strategic and operational plans and where the project meets the competitive funding arrangements in the department/agency.

5.2 Commonwealth Scientific and Industrial Research Organisation (CSIRO)

The Climate Adaptation Flagship provides the primary CSIRO focus for climate change adaptation research. Research related to the Freshwater Biodiversity NARP is implemented mainly through CSIRO's Species and Ecosystems theme. Within this theme, CSIRO is developing and delivering adaptation options to protect Australia's freshwater, marine and terrestrial species, ecosystems and the services they provide.

To identify and manage the threats facing our biodiversity and ecosystems Flagship researchers work in two key areas:

1. Predicting the responses of natural ecosystems to climate change, and developing adaptation options to improve their resilience;
2. Reducing the threats posed by invasive species, bushfires and habitat loss through development of well prioritised response strategies

The Climate Adaptation Flagship provides information for ecosystem managers and policy makers, and helps to improve how climate change adaptation is embedded into policy, by responding to requests from policy agencies.

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.

5.3 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 management of freshwater biodiversity.

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

5.4 Universities

Universities employ researchers with wide ranging capabilities for research across disciplines relevant to freshwater biodiversity - from highly theoretical approaches which challenge the ways we frame problems through to practical problem solving.

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

The NCCARF Adaptation Research Network for Freshwater Biodiversity, hosted by Griffith University, has a membership of over 200 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. Direct cash investment is unlikely to be secured through these sources, but in-kind research time is possible.

The Network has strategically sought expertise in a variety of fields and disciplines, from ecology and biodiversity to mathematical modeling, policy and conservation planning. It has explicitly invited membership and participation from resource management and policy groups and will continue to develop these links in all states and at the national level.

5.5 Museums and Botanic Gardens

Australia's museums, botanical gardens and herbaria are important institutions for preserving and studying the biodiversity of living species. They have a range of scientific equipment for the examination and analysis of specimens which are used for research and conservation, and they develop and maintain substantial biological and other databases. Museum researchers investigate topics such as identification of populations within species that have high conservation or economic value, identification of new species and the evolutionary relationships of animals. These institutions may also offer a variety of fellowship opportunities and postgraduate awards. Botanic gardens and herbaria also serve as reference centres for plant identification, cultivar registration, nomenclature, plant exploration and as repositories of germplasm (e.g., seedbanks) for some threatened species.

5.6 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 emergency management, natural resource management decision-making, and to act as a national standard baseline for change detection and environmental reporting.

5.7 Institute of Foresters of Australia (IFA)

The Institute of Foresters of Australia is a professional body with 1350 members engaged in all branches of forest management and conservation in Australia. The Institute is strongly committed to the principles of sustainable forest management and the processes and practices which translate these principles into outcomes.

The membership represents all segments of the forestry profession, including public and private practitioners engaged in many aspects of forestry, nature conservation, resource and land management, research, administration and education.

5.8 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 snapshot of activities in some of the CRCs clearly indicates that CRCs can contribute strongly to the delivery of the national research agenda for climate change and freshwater biodiversity.

5.8.1 *CRC for Forestry*

One of the programs of the CRC for Forestry focuses upon developing forestry practices that meet agreed environmental certification requirements and that foster constructive community engagement. It promotes the monitoring and management of biodiversity in forest landscapes, gene pool management and sustainable management of key pests and diseases.

5.8.2 *CRC for Tropical Savannas Management*

One of the main focuses of the CRC for Tropical Savannas Management is to maintain and protect the natural resources in northern Australia that continue to be subject to increasing pressures for development and intensification of their use. The CRC officially ended in December, 2009, though some activities will continue, including the FireNorth, Land Manager and EnviroNorth websites.

5.8.3 *Invasive Animals CRC*

The Invasive Animals CRC creates new technologies and integrated strategies to reduce the impact of invasive animals on Australia's economy, environment, and people. The CRC has the potential to undertake research addressing the threats imposed by climate change to healthy biosystems in Australia, as in any research grants program directed to the priorities in the Freshwater Biodiversity NARP.

5.8.4 *Other Cooperative Research Centres*

There are a number of other CRCs that have the potential to deliver research directed to the priorities in the Freshwater Biodiversity NARP. This again demonstrates the broad-based research capability that could be harnessed in any research call. Examples are the Desert Knowledge CRC (in partnership Desert Knowledge Australia), the new CRC for

Remote Economic Participation, due to commence work in mid-2010, the CRC for Contamination Assessment and Remediation of the Environment (CARE), the Bushfire CRC, the CRC for Molecular Plant Breeding, the CRC for National Plant Security, and the Sustainable Tourism CRC.

5.9 Non Governmental Organisations (NGOs)

Many non-government organisations have a national or state-based focus whose primary aim is to conserve and improve the well-being of Australia's ecosystems and natural biodiversity. These are often supported by private funds and are guided by leading scientists. They support a range of environmental initiatives such as bushland preservation, wildlife conservation, water management and environmental education and research programs.

NGOs, with the help of a large number of volunteers, have been instrumental in providing scientific information and on-ground works to help better manage the Australian natural environment.

What follow are some examples of some of the more prominent NGOs in the freshwater biodiversity area in Australia. Analysis by NCCARF, represented in this snapshot, indicates a capacity across Australia to undertake and contribute to research efforts addressing the priorities in the Freshwater Biodiversity NARP. While NCCARF has not been able to secure financial commitments from these organisations at a program level at the current time, the act of initiating a research call, in itself, is likely to provide the opportunity for NGOs to bring their resources and expertise to the fore on a project-by-project basis.

5.9.1 Greening Australia

Greening Australia was established in 1982, and is Australia's largest environmental NGO. It focusses on salinity, declining water quality, soil degradation, climate change and biodiversity loss through a blend of practical experience, science and community engagement. The Macquarie Group Foundation has made a three-year commitment through Greening Australia to fund the River Recovery Program. This program aims to restore the health and productivity of Australia's key waterways.

5.9.2 World Wildlife Fund and International Union for Conservation of Nature

The World Wildlife Fund (WWF) along with the International Union for Conservation of Nature (IUCN) was instrumental in creating the Convention on Biological Diversity (CBD) – a united effort by governments to address the rate at which the world's natural resources are being degraded and destroyed. WWF and IUCN continue to play an active role in guiding CBD processes that address specific environmental questions, as well as helping governments to implement their CBD commitments. WWF is also actively involved in preparing National Biodiversity Strategic Action Plans in several developing countries. These action plans reflect both WWF priorities and provide the basis for improved conservation and sustainable use activities at the national and local levels.

5.9.3 Conservation Volunteers

Conservation Volunteers was formed in 1982, and focuses on implementation of practical conservation measures attracting and managing an extensive workforce of volunteers. A new program managed by Conservation Volunteers is *Action for Climate Change* one aim of which is to support species under threat from dangerous climate change.

5.9.4 *The Conservation Management System Consortium (CMSC)*

The Conservation Management System Consortium (CMSC) is a group of conservation organisations whose aim is to raise standards in conservation and countryside management in Australia. They produce an extensive range of planning guidelines and software tools for conservation management.

5.9.5 *Australian Wildlife Conservancy*

The Australian Wildlife Conservancy (AWC) is an independent, non-profit organisation dedicated to the conservation of Australia's threatened wildlife and ecosystems. AWC now owns 20 sanctuaries covering 2.5 million hectares (6.2 million acres) around Australia. AWC sanctuaries protect at least 300 ecosystems, 100 threatened ecosystems and 170 threatened animal species. AWC acquires land to establish sanctuaries, implements on-ground conservation programs, conducts scientific research and undertakes public education programs.

5.9.6 *Bush Heritage*

Bush Heritage strives to protect for the long term the unique and abundant diversity of life in Australia. It achieves this by acquiring and managing land, water and wildlife of outstanding conservation significance.

Bush Heritage currently owns and manages 31 reserves throughout Australia, covering over 946,000 hectares. Actions undertaken on the ground include pest plant and animal control and monitoring, erosion control, seed collection and revegetation, fire management and fuel-reduction burning. Bush Heritage continues to monitor the effectiveness of these management actions using flora and fauna surveys, mapping, and ongoing data collection.

5.9.7 *State and Territory Conservation Councils*

Lead conservation organisations have been established in states and territories, including the Conservation Council of South Australia, Conservation Council of Western Australia, Nature Conservation Council of NSW, Queensland Conservation and Tasmanian Conservation Trust. These organizations provide a focus for more local or focused conservation groups which frequently undertake research pertinent to their areas or interests.

5.9.8 *Sector-Specific Organisations*

There are several other NGOs whose aim is to conserve biodiversity in specific sectors such as the Queensland Frog Society, the Australian Mammal Society, the Australian Herpetological Society, and Birds Australia. These organisations both advocate for the ecological and other needs of the sector or taxa in which they are interested and lead or coordinate research concerning their sector of interest.

5.10 *Ecological Society of Australia (ESA)*

The Ecological Society of Australia Incorporated (ESA) is the peak group of ecologists in Australia, with over 1500 members from all states and territories. It aims to create a community of knowledge and understanding amongst ecologists, and reach out to those working in related fields. It takes a collaborative approach to promoting the scientific study of all organisms in relation to their environment, and encourages the application of ecological principles in the development, use and conservation of Australia's natural resources. ESA is in a strong position to marshal national resources for the delivery of research that addresses the priority questions in the Freshwater Biodiversity NARP.

5.11 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 conservation and management of freshwater biodiversity (parks, reserves, species etc.). The implications of climate change are increasingly being considered within these partnerships, and they create a valuable research resource across Australia that could be harnessed to address the priorities in the NARP. Conservation Councils, and extensive regional and local networks of experienced and knowledgeable citizens, add to the richness of regional and local research capacity.

5. Strategy for National Coordination

NCCARF has undertaken a range of activities to formulate this Implementation Plan, including interviews with prospective research partners. Analysis shows that while there are not many opportunities for funding to address the research priorities in the Freshwater Biodiversity NARP at the moment, these opportunities are likely to grow substantially over the next few years.

5.1 Immediate investment

The main opportunity at present for national program-level research funding for freshwater biodiversity adaptation research is the Australian Government's *Climate Change Adaptation Research Grants Program*, administered through the Department of Climate Change and Energy Efficiency (DCCEE). The DCCEE is able to allocate up to a total of \$2 million for research conducted up to June 2012.

There are a number of other Australian Government Departments with a developing interest in the climate change adaptation agenda in freshwater biodiversity: The main ones are outlined in Section 3.1 i.e. (1) Department of Sustainability, Environment, Water, Population and Communities and (2) Department of Agriculture, Fisheries and Forestry.

None of these departments are in a position to invest in research now to address the priorities in the Freshwater Biodiversity NARP – either in association with the ARGP, or independently.

A range of research providers are well positioned to respond immediately to any research call into climate change adaptation in freshwater biodiversity (see Section 4). These research providers may be able to bring additional host-agency funding to any partnership arrangement on a project-by-project basis. These organisations are likely also to be able to secure additional partnership funding, but again only on a project-by-project basis.

The NCCARF Climate Change Adaptation Research Network for Freshwater Biodiversity (hosted by the Griffith University) is well placed to assist with building research consortia and securing additional resources for any new initiatives.

It is proposed that there be an open call for research to address the priorities in the NARP through the *Climate Change Adaptation Research Grants Program*. This research call should be made in late 2010, and be coordinated by NCCARF and the DCCEE. The call would involve a two-stage process of short Expressions of Interest, evaluated by the Science Review Panel, leading to invitations for full proposals - also to be evaluated by the Science Review Panel. Contractual arrangements for the projects will be made between the DCCEE and the project host organisation.

The call will specifically target the research priorities within all priority areas of the Freshwater Biodiversity NARP.

NCCARF will assist the research call by:

1. providing information on the NCCARF website,
2. engaging the *NCCARF Adaptation Research Network for Freshwater Biodiversity*, hosted by the University of New South Wales, to promote the call to researchers,

3. managing the research call,
4. establishing the Science Review Panel to assess expressions of interest and full proposals,
5. playing a lead role in brokering research consortia for submission of full proposals,
6. making recommendations to the DCCEE and other funding partners on funding investments.

NCCARF will also play a lead role in communicating the outcomes of the research call to the Australian research community, and over time will promote the outputs from the research investments.

The DCCEE will play an active role in building national consortia to address the identified priorities within the Freshwater Biodiversity NARP that are of specific importance to the developing climate change adaptation agenda of the Australian Government, prior to the submission date of Expressions of Interest.

The Science Review Panel will be briefed by the DCCEE on these Australian Government priorities prior to assessment of the Expressions of Interest. The Science Review Panel will take this advice into account. Nevertheless, the quality of the proposed research remains of paramount importance in assessment.

The intent is for contracts to be in place for research to commence by June, 2011.

5.2 Building future programs

The NCCARF Adaptation Research Network for Freshwater Biodiversity will continue to undertake an analysis of stakeholders with a view to developing and enhancing opportunities for research investment and collaboration. It will also enhance international links to Australia's research program, for example, through its international visiting scientist program.

It is anticipated that a research call instigated immediately may encourage other funding organisations to identify and allocate funds towards the high priorities in the NARP. NCCARF together with the DCCEE and other partners will continue to explore options to build the national research base to address these high priorities (see Appendix 1).

6. Impediments and Risks

Australia has a small research community – especially considering the challenges that will be involved in building and delivering a national research program to address the priorities in the NARP. It is recognised that building research capacity will not be easy or straightforward.

As such, it is expected that implementing the research agenda will take time. A key focus will need to be on increasing the size of the research funding directed to this research agenda – across a wide variety of organisations and stakeholder groups – while at the same time utilising the resources available immediately for carefully targeted and effective research. The Adaptation Research Network for Freshwater Biodiversity will play a prime role in building the research agenda and reducing risks in program implementation.

7. Monitoring

NCCARF will work with the Adaptation Research Network for Freshwater Biodiversity to track research being conducted across Australia that implements the NARP. NCCARF will provide advice on the progress of research contracted through the proposed new research call in order to identify emerging gaps and research needs. It will also maintain continuing dialogue with key stakeholders and the research community. NCCARF will produce an annual report on the progress of investments being made, with the first to appear in 2011. The Implementation Plan will be updated periodically.

NCCARF, through a dedicated research program, will also synthesise research outcomes in the area of climate change and freshwater biodiversity as these evolve.

Success in developing and implementing research directed towards priorities in the NARP will be measured in terms of the extent to which the research budget is built nationally, the degree of collaboration and coordination to maximise the efficiency of resource use, and the extent to which the research delivers to the needs of research funders, to decision makers, and to stakeholders nationally.

Appendix 1

Priority Research Questions in the *National Climate Change Adaptation Research Plan: Freshwater Biodiversity*

Goal 1: Incorporate climate change adaptation into management of freshwater species and ecosystems
<ul style="list-style-type: none">• What management options will conserve freshwater species and ecosystems that are currently at or near their climate limits? (Very high)• What attributes will enable freshwater species to adapt and ecosystems to successfully change autonomously in response to climate change? (Very high)• How will climate change alter current freshwater biodiversity management effectiveness, and what management changes will be required, including for poorly understood species and ecosystems?
Goal 2: Identify climate change adaptation options for Australia's freshwater biodiversity refugia
<ul style="list-style-type: none">• How can the climate resilience of freshwater biodiversity refugia be increased? (Very high)• What changes to Australia's conservation reserve system are required to improve protection of current and projected climate refugia and to support connectivity for freshwater biodiversity? (Very high)• What adaptation options will facilitate the type and level of connectivity and dispersal required under climate change impacts?
Goal 3: Understand climate change adaptation interactions between freshwater biodiversity and other sectors
<ul style="list-style-type: none">• How will climate change impacts on other sectors affect existing stressors on freshwater biodiversity?• How can current non-climate stressors on freshwater biodiversity be managed or reduced to minimize the synergistic effects of climate and non-climate stressors? (Very high)• What integrated climate change adaptation response plans at the local, landscape, catchment and regional scales will build the resilience of freshwater biodiversity, and also terrestrial biodiversity, primary industries, water resources, and associated communities and industries?
Goal 4: Understand the role of environmental policies in protecting freshwater biodiversity under changing climate conditions
<ul style="list-style-type: none">• How will climate change affect existing conservation goals, policies and programs for freshwater biodiversity, including meeting Australia's international obligations? (Very high)
Goal 5: Cross-cutting theme: Ensure that adaptation initiatives for freshwater biodiversity and other sectors are mutually supportive and integrated where appropriate
<ul style="list-style-type: none">• What climate change adaptation and mitigation actions taken in other sectors will benefit freshwater biodiversity?