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NCCARF
National
Climate Change Adaptation
Research Facility

Western Australian Climate Change Adaptation Symposium

Perth, Western Australia

December 8th, 2009

Programme & Abstracts

Western Australian Climate Change Adaptation Symposium

8th December 2009

Venue: Robertson Lecture Theatre
Murdoch University
South Street
MURDOCH WA 6150

Sponsored by:

National Climate Change Adaptation Research Facility

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WELCOME

The purpose of the Symposium is to provide a forum for Western Australian researchers to connect with lead researchers from other parts of Australia, and to promote and facilitate a national network of climate change adaptation researchers.

It also aims to 'showcase' latest advancements in climate change adaptation research, with a particular focus on Western Australia, and an opportunity for the Western Australian research community to learn more about the activities of the National Climate Change and Adaptation Research Facility activities, including its Networks.

NCCARF

In 2008 the Australian Government established the National Climate Change Adaptation Research Facility to lead the Australian research community in a national interdisciplinary effort to generate the information needed by decision makers in government and in vulnerable sectors and communities to manage the risks of climate change impacts.

NCCARF is based at Griffith University Gold Coast and has nine partners: The Queensland Government, Griffith University, James Cook University, Macquarie University, Murdoch University, The University of Newcastle, Queensland University of Technology, University of Southern Queensland and University of the Sunshine Coast.

NCCARF's priority activities are:

- To provide national scientific leadership for adaptation research, including the development of National Climate Change Adaptation Research Plans.
- To coordinate researchers and funders to implement the National Climate Change Adaptation Research Plans using resources available Australia-wide.
- To coordinate the Australian research community, particularly through the Adaptation Research Networks.
- To undertake Synthesis and Integrative research to address national priorities and synthesise existing and emerging national and international research on climate change impacts and adaptation.
- To communicate research findings and facilitate the adoption of adaptation knowledge.

MURDOCH UNIVERSITY

At Murdoch, there are more than 18,000 students and 1,400 staff, including 2,000 overseas students from about 90 countries. Students are enrolled in over 200 undergraduate degrees and postgraduate courses across a range of disciplines.

Murdoch University is recognised as one of Australia's leading research institutions and currently has over 2,000 higher degree students.

Murdoch University is committed to its vision of being a prominent and influential research intensive university renowned for its teaching quality and research excellence; promoting intellectual independence and social and scientific critique within a supportive and sustainable environment for students and staff; and engaging with and benefiting local, national and international communities.

Recently, the University established eight new research institutes – the Institutes for Immunology and Infectious Diseases, Integrated Health, Resource Technology, Sustainable Ecosystems, Animal Research, Crop and Plant Sciences, Media, Creative Arts and Information Technology, and the Sustainable Societies, Education and Politics. Murdoch's initiatives in Climate Change and Adaptation Research include the recent establishment of a State Centre of Excellence on Climate Change and Woodland and Forest Health, with funding from the State Government funding over five years, and funds and in-kind support from some 27 collaborating organisations. Professor Giles Hardy is the Acting Director of this Centre.

PROGRAM

Time	Activity	Presenter
8:15-8:45am	Registration	
8:45-9:00am	Introduction/Welcome	Jim Reynoldson, Murdoch University
9:00-9:20am	Overview of NCCARF	Jean Palutikof, NCCARF
9:20-9:40am	The Climate Adaptation Program	David Bowran, DAFWA/ARWA
9:40-10:00am	Human Health Network	Tony Capon, Australian National University
10:00-10:20am	Human Health Climate Adaptation in WA	Dianne Katscherian, DOHWA and Jeffery Spickett and Helen Brown, Curtin University
10:20-10:30am	General discussion/questions	
10:30-11:00am	<i>Morning tea</i>	
11:00-11:20am	Settlements and Infrastructure Network	Michael Taylor, University of South Australia
11:20-11:40am	Social, Economic and Institutional Dimensions Network	Jon Barnett, University of Melbourne
11:40-12:00pm	Resilience of regional areas to drought	Glenn Albrecht and Helen Allison, Murdoch University
12:00-12:20pm	Emergency Management Network	Bryan Boruff, University of Western Australia and Brian Smith, FESA
12:20-12:40	An integrated approach to climate adaptation for estuaries	Janet Howieson, DoFWA/Curtin
12:40-12:50pm	Discussion	
12:50-1:40pm	<i>Lunch</i>	
1:40-2:00pm	Primary Industries Network	Snow Barlow, University of Melbourne
2:00-2:20pm	Primary Industries Adaptation	Megan Abrahams, ARWA
2:20-2:40pm	Terrestrial Biodiversity Network	Lesley Hughes, Macquarie Uni.
2:40-3:00pm	Climate adaptation: woodlands and biodiversity in southwest WA	Giles Hardy, Paul Barber and Neal Enright, Murdoch University
3:00-3:30pm	Water Resources and Freshwater Biodiversity Network	Stuart Bunn, Griffith University
3:30-3:50pm	<i>Afternoon tea</i>	
3:50-4:10pm	Water resources and freshwater biodiversity adaptation	Jane Chambers, Murdoch University
4:10-4:30pm	Marine Biodiversity and Resources Network	Neil Holbrook, UTAS
4:30-4:50pm	Climate change affects on fisheries: implications for management	Nick Caputi, DoFWA
4:50-5:15pm	Summary and discussion	Jean Palutikof, NCCARF
5:15-6:15pm	<i>Refreshments and networking</i>	

ARWA's Climate Adaptation Program

David Bowran, DAFWA and the Climate Adaptation Program Team¹

¹ Members from: University of Western Australia, CSIRO, Department of Agriculture and Food Western Australia, Curtin University of Technology, and Murdoch University; Climate Adaptation Program Science Coordinator Dr Senthold Asseng, CSIRO Centre for Environmental and Life Sciences, Floreat Park WA P: (08) 9333 6615; E: Senthold.Asseng@csiro.au

Abstract

The Western Australia wheat-belt delivers 40% of Australia's wheat. This region has already experienced rainfall declines of up to 20% over recent decades. More changes are inevitable even if greenhouse gas emissions are capped quickly. Likely effects in WA include: further decline in average winter rainfall, reduced run-off to dams, decreased aquifer recharge, increased seasonal variability, increased risk of prolonged drought, higher average temperatures, rising atmospheric carbon dioxide concentrations, and more extreme events such as hot days, storms and wild fires. Western Australia's \$12 billion agri-food sector and related industries are vulnerable to these changes, which could result in significant production losses and damage to agricultural and native ecosystems. Western Australia's grain cropping underpins Australia's grains export. Future climate change impacting on Western Australia could threaten Australia's reputation as a reliable international grain supplier contributing to global food security.

To address the challenge presented by climate change in Western Australia, in 2007 a Climate Adaptation Program was developed by Agriculture Research Western Australia (ARWA) which is a collaborative partnership between the University of Western Australia, CSIRO, the Department of Agriculture and Food Western Australia, the Curtin University of Technology, and Murdoch University. The Climate Adaptation Program brings together the capability of all of the ARWA partners to undertake priority climate change impact and adaptation research. With multiple projects it seeks outcomes beyond the reach of individual members and aims to deliver the information, knowledge and tools that decision makers require to manage the risks and capture the opportunities a changing climate will present to rural industries and communities in southern Western Australia. Funding for the first 11 CAP projects with a 6.5M\$ investment from a range of sources has been secured.

Keywords: Climate change impact, climate adaptation; dry-land wheat and pasture systems

Human Health Network

Tony Capon

Australian National University

The Adaptation Research Network Human Health is hosted by the National Centre for Epidemiology and Population Health at the Australian National University. It comprises researchers from various disciplines (including epidemiology, climate science, environment, rural science, sociology, economics, mental health, infectious diseases, physiology, ergonomics, health promotion, health services) and research users (policymakers, practitioners, industry, community). Research users are encouraged to participate in the scoping and planning of research projects, to guide research effort and to orient it towards the needs of policy makers and other decision makers.

The main aims of the network are to:

- Foster interdisciplinary research and emerging research methods (time-series methods, spatial analyses, systems-based modelling of complex ecological relationships and processes, and scenario-based modelling of future health risks).
- Build research and decision-making capacity by attracting and leveraging new funding, and focusing on mentoring and support for early career researchers and policymakers.
- Facilitate collaboration between researchers, policymakers and practitioners, including regional conditions to strengthen Australia's capacity to anticipate and mitigate the human health consequences of climate change.

Application of a Health Impact Assessment Framework to Identify Adaptation Strategies for Health Impacts of Climate Change in WA

Jeffery Spickett¹, Helen Brown¹, Dianne Katscherian²

¹ WHO Collaborating Centre of Environmental Health Impact Assessment, Curtin University, GPO Box U1987, Perth, 6845.

² Department of Health WA, PO Box 8172, Perth BC 6849

Abstract

The type and extent of health impacts that may arise from climate change are a reflection of the unique environmental, climatic and socio-economic parameters of Australia. A joint project, between the Environmental Health Directorate of the Department of Health and the WHO Collaborating Centre for Environmental Health Impact Assessment at Curtin University was undertaken in collaboration with Government and other stakeholders to consider the implications of climate change on the health of the people of WA and to develop a range of adaptive responses to provide Government with the basis for future decision making.

A Health Impact Assessment (HIA) framework provided an appropriate means by which the potential impacts of climate change could be initially assessed. The framework was used to identify potential health impacts and vulnerable groups and regions in WA in the year 2030. A risk assessment of potential impacts was conducted and the suitability and implementation of adaptation measures was considered. Knowledge gaps and research needs for policy development were highlighted. The process has also since been modified for use in other sectors to consider vulnerability and the development of appropriate response policies

The periodic application of an HIA framework is seen as an ideal tool to develop appropriate adaptation strategies to address the potential health impacts of climate change.

Keywords: Health Impact Assessment, Climate Change, Adaptation

ACCARNSI: the Australian Climate Change Adaptation Research Network on Settlements and Infrastructure

Michael A P Taylor¹

¹ *Institute for Sustainable Systems and Technologies, University of South Australia, Mawson Lakes campus, Adelaide South Australia, and Co-Convenor, Adelaide (Urban Management, Transport and Inclusion) node, ACCARNSI*

Abstract

ACCARNSI is one of the eight research networks in NCCARF. It is built on a host plus four node model, which provides a strong basis for cross-node communications and interaction. It maintains an active and growing committed membership of researchers, industry, government and professional agencies from across the country (there are about 200 members at present). The success of the ACCARNSI largely depends on the inclusion of a wide range of appropriate academic contributors to the work of the network through its four nodes. These nodes are:

1. Coastal Settlements (Griffith University)
2. Urban Management, Transport and Inclusion (jointly at University of Adelaide and University of South Australia)
3. Built Environment, Innovation and Institutional Reform (university of New South Wales)
4. Infrastructure (University of New South Wales).

This presentation will provide an overview of the network, its current research activities, and future directions in research and information dissemination.

Keywords: research network, settlements and infrastructure, climate change adaptation, information dissemination

Social, Economic and Institutional Dimensions of Adaptation Research Network

Jon Barnett

Melbourne University

This presentation will describe the goals and activities of the Social, Economic and Institutional dimensions of adaptation research network, funded by the National Climate Change Adaptation research Facility. The SEI-network is a large, inclusive and diverse community of researchers, practitioners and decision makers from universities, government, the private sector and civil society. It is helping to drive thinking across sectors and disciplines about the complex social, economic and institutional dimensions of climate adaptation. An understanding of these dimensions will allow decision makers to develop more effective adaptation measures.

Resilience and Water Security in Two Outback Cities,

Kalgoorlie and Broken Hill

Glenn Albrecht¹, Helen Allison ²

¹ School of Sustainability, Murdoch University, South Street, Murdoch, WA 6150.

² School of Environmental Science, Murdoch University, South Street, Murdoch, WA 6150.

Abstract

This project explores the adaptive capacity of two relatively large inland regional cities facing different challenges relating to climate change and water supply on two sides of the continent. Kalgoorlie in WA and Broken Hill (BH) in NSW are towns of around 30,000 and 20,000 respectively in semi-arid environments with limited local water supplies. Each has a rich history based on mineral resources and a developing tourism industry. However, they face different resilience problems in the face of climate change and water supply. Kalgoorlie is reliant on surface water transported 650 km through the Golden Pipeline from the Mundaring Dam in the water catchment near Perth. Kalgoorlie has no alternative water source other than a possible desalination plant and another pipeline from coastal Esperance over 350km south. Kalgoorlie will have little direct climate change impact but a strong climate change impact on the source of its water supply. The Perth water supply is under intense pressure with desalinisation already supplementing declining rainfall and aquifer extraction. Despite the likelihood of increasing costs for potable water, Kalgoorlie will continue to be supported by Government because it has a strong economic resource and population base.. On the other hand, BH has a much diminished mining industry but strong social base and a new economy as an ‘outback’ tourism destination. Under current demands BH is totally reliant on limited ground and surface water supply (Menindee Lakes water supply system). To meet future demand, the Australian Government is currently supporting further investigation into regional groundwater resources and the potential for managed aquifer recharge or a possible coastal desalinisation plant 350 km away in Upper Spencer Gulf, South Australia. Such technological solutions will inevitably impact on existing complex social-ecological relationships with, for example, desalinated water supply produced at the possible expense of fisheries, including giant cuttlefish in the Upper Spencer Gulf. We shall present future scenarios for both cities that will involve full examination of the likely impacts of climate change, technological solutions and the economic costs of providing potable water to inland cities. Our research provides a resilience perspective on the limits of adaptive capacity in both cities for policy and decision makers. It also provides the two communities with much needed information about water security and resilience in a drying climate.

Keywords: Resilience, semi-arid environments, potable water supply, water costs, future scenarios; Kalgoorlie, Broken Hill, mineral resources

Emergency Management Network

Bryan Boruff¹ and Brian Smith²

¹ University of Western Australia, ² Fire and Emergency Services Association

The Adaptation Research Network for Emergency Management is hosted by RMIT University.

The Adaptation Research Network for Emergency Management will bring together researchers and stakeholders with an interest in the implications of climate change impacts, such as the changes in the frequency and intensity of extreme weather events, for disaster mitigation, preparedness, response, and recovery.

An integrated approach to climate adaptation for estuaries

Howieson Janet R^{1,2}; Sarti N¹; McHenry M³ and Katscherian D⁴

*Dept of Fisheries WA*¹, *Curtin University*² *Murdoch University*³ *Department of Health*⁴

Abstract

This talk will summarise the outcomes of a consultative initiative entitled: “Climate Change in South West Estuarine and Inland Fisheries: What are the Potential Impacts and are we ready for them?”

The objectives of the initiative were to:

- Raise understanding of how climate change will impact on the communities associated with South West estuarine and inland fisheries.
- Develop a set of agreed and collaborative strategies on how best to respond to these potential impacts.
- Report these strategies to relevant agencies/funding bodies/stakeholders.
- Develop a generic consultative methodology, which can be transferred to other primary production/regional sectors.

The methodology was based on the methodologies outlined in the National Greenhouse Office guide “Climate Change: Impacts and Risk Management: A Guide for Business and Government, and for Health Impact Assessment. In brief the project was conducted in three phases incorporating two half-day workshops and an internal risk assessment. The phases were

- a. Phase 1: Workshop 1: Impacts, Vulnerabilities and Coping Capacity.
- b. Phase 2: Internal risk assessment
- c. Phase 3: Workshop 2: Verification of Risk Assessment of Adaptation strategies.

The presentation will summarise the projected impacts of climate change on SW estuarine and inland fisheries, results of a risk assessment of the identified impacts and the development of a set of adaptation strategies to assist the communities in adapting to the impacts. The adaptation strategies developed were in the areas of legislative/regulatory, research, infrastructure development, surveillance and monitoring, and communication and education. These adaptation strategies can be then be applied generically for planning climate change adaptation research and activity or applied as appropriate to specific systems to facilitate a local response.

The consultative methodology developed in this initiative can be modified for application to other primary production sectors or scenarios in developing climate change adaptation strategies.

Primary Industries Adaptation Research Network (PIARN)

Professor Snow Barlow, ATSE, FAIAST^{1,2}

¹ Convener, Primary Industries Adaptation Research Network, NCCARF

² Foundation Professor of Horticulture and Viticulture, University of Melbourne

Abstract

The Primary Industries Adaptation Research Network of NCCARF is convened by Snow Barlow within the Melbourne School of Land and Environment in conjunction with an eminent and very active Research Leadership Group (RLG) consisting of Mark Howden (CSIRO), Peter Grace (QUT), Ross Kingwell (UWA/AWA), Richard Eckard (UM/VicDPI) and Peter Hayman (SARDI/UA). PIARN's objective is to establish an enlightened adaptation research philosophy and ethos within the Australian Primary Industries Research community by implementing the following activities.

- *Establish network with nodes in key thematic research areas*
- *Communicate with the established and expanding membership of the Adaptation Research Network for Primary Industries*
- *Promote collaborative funding of NARP priorities with funding agencies*
- *Build Adaptation Research Capacity within the primary industries research community through honours scholarships and mentoring*
- *Inform and enrich national and international policy development through the production of state-of-the-knowledge reports in primary industries adaptation for stakeholders, governments and international agencies*
- *Engage with network members, primary industries stakeholders (including CCRSPI) and the regional communities to support the development of productive and sustainable adaptation strategies*
- *Use innovative new communications channels, research techniques, and fora, to reach stakeholders and regional communities*
- *Engage network members with decision makers, politicians, senior bureaucrats and industry and community leaders with the work of NCCARF in climate change adaptation in the primary industries sector*

The PIARN network convened by the University of Melbourne was selected and contracted by NCCARF last month and will begin to implement the formation of the network immediately beginning with the establishment of the thematic networks in *Farming Systems, Soil management, Water management, Plant Adaptation to Climate Change, Animal Health, Production and Biosecurity, Regional Social and Economic Adaptation and Assessment.*

PIARN is seeking to build its membership as quickly as possible through the accessing as many existing primary industry and community networks as possible. As part of its thematic workshops brief it will run a symposium on "plant adaptation to new environments" at the University of Western Sydney in April /May next year.

How will climate change affect your farming system? — developing and testing a methodology

Caroline Peek, Kari-Lee Falconer, Megan Abrahams, Daniel Gardiner, Chad Reynolds and Dennis Van Gool.

Department of Agriculture and Food WA

Abstract

This paper describes a methodology to (i) model the economic impact of climate change on farming systems and (ii) evaluate adaptive strategies to cope with climate change. Research has indicated that the negative impacts of climate change on Australian farming systems will be greatest in WA (Howden and Jones, 2001). The NAR within WA experiences warmer and shorter growing seasons than other WA broadacre agricultural regions and hence, may be more challenged by climate change predictions for warmer and later season starts. Therefore the methodology was tested in the Northern Agricultural Region (NAR) of Western Australia.

The impact of climate change on the economic viability of farming systems in the NAR was modelled in three stages. Firstly, future climate scenarios were generated for the next 50 years using the OzClim program developed for Australia (CSIRO, 2007) with data from suitable global climate models. Secondly, declining crop yields were predicted for the future climate scenarios using a modified French-Schultz equation (van Gool and Vernon 2005, 2006a, 2006b), developed for WA. Lastly, the economic impact of the predicted production changes were modelled for representative farming systems in the the region using the STEP (Simulated Transitional Economic Planning) tool (overviewed in Peek and Abrahams, 2005), which tracks whole farm cash flow for up to 50 years. For each model farm the financial position under its current farming system was compared in the presence and absence of climate change. Sensitivity of the system to changes in production outputs, prices and costs was also assessed. Changes in agricultural production on the model farms were then scaled up to reflect the potential impact on the regional economy.

Potential adaptive strategies to cope with climate change predictions were evaluated using STEP and the production thresholds required to achieve profitability were determined. Adaptation strategies ranged from ways to maximize the profitability of cropping in the face of declining rainfall to changing the enterprise mix on the farm.

Use of this new approach has provided a picture of the potential impact of climate change in our region and has allowed us to assess alternative land uses and production thresholds required to make these work. It has highlighted the gaps in our research and knowledge of potential alternative enterprises and thereby contributed to the development of the Department of Agriculture and Food's strategic direction for the NAR in the face of climate change.

References

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NCCARF Terrestrial Biodiversity Adaptation Research Network

Lesley Hughes

Terrestrial Biodiversity Adaptation Research Network Co-convenor, Dept of Biological Sciences, Macquarie University.

Abstract

The Terrestrial Biodiversity Adaptation Research Network (TB ARN) is funded under the auspices of the National Climate Change Adaptation Research Facility (NCCARF). Its overarching goal is to provide decision makers with the information to develop and implement strategies that will promote adaptation to climate change in terrestrial ecosystems. This goal will be achieved by (i) promoting development of explicit and practical strategies that will increase resilience in terrestrial ecosystems, (ii) promoting strategies to maximize the adaptive potential of terrestrial ecosystems in the face of climate change and (iii) fostering of an inclusive collaborative research environment.

The network has two convenors (Steve Williams, JCU and Lesley Hughes, Macquarie) and a 14-member steering committee. The network is structured around 8 regional nodes covering all states and territories. The network currently has nearly 400 members, including participants from 37 Universities, 59 government agencies, 5 research organisations and 13 NGOs.

Network members receive bimonthly email updates about activities, and quarterly e-bulletins. The network website has been live since July 2009 and contains information on the network structure and subscriptions; priorities and goals; funding and job opportunities; downloadable resources and the National Adaptation research Plan (NARP).

During 2009 the network's activities have included: preparation of information sheets and network pamphlets, hosting international visitors, hosting symposium at INTECOL, thematic workshop on conservation planning, preparation of 'road show' material, preparation of regional databases of stakeholders contacts, awarding honours and masters project funding, awarding PhD collaborative travel grants, and the development and collation of resources and databases on the website. These activities will be further developed in 2010, with the addition of two more thematic workshops.

Climate Adaptation: Forest, Woodland and Shrubland Health in Southwest Western Australia

Giles Hardy¹, Neal Enright¹, Tom Lyons¹, Bernie Dell¹, Paul Barber¹, Katinka Ruthrof¹, Sue Moore¹, Trish Fleming¹, Catherine Baudains¹, Brad Evans¹, Kobus Wentzel¹, Renato Schibeci¹, Richard Hobbs², Erik Veneklaas², Pieter Poot², Michael Renton².

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² *School of Plant Biology, Faculty of Natural and Agricultural Sciences, University of Western Australia, Crawley, Perth, Western Australia 6009.*

Abstract

Forest, woodland and shrubland declines are widespread and in many cases severe in Western Australia and elsewhere in temperate Australia. The causes are often complex, poorly understood and include: declining rainfall, changes in groundwater levels and quality, pathogens and pests, excess nutrients, salinity, changing fire regimes, and weed competition to name a few. This presentation reviews current projects by members of the State Centre of Excellence on Climate Change Woodland and Forest Health and other researchers based at Murdoch University. The Centre, a co-operative venture with the University of Western Australia, the Department of Environment and Conservation and approximately 26 other partners, has four key Research Programs: Climate Change, forest and woodland declines; Decline Ecology; Restoring Biodiversity Values, and Education, Training, Communication and Policy. The aim of the Centre is to bring together multi-disciplinary teams of research scientists to (a) determine the factors that contribute to declines, (b) determine how they interact with climate change, (c) develop adaptive management strategies to mitigate the declines and to restore ecosystem function and health, and (d) work with agencies, industry and the wider community to ensure research findings are rapidly and effectively implemented through policy, legislation and community engagement.

Keywords: Climate Change; Remote Sensing, Restoration, Fauna, Flora

Climate change adaptation and Australia's water resources and freshwater biodiversity

Stuart E. Bunn¹ and Brendan Edgar²

¹ Australian Rivers Institute, Griffith University, Nathan, QLD, 4111 (s.bunn@griffith.edu.au);

² Edgar and Partners Pty Ltd, ACT 2614 (b.edgar@homemail.com.au)

Abstract

Our planet is facing a water crisis, not only in relation to public health and the environment but increasingly in other key sectors such as agriculture, energy and mining. While much of this emerging crisis is the direct result of population growth and rapid economic development, some is driven, or at least exacerbated by, climate pressures. Current water management practices are unlikely to be adequate to fully mitigate the negative impacts of climate change on water supply reliability, flood risk, human health, energy production and aquatic ecosystems. This is evident in the National Water Commission's 2009 Biennial Assessment, which highlighted that climate change has raised the bar on the water reform process. Few water plans in Australia explicitly deal with climate change and it is apparent that the environment is a big loser in times of drought because environmental water entitlements lack security. There is an urgent need to understand the risks to Australia's surface and groundwater resources and freshwater biodiversity due to climate change (in the context of other pressures) as well as the technical and policy interventions that will be required to meet future human water needs without further degrading freshwater ecosystems and the important natural assets and values they provide. The Water Resources and Freshwater Biodiversity adaptation network brings together Australia's top water scientists with interests and skills in water resources and freshwater biodiversity, and the implications of climate change. The network is supported by over 20 partner research institutions from across the country and aims to: facilitate the development of collaborative and cross-disciplinary research at the national scale; build research capacity through support and mentoring of early career scientists; and synthesise relevant knowledge to give Australian water and biodiversity managers the best chance of coping with a difficult climate future.

Climate change impact on WA wetlands and waterways: current knowledge and future direction

Jane Chambers¹, Peter Davies², Jenny Davis³, Frances D'Souza⁴ and Michael Coote⁵

¹*Murdoch University*, ²*The University of WA*, ³*Monash University*,

⁴*WA Department of Water*, ⁵*WA Department of Environment and Conservation*

Abstract

The large geographic range of Western Australia (14° to 35° south) places it a number of climate zones from Mediterranean in the southwest, across the dry interior, to the summer wet and winter dry in the north. There is a huge diversity of wetlands and waterways across this landscape and while predictions of climate change suggest all of the state is likely to get warmer, predicted changes in rainfall are more variable. Biodiversity hotspots in the south-west are faced with increases in temperature that may prove fatal to our cold-adapted fauna, especially where rivers are modified through clearing. Long term datasets of wetlands on the Swan Coastal Plain show a decline in invertebrate species richness with decreasing rainfall. Climate change adaptation depends on our understanding of these changes across the state. NCCARF (WA node of Water Resources and Freshwater), Department of Water and Department of Environment and Conservation have joined together to organise a workshop and forum on climate change in WA in early 2010 to:

1. understand what is currently known and what current research is being undertaken on the effects of climate change on wetlands and waterways in WA and to
2. provide direction and priorities in research, management and policy in response to the impact on these ecosystems.

Adaptation Research Network for Marine Biodiversity & Resources

Neil J. Holbrook^{1,2}

¹ *Convenor, Adaptation Research Network for Marine Biodiversity and Resources*

² *School of Geography and Environmental Studies, University of Tasmania, Hobart Tasmania 7001*

Australia's Adaptation Research Network for Marine Biodiversity and Resources (ARN-MBR, or simply the Marine Adaptation Network) aims to build adaptive capacity and adaptive response strategies for the effective management of Australia's marine biodiversity and natural marine resources under climate change. The network comprises a holistic framework that cross-cuts climate change risk, marine biodiversity and resources, socioeconomics and policy, and includes ecosystems and species from the tropics to Australian Antarctic waters. It is framed around five interconnecting marine themes (integration, biodiversity and resources, markets, communities, and policy) that considers, responds to, and addresses cross-cutting issues and feedbacks between the themes. The governance structure provides the mechanism to encourage interdisciplinary collaboration, data-sharing, communication and education, and the synthesis and advancement of climate change adaptation knowledge so that policy and decision-makers can develop appropriate climate change adaptation strategies to build adaptive capacity. Initiatives include the synthesis of existing and emerging research, promotion of a meta-data repository for data-sharing across all marine disciplines, development of interactive tools (e.g. searchable on-line databases; case studies; research project links; stakeholder toolkits responding to climate change risks), publications including the quarterly Marine Adaptation Bulletin and information sheets, and summer/winter schools for post-graduates and early career researchers. The network structure and network activities, plus some recent research by the network's Western Australian partner institution, the Western Australian Marine Science Institution (WAMSI), will be outlined in this presentation. For more information regarding the Marine Adaptation Network, please visit <http://www.nccarf.edu.au/marine/> or email arnmbr@arnmbr.org.

Keywords: Marine Adaptation Network; holistic framework; climate change risk; adaptive capacity; biodiversity and resources; socioeconomics and policy; WAMSI.

Climate change effects on fisheries: implications for management

Nick Caputi, Rod Lenanton and A. Pearce

Western Australian Fisheries and Marine Research Laboratories, Department of Fisheries, PO Box 20, North Beach, WA 6920, Australia.

Abstract

The approach adopted for assessing climate change effects on fisheries was: (a) understanding of the key environmental trends occurring in the marine environment; (b) determining the effect environmental variability is having on fish stocks using some case studies; (c) examining the historical variability of these environmental variables; (d) assessing the likely future trends of these environmental variables (e) hypotheses on the effect of these trends on the fisheries can then be developed. The initial focus of this study was on (a) to (c). Climate change studies in WAMSI and the Indian Ocean Climate Initiative can then be examined to assess how these environmental trends may change in the future. Some of the key environmental trends that may be affecting fish stocks of WA include: (a) increasing frequency of ENSO events; (b) more years with weaker Leeuwin Currents; (c) increase in water temperature off the lower west coast of WA, particularly in autumn-winter; (d) increase in salinity with large annual fluctuations; (e) change in frequency and location of storms (and rainfall) affecting the lower west coast of WA; and (f) change in frequency of cyclones (and summer rainfall) affecting the north-west of WA.

The western rock lobster fishery has long-term time series (about 35-40 years) in a number of biological variables as well as juvenile abundance, which makes it one of best candidates to study climate change effects on a fishery in Australia. Climate change effects such as increasing water temperatures over the last 30-35 years may have resulted in a decrease in size at maturity, decrease in the size of migrating lobsters from shallow to deep water, an hence an increase in abundance deep water relative to shallow water. Some of these changes (such as the increasing frequency of El Niño events) may have negative implications on the western rock lobster fishery but others such as increasing water temperature may have some positive influence.

The possible climate change trends identified for some fisheries can have significant effects on the stock assessment and management of the fisheries. The changes in some of the biological parameters (e.g. size at maturity) of the rock lobster stocks since the 1970s have been included in the population dynamic model of the fishery which generally have a stationarity assumption of parameters. Long-term changes in the abundance of fish stocks, particularly declines, requires an appropriate adjustment of fishing effort or catch quota, for the stocks to be managed sustainably. Changes in the spatial distribution of fish stocks poses some interesting policy dilemmas to evaluate when there are fixed management boundaries. Does fisheries management maintain the current zone structure and recognize that there could be some long-term 'winners' and 'losers' in that situation or does it adjust the management to maintain some historical equity in the system? These case studies highlight the value of long-term time series in fisheries and environmental in assessing the effect of climate changes on fisheries.

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