Hon. Bob Debus (MP)

NSW Minister for the Environment

The Hon. Bob Debus is the Attorney General for NSW, NSW Minister for the Environment, and NSW Minister for the Arts and he is going to officially welcome you all and open the Great Greenhouse Gamble.

Professor Ian Lowe AO
Keynote Speaker

President Australian Conservation Foundation

Ian Lowe is an emeritus professor at Griffith University, an adjunct professor at Sunshine Coast University and QUT, an honorary research fellow at the University of Adelaide and a consultant to CSIRO Division of Sustainable Ecosystems.

Professor Lowe was made an Officer of the Order of Australia in 2001 for services to science and technology, especially in the area of environmental studies. In 2002 he was awarded a Centenary Medal for contributions to environmental science and won the Eureka Prize for promotion of science. His contributions have also been recognised by the Prime Minister's Environment Award for Outstanding Individual Achievement, the Queensland Premier's Millennium Award for Excellence in Science and the University of NSW Alumni Award for achievement in science. Professor Lowe was named Humanist of the Year in 1988. Professor Lowe has been a referee for the Intergovernmental Panel on Climate Change, attended the Geneva and Kyoto conferences on climate change and was a member of the Australian delegation to the 1999 UNESCO World Conference on Science.

Dr David Jones

Head of Climate Analysis Section
National Climate Centre
Bureau of Meteorology

Dr David Jones is the head of Climate Analysis and Prediction at the National Climate Centre of the Australian Bureau of Meteorology. The group he heads is responsible for monitoring Australian climate variability and change, the development and update of a range of climate change datasets, and seasonal through to interannual climate prediction.

He has a PhD in Earth Sciences (meteorology) from the University of Melbourne, and a Graduate Diploma in Meteorology from the Bureau's training school. He has published widely on Australian climate and global climate dynamics, participates in several intra-governmental climate advisory committees and is an invited expert reviewer for the 2007 IPCC assessment report.

Observed and Projected Climate Change for Australia

The past few years have seen a rapid advance in our understanding of climate change, with a veritable flood of new observations and scientific papers. These have revealed the pervasiveness of global warming. Recent warming has been shown to extend throughout the depth of the troposphere (up to altitudes of 10-15km), and to have penetrated well into the deep ocean. In recent times, numerous studies have used proxy indicators such as isotope ratios, growth rings in trees, and pollen to map pre-historic climate variability. Such paleoclimate studies reveal that the warming since 1900 is probably unprecedented in the last two millennia, and that near-global temperatures during the last decade have been higher than at anytime since at least 200AD. To climate scientists, the degree and rapidity of recent climate changes is not surprising, as the combined radiative forcing associated with the enhanced greenhouse effect greatly exceeds any forcing which has occurred in at least 1000 years.

To foster an increased understanding of climate and climate change science and to provide best guidance for future adaptation and mitigation options, the world's largest ever co-operative scientific review, involving some 2500 international scientific experts, was commissioned by the World Meteorological Organisation/United Nations - the Intergovernmental Panel on Climate Change (IPCC). The most recent climate change assessment by the IPCC was published in 2001, with the next update currently being prepared and due for publication in 2007. Based on evidence available at the time, the 2001 report concluded that "most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations".

To better understand climate change over Australia, the Bureau of Meteorology, in collaboration with CSIRO and the Australian Greenhouse Office, has been very active in the development of several "high-quality" climate datasets for describing climate trends. Observational records in these datasets have been adjusted for artificial discontinuities associated with changes in site location and exposure, observation practice and instrumentation. These data have revealed a warming of Australian temperatures since 1910 of approximately 0.9ºC (slightly larger than the global average), with an increase in the frequency of hot days, hot nights, and heatwaves, and a decreased frequency of cold days and cold nights, increases in heavy rain events, and decreases in spring-time snow depth in the Snowy Mountains. Key results drawn from analyses of these Australian datasets, in combination with projections for the future, will be presented and discussed.

Dr Roger Jones

Principal Research Scientist
CSIRO Marine and Atmospheric Research

Dr Jones is a principal Research Scientist in the Climate Impacts and Risk Group of CSIRO Marine and Atmospheric Research. He specialises in the development of risk management methods for coping with climate change. These methods have been applied in a variety of national and international projects assessing water, agriculture, biodiversity, economics, adaptation to climate change and the benefits of climate policy. Dr Jones is currently a convening lead author for the IPCC Fourth Assessment Report.

Betting against biodiversity – weighing the long-term benefits of climate policy against the short-term risks

The risks that climate change poses to species and ecosystems are becoming clearer, as are the methods of treating those risks. Negative impacts become larger and more widespread with increases in global warming, implying that serious impacts may affect many ecosystems by the end of the century. Where a relationship can be established between global warming and impacts it is possible to estimate the likelihood of exceeding specific thresholds at some given time in the future. Such exercises have been carried out for coral reefs, bioclimatic envelopes of selected animal and plant species and other species and communities with strict eco-physiological limits. This has been less successful for impacts linked to extreme events, such as drought and fire, where a more qualitative understanding is the norm. The rate of climate change can also exceed the ability of organisms to adapt naturally, whether in situ or through migration.

Methods of risk treatment include adaptation to climate change, the mitigation of climate change through the abatement of greenhouse gases or through their sequestration and by improving adaptive capacity. Mitigation and adaptation are complementary in the way they reduce risk. Mitigation successively reduces the most extreme impacts over time, but long delays between emissions and impacts means that its benefits are slow in coming. Adaptation helps species cope with changing climate but has its limits. Here the difference between developing adaptive capacity and adaptation is that the former works to maximise potential, while the other works to realise that potential. Improving adaptive capacity provides the space for ecosystems to adapt naturally, exercising the significant resilience that they have shown in the past when responding to environmental change. Planned adaptation is the effort that society makes to reduce the impacts of climate change on biodiversity.

For natural ecosystems to adapt naturally to climate change and avoid “dangerous” outcomes, all three risk treatment measures need to be implemented. Both adaptation and improvements in adaptive capacity can provide many short-term benefits, but the benefits of mitigation in terms of biodiversity are more long term. Mitigation creates a significant difficulty for policy, which is focussed on short-term economic losses (and gains) rather than the long-term benefits to ecosystem services and ecological amenity. This is an expected outcome of human behaviour. People give losses more than twice the weight of gains and engage in hyperbolic discounting, where the future is worth much, much less than today. These heuristics, or rules of thumb, are accentuated by our political structure which focuses on the short-term. Climate policy would profit from assessing risks to biodiversity within a structured decision-making environment that weighs these risks more evenly rather than on an ad hoc basis, so that the long-term benefits of climate policy are not decided on the toss of a coin.

Ben Pearson

Climate and Energy Campaigner
Greenpeace Australia Pacific

Ben Pearson has worked on energy issues for the past 12 years. From 1993-96 he worked as a nuclear campaigner for Greenpeace Australia, then from 1997-2000 as a nuclear campaigner for Greenpeace International. During that time he worked on the campaign to keep nuclear power out of the Kyoto Protocol's flexible mechanisms, which was finally achieved in 2001. In 2001 Ben set up CDM Watch in Indonesia, a watchdog and capacity building organisation focussed on the Kyoto Protocol's Clean Development Mechanism (CDM). In 2005 he joined Greenpeace Australia as a climate and energy campaigner.

The climate disconnect: As the world warms the policy response cools

Over the past 20 years the evidence for anthropogenic climate change has mounted, and is now beyond doubt. Alongside that, media attention to the issue has also increased, as has public concern. Yet in the same timeframe, the international response to climate change has not intensified to match the scientific certainty and public concern, and arguably has actually weakened. A retrospective look at the emergence of the UNFCCC and Kyoto Protocol, and the variety of regimes that are now being proposed as successors to the KP bears this out. The disconnect between the reality and the policy response has most accurately been manifested in Australia, where the Government has simultaneously released research showing Australia's acute vulnerability to climate change while denying climate change exists in the Federal Court, and attempting to undermine the Kyoto Protocol internationally. How did this policy disconnect come about, and how can it be dealt with?

Ary Hoffman

Federation Fellow
Centre for Environmental Stress and Adaptation Research
The University of Melbourne

Professor Ary Hoffman is a Federation Fellow at the University of Melbourne. His research addresses the way organisms (and in particular insects) deal with environmental stresses. He has published extensively on the genes involved in adapting to warming and cooling environments, and the way stressful environments influence rates of evolution. His research has led to new methods of using genes and insects to monitor for environmental pollutants, new ways of controlling pests, and new ways to promote the conservation of species threatened by climate change. In 2000 he obtained a grant from the Australian Research Council to establish a Special Research Centre, the Centre for Environmental Stress and Adaptation Research. He has gained several awards including the Dobzhansky Prize, election to the Australian Academy of Science, and the Mackerras Medal from the Australian Entomological Society. He is on the Editorial Review Board of *Science* and other journals and is currently President of the Genetics Society of Australia and international Vice-President of the Society for the Study of Evolution.

Climate change: can evolution counter its impact on organisms?

For several species there is now good evidence that distributions have been changing over the last few decades as a consequence of climate change. Yet shifts in distributions might not occur if species evolve to counter new environmental conditions. In several widespread insects and plants, there is good evidence that populations vary genetically in their ability to deal with climatic stress.

Genetically-determined gradients in traits like desiccation resistance and thermal resistance across latitudes and altitudes indicate that recent evolutionary shifts have taken place to counter stress within species. A few studies that span several decades have now also shown that populations of widespread species can rapidly adapt to climate change at the genetic level. DNA markers of specific genes might even act as monitors of climate change; for instance, there has been an impact of increasing temperatures and decreasing rainfall along the east coast of Australia over the last 20 years on the genetic constitution of *Drosophila* vinegar flies. However, the evolutionary potential of species with restricted distributions is likely to be much more limited than those with widespread species.

In restricted species, levels of genetic variation will often be low because of small population sizes, decreasing their evolutionary potential. Moreover, if small populations suffer from inbreeding, they are likely to be particularly sensitive to climate change because inbreeding increases susceptibility to stressful conditions. Genetic data also suggest that even when restricted species are genetically variable, they may not be able to adapt to climate change. Selection experiments on rainforest insects suggest that they cannot evolve and adapt to the dry conditions to which they are particularly susceptible. It is therefore unclear if there is much evolutionary potential for adaptation, although practical steps can be taken to maximize the limited potential that is likely to be available, and more evolutionary studies need to be undertaken on species from threatened habitats.

Tony Slatyer

First Assistant Secretary, Land Water and Coast Division
Australian Government
Department of the Environment and Heritage.

Tony Slatyer is the First Assistant Secretary (FAS) who leads the Land, Water and Coast Division in the Department of Environment (DEH) and Heritage.

The principle responsibilities of this Division are to:

- Provide government policy advice on NRM issues as they effect the environment such as native vegetation, water reform, land clearing and forestry;
- Administer national land, water and coastal projects funded through national component of NHT and other portfolio programs such as the Biodiversity Hotspots and Great Barrier Reef coastal wetlands and structural adjustment programs; and
- Assist Ministers and represent DEH at national and international forums.

Tony has worked within the Australian public service since 1979 in a range of roles for various departments including the Department of Transport and Regional Services (DOTARS) and Department of Agriculture, Fisheries and Forestry and in the mid-1990's Tony worked as the Deputy Secretary General for the South Pacific Forum.

Abstract

The Natural Resource Management Ministerial Council (NRMC) agreed the *National Biodiversity and Climate Change Action Plan 2004-2007* (the Plan) in 2004.

The plan has been developed in response to a number of Australian Government commitments including:

- as a key objective of the *National Strategy for the Conservation of Australia's Biological Diversity (1996);*
- as a key action in the *National Objectives and Targets for Biodiversity Conservation 2001-2005 (2001)* ;

In its Third Assessment Report (2001a,b), the Intergovernmental Panel on Climate Change (IPCC; convened under the United Nations Framework Convention on Climate Change) highlighted the need for countries to develop climate change adaptation strategies in addition to greenhouse gas emission reduction programs.

The focus of the Plan is on research, integration, capacity building and education. The Plan outlines a number of actions to improve our understanding of the capacity of Australia's natural systems to adapt to anticipated climate change. The Plan also provides a framework to formally consider the implications of climate change on NRM/biodiversity policies, strategies and programs.

A Climate Change in Agriculture and Natural Resource Management Working Group has been set up under the NRMMC to implement the Plan. The Australian government is also implementing National Climate Change Adaptation Programme, which is looking at piloting regional adaptation case studies to explore possible integrated solutions to addressing climate change impacts at a regional level.

Dr John Merson

Executive Director
Blue Mountains World Heritage Institute

Dr Merson is the Executive Director of the Blue Mountains World Heritage Institute, an interdisciplinary research agency concerned with environmental policy and management in the Blue Mountain & Sydney Basin region. He is also coordinator of the graduate research program in Environmental Policy and Management at the University of New South Wales.

Climate change induced increase in the frequency and intensity bush fires and the implications for biodiversity and natural resources management in the Sydney Basin region.

This paper will argue that under the present climate change models (IPCC & CSIRO), rising temperature and declining rainfall in the South East and South West of Australia will significantly increase the frequency and intensity of forest fires in the eucalypt forests of these regions. The paper will focus on the possible impact on the Blue Mountains World Heritage Area, and the implications for biodiversity and ecosystem services in the Sydney Basin region. It will also provide some comparisons to similar problems faced by Mediterranean countries and the south-west USA, and some possible mitigation strategies.

Dr Ian Mansergh

Manager, Biodiversity Conservation Strategies
Department of Sustainability and Environment, Victoria

Abstract

Ian Mansergh [1] and David Cheal [2] and Nevil Amos
[1] Department of Sustainability and Environment and [2] ARIER

Climate change (global warming) is happening. Atmospheric concentrations of CO_2 are increasing, with the rate of change being unprecedented for at least 400,000 years (IPCC 2002). Species' and community's distributions and abundances are changing in response to climate change. The predicted climate change threatens biodiversity assets and related ecosystem services at the global scale, with between 15-35% of species at risk of extinction (Nature 2004) and Australia is at the upper level of risk (Brereton *et al* 1995). Greenhouse debates of the 1990's emphasised amelioration of the causes (e.g. $C0_2$ emissions) but now encompass a two-tiered response - including adaptation. Adaptation for natural systems is a profound challenge for the 21st Century and inter-generational equity (Brandtland Commission, 1987).

With warming, the theoretical and modelling evidence suggests species and communities may move to "cooler" areas, ie higher latitudes (southward in Australia) and upward in altitude (Peters and Darling 1985, Brereton *et al* 1995). Recent genetic studies reveal at least one Australian species has already "moved" commensurate with climate, -4^0 in latitude over the last 30 years (Umina et al. 2005). Changing species distributions is part of evolution. However, the predicted rate of change in eastern Australia is happening rapidly across fragmented and modified habitats. Bluntly, lack of appropriate living space will progressively inhibit the capacity for evolution and survival (adaptation) of our biota.

The primary conservation pillar, a comprehensive, adequate and representative (CAR) reserve system, is challenged as changing distributions effect the long term capacity to protect biodiversity assets (primary purpose). Furthermore, what we now define as vegetation communities (surrogates for habitat) will reconfigure into new amalgams. Maximising the resilience (health) of the reserves provides a time buffer. Nevertheless, the inevitability of change requires a move from a static (cadastral view) to a long-term, landscape approach. In order for the areas between these reservoirs to maintain some ecological capacity to allow for large-scale climate change, migration space is required. These living spaces have been termed "biolinks".

In eastern Australia, migration will occur across the mostly highly fragmented and alienated landscapes on the continent. The historic land-use and management trends in this region have developed in different climatic zones. A sub-continental cross-section (from coast, foothill, montane, foothill, plain and semi-arid zones) suggests that the biota will face diverse challenges and we have various opportunities to assist in the provision of living space. Within this context, this paper examines:

- the ecological need and principles for biolinks in eastern Australia
- the historical land-uses / drivers and emerging scientific trends in land use and management;
- current socio-economic drivers of land-use change in rural eastern Australia, in the light of the constraints and opportunities presented by biolinks for biodiversity conservation.

Assoc/Prof. Sharon Robinson

Director of the Institute of Conservation Biology and Law
University of Wollongong

Associate Professor Sharon Robinson is Director of the Institute of Conservation Biology and Law at the University of Wollongong. She has lectured in Plant Ecophysiology at Wollongong since 1996. Prior to that she held postdoctoral positions at the Research School of Biology at ANU and at Duke University in the USA. She was awarded a PhD in Plant Biochemistry from University College London in 1990.

Since 1996 she has actively researched the response of Antarctic plants to environmental change with funding and logistic support from **Australian Antarctic Science Grants**.

Sharon's research group is investigating;

- how changes in water and nutrient availability will affect plant growth in Antarctica
- the impact of the ozone hole and the resultant increase in UV-B radiation on these communities (sunscreen pigments, DNA damage and persistence of genetic mutation in Antarctic plants).
- assessing the practicality of using remote sensing to map and monitor vegetation change on subantarctic islands

How is climate change affecting Antarctic Plant Communities?

Sharon A. Robinson, Jane Wasley, Johanna D Turnbull, Jodie Dunn
Institute of Conservation Biology and Law, University of Wollongong, Northfields Ave., NSW 2522

Antarctic plants are exposed to a highly seasonal, rapidly variable and often extreme climate with frequent sub zero temperatures, an intermittent water supply and almost continuous sunlight. These severe environmental conditions limit plant life to small, nonvascular plants such as mosses and lichens. Global climate change has the potential to increase temperature, and alter the availability of water and nutrients to Antarctic organisms. Additionally, recent ozone depletion has resulted in elevated levels of potentially damaging ultraviolet-B radiation early in the growing season, with Antarctic plants exposed to the largest relative increase in UV-B exposure on Earth.

Our work is investigating the impact of climate change on 3 moss species that are found within the Australian Antarctic Territory around Casey Station. Separate trials have investigated the impact of increasing water and nutrient availability and the impact of current levels of UV-B radiation on these mosses. Our results show that several communities are currently nutrient limited and this is likely to limit their ability to respond to climate change. Changes to water availability will alter the balance between moss and lichen communities in this region and also the composition of species within the moss communities. We have also shown that the 2 cosmopolitan moss species, *Ceratodon purpureus* and *Bryum pseudotriquetrum* are more tolerant of current levels of UV-B radiation than the endemic species *Grimmia antarctici*. Given that several cosmopolitan Antarctic bryophytes possess UV-B absorbing pigments that should offer better protection under ambient UV-B radiation, these findings suggest *G. antarctici* may be disadvantaged under a climate with continuing high levels of springtime UV-B radiation. Climate change is thus likely to influence biodiversity in Antarctica with severe consequences for some endemic species.

Kerry Bridle

Research Fellow
School of Geography and Environmental Studies
University of Tasmania

Kerry Bridle is a research fellow in the School of Geography and Environmental Studies, UTAS. She is an ecologist who completed a Masters of Environmental Studies on the organic soils of south-west Tasmania in 1994. More recently, she was employed as a peatland ecologist for the Department of Primary Industries, Water and Environment. The report '*Peatland hydrology, fire management and Holocene fire regimes in southwest Tasmanian blanket bogs'* (K. Bridle, P. Cullen and M. Russell) was published by the Department in 2003.

Impacts of Climate Change on Tasmanian Peatland Ecosystems, the Challenge of Managing for Today and for the Future.

Bridle, K and Russell, M.
School of Geography and Environmental Studies, University of Tasmania.

It is estimated that up to a third of the world's carbon is stored in peatlands. Tasmanian peatland ecosystems cover approximately 40% of the State, much of which lies in the Tasmanian Wilderness World Heritage Area (WHA). The peatlands of the WHA are dominated by buttongrass, a pyrogenic vegetation type that ranges from valley bottoms to steep slopes and subalpine environments. They are not topographically confined and are regarded locally as blanket bogs. Blanket bogs occur in regions where rainfall is high, mean temperatures are relatively low and relative humidity is high. Tasmanian blanket bogs are at the climatic limit for blanket bog formation. The shallow, well humified, peat profiles are often dry for much of the summer, therefore it is highly likely that these peat deposits are carbon sources rather than sinks, especially during the summer months. The extent of buttongrass moorlands is considered, by some, to be an artefact of aboriginal burning practises. Current fire management is centred on fuel reduction burns in the moorlands in an attempt to reduce the risk of wild fire escapes into fire sensitive rainforest and alpine vegetation. In this paper we present climatic data that illustrates that these peatlands are likely to be under threat from increased temperatures. We also discuss the possible role of fire in maintaining/destroying current peat profiles, and whether changes to fire management can mitigate the impact of increased soil temperatures on carbon release.

Linda Beaumont

PhD Student
Climate Change Ecology Group
Department of Biological Sciences
Macquarie University

Linda Beaumont is a PhD candidate in the Department of Biological Sciences, jointly supervised by Dr Lesley Hughes and Dr Michael Poulsen. The aims of her PhD are to detect the extent to which climate change has already had an impact on Australian birds and butterflies, and to use computer models to predict future possible impacts. Since 2001 she has been engaged in teaching a variety of classes at Macquarie University, including Geographic Information Systems, and Ecology.

A Matter of Timing: Changes in the Arrival and Departure Dates of Australian Migratory Birds.

Linda J. Beaumont, Ian McAllan, Lesley Hughes.
Plant-Insect, Climate Change Ecology Lab, Department of Biological Sciences
Macquarie University

Phenology is the study of annual cycles of plants and animals, such as migration dates, nesting of birds, emergence of insects, and flowering of plants. It has long been known that the timing of these events is linked with climate. In recent years, as global temperatures have changed, so too has the phenology of a wide range of species, with there being a clear trend toward the earlier timing of spring events.

In this study we assess whether the arrival and departure dates of migratory birds in south-east Australia has changed since 1960. Data were compiled from journals, published Bird Reports and observations supplied to us by individuals. We obtained records of the first date of arrival for 24 species. Of these, we gathered records from more then one location for 12 species, enabling us to examine a total of 45 arrival datasets. Similarly, we obtained data on departure dates for 15 species, five of which we had data from more then one location, enabling us to examine the last date of departure for 21 datasets.

We found that 33% of datasets (represented by 50% of the species studied) show a significant trend toward earlier arrival, while only one dataset showed a significant delay. On average, the migratory birds included in this study are arriving 3.5 days per decade earlier since the 1960's. Similarly, 19% of datasets (27% of species studied) show a significant trend toward later departure, while one species has shown a significant trend toward earlier departure. The average delay of departure across all datasets is 5.1 days per decade. Regressions of climate variables against year show that across all sites average seasonal maximum and minimum temperatures have increased by 0.2ºC and 0.12ºC per decade since 1960, respectively.

The patterns of change in the date of arrival and departure of Australian migratory birds are of a similar magnitude to changes undergone by Northern Hemisphere species, and suggest that the modest warming experienced so far has already had a significant biological impact.

Monica Morgan

Yorta Yorta Woman
Project Worker
Murray Darling Basin Commission

Monica Morgan is a Yorta Yorta woman, a mother of four children and grandmother of three. Monica is Co-ordinator of the landmark Yorta Yorta native title claim and has been centrally involved in the native title and agreement-making process from the claim's foundations in 1994, unsuccessful High Court appeal in 2002, subsequent Co-Operative Management Agreement with the State of Victoria and pending submission to the United Nations Commission on Human Rights.

Monica has been a Project Worker for the Murray Darling Basin Commission, Coordinator of the Yorta Yorta Nation Aboriginal Corporation and is currently a researcher for the Yorta Yorta Nation.

Dr Tom Okey

Senior Quantitative Marine Ecologist
CSIRO Marine and Atmospheric Research

Dr. Okey is a Senior Quantitative Marine Ecologist with CSIRO Marine and Atmospheric Research. Over the last 17 years, his work has focused on the effects of human activities on the structure and resilience of marine communities. His background in benthic (sea floor) community ecology and disturbance ecology has allowed him to contribute an ecosystem perspective to traditional fisheries science and management as the transition to Ecosystem-Based Fisheries Management is made around the world. He has served as the chair of three conservation and natural resource management committees, and is the incoming chair of Australia's Northern Prawn Resource Assessment Group. Dr. Okey developed marine conservation policies for Pacific waters under U.S. and California jurisdiction as the Pacific Fisheries Program Director for the Centre for Marine Conservation. He is also the founder and Science Director of the public charity Conservation Science Institute. His interest in climate change effects on marine ecosystems and fisheries has led to contributions to international assessments and to engagement in published debates on emissions reduction strategies.

What is known about the vulnerability of Australia's marine fisheries to climate change?

Many recently documented changes in marine ecosystems throughout the world have been attributed to increases in atmospheric concentrations of greenhouse gasses. Demonstrated impacts of long-term climate change on Australia's fishery stocks are rare, but a developed literature does exist on the exposures, impacts, and vulnerabilities some of Australia's stocks to changes in physical and chemical aspects of marine ecosystems. These variables include rainfall/river runoff, salinity, temperature, wind and weather regimes, and sea level changes. Each fishery stock, and interrelated species, has a different potential for adaptation to directional changes in such variables. As a result, such changes can cause range shifts, reproductive disruption, local extinction, invasion of exotic species, and modification of community structure and functions. If long-term changes in climate/oceanography do considerably influence fisheries stocks, either directly or indirectly, or if such changes adversely affect components of broader biological communities that are also sensitive to fishery activities, then fisheries will face the challenge of implementing management systems that are adaptive to climate changes. Potential crises such as long-term climate change impacts underscore the necessity to view Australia's fisheries dilemmas as imbedded in the context of competing uses of shared natural resources. Drought, for example, triggers a multi-user squeeze on the fresh water that enhances marine ecosystems (and fisheries), and resulting higher demand could degrade fisheries considerably.

Alan Jones

Senior Research Scientist
Department of Marine Ecology, Australian Museum

Alan Jones was awarded his PhD in marine ecology from the University of Queensland in 1974 and joined the Australian Museum in 1975 where he has been Head of the Museum's Division of Earth and Environmental Sciences from 1991 to 2005. His interests include the ecology and management of marine and coastal ecosystems with research focussed on environmentally vulnerable areas such as the Hawkesbury River Estuary and beaches in the Sydney region. He is also interested in ecological sustainability and the environmental effects of human population growth.

Sandy-Beach Ecosystems and Climate Change: Potential Ecological Consequences and Management Implications

Alan Jones[1], William Gladstone[2] and Nicole Hacking[3].
[1] Australian Museum, [2] University of Newcastle, [3] Department of Infrastructure, Planning and Natural Resources

Sandy beaches are frequently seen as ecological deserts and have attracted little ecological research. This is unfortunate because a) they are home to numerous species with intrinsic values, b) they have important linkages with adjacent ecosystems, c) they have large socio-economic values and d) they are vulnerable to increasing human pressures including climate change. Although there are large uncertainties concerning a) the magnitude of climate changes, b) their physico-chemical effects on coastal ecosystems, and particularly c) the ecological consequences, some ecological effects of climate change are explored and management suggestions for sandy beaches are made in this paper. The former include the likelihood that the geographical ranges of some species will change, some cool-adapted species will decline in abundance, possibly to extinction, and the diversity and composition of beach assemblages will change. The most extreme effect would be the total loss of sandy beach habitat. Alternatively, in some areas, there may be a slow retreat of the coastline with few effects on beach ecosystems. Concerning management, both proactive and reactive measures are suggested although the latter are unlikely to meet stated goals of ecological sustainability. Since beach ecosystems are poorly understood even at basic descriptive levels, focussed research programmes would assist management.

Dr Neil Saintilan

Director
Environmental Restoration and Stewardship
Australian Catholic University

Dr Neil Saintilan is the Director of the Centre for Environmental Restoration and Stewardship at the Australian Catholic University. He is the President of the Australian Chapter of the Society of Wetland Scientists and Editor of Wetlands (Australia).

Regional Climate Change Impacts on Coastal Wetlands in SE Australia.

Air photograph records of the last fifty years demonstrate a dramatic decline in the area of coastal saltmarsh in the estuaries of SE Australia. The median rate of decline has been 30% for estuaries extending from Moreton Bay, Queensland, through New South Wales, Victoria, South Australia in New Zealand. The cause of decline has been primarily the encroachment of saltmarsh by mangrove, and in the light of these changes coastal saltmarsh was declared an Endangered Ecological Community in 2005 under the Threatened Species Conservation Act. Recent research has demonstrated a relationship between mangrove encroachment and relative sea-level rise across the region. Higher sea-levels, coupled with drought-related subsidence, have promoted the colonisation of saltmarsh by mangroves.

The ecological consequences of saltmarsh decline are becoming clear. Saltmarsh is the primary night-time roosting habitat for migratory shorebirds. Declines of saltmarsh are forcing shorebirds into sub-optimal roosting habitats, where they are more prone to attack from predators. Saltmarsh is now understood to be of importance to fisheries in the estuaries of NSW and Queensland, providing nutrition to many species of estuarine fish through the export of saltmarsh crab larvae.

The capacity of saltmarsh to adapt to further rises in sea-level is limited by the widespread development of coastal lowlands. Saltmarshes are likely to be the first coastal ecosystem to suffer from “coastal squeeze”, whereby declines at the seaward edge are not compensated by expansion at the landward edge, because of hard barriers emplaced to protect coastal urban and agricultural developments. Consideration needs to be given to adequate wetland buffers and possible remediation measures to promote the continued existence of saltmarsh in the estuaries of the region.

Dr Joanna Ellison

Lecturer
Environmental Science
University of Tasmania

Joanna is a lecturer in Physical Geography at the University of Tasmania. Her PhD from the University of California (Berkeley) was on sea-level rise impacts on mangroves, and she has published widely on this subject since. She is Vice Chair of the North Tasmania NRM Regional Committee, chairing the Coastal Strategy Working Group.

Impacts of climate change and sea level rise on mangroves

Australia has the third largest mangrove area in the world, covering an area of 8 195 km^2, of which 42% occur in Queensland, 36% in the Northern Territory, and 19% in Western Australia. Mangroves in Australia are valued primarily for their importance as fish and crab habitats, and outwelling of mangrove detritus has been shown to support foodchains including commercial species offshore. Mangroves also stabilize and trap sediments, lowering suspended sediment levels in coastal waters to benefit shallow water communities such as coral reefs. The mangrove biodiversity in Australia is one of the richest in the world, though the size of trees and diversity of species declines away from the northern tropics.

Climate change impacts on mangrove ecosystems are likely to be less significant than the far greater effects of associated sea-level rise. Rise in temperature and the direct effects of increased CO_2 levels are likely to increase mangrove productivity, change phenological patterns, and expand the ranges of mangrove species into higher latitudes.

IPCC projections give a global rise in sea level of 9-88 cm by 2100, an average rate of 0.9-8.8 mm a^{-1}. Mangrove forests occupy an inter-tidal habitat, and are extensively developed on accretionary shorelines, where sediment supply determines their ability to keep up with sea-level rise. Mangroves of low relief islands in carbonate settings that lack rivers are likely to be the most sensitive to sea-level rise, owing to their sediment-deficit environments

The tight control of sea-level elevation on the seaward margin of mangroves has been demonstrated by survey of marine-dominated low island mangrove systems on the Northern Great Barrier Reef. The mean elevation of the mangrove/ lagoon margins at Low Isles, Three Isles and Pipon was found to be 0.36 m below MSL, with insignificant differences in means between islands.

Mangrove response to sea-level rise has been investigated by reconstruction of Holocene analogues in the Cayman Islands, Tonga, and Bermuda. Mangrove recession events and replacement by lagoon environments are shown to occur during more rapid sea-level rise. In Bermuda, present rates of sea-level rise exceed 2 mm a^{-1}, and contemporary recession of the seaward margin of mangroves has occurred. Retreat of mangrove zones with slowly rising sea-level has also been demonstrated from the extensive coastal swamps of southern New Guinea (West Papua). This indicates that while low island mangroves are likely to be the most sensitive to sea-level rise, continental margin mangroves will also suffer disruption and retreat.

Michael Dunlop

Research Scientist
CSIRO Sustainable Ecosystems

Mike has a background in applied physics, statistics, and plant and animal ecology. He has spent most of the last five years in CSIRO specialising on the task of exploring long-term land and water futures at the national scale. In 2003/04 Mike spend six months on secondment to Environment Australia (now DEH) to assist them with the development of policy to address the impacts of climate change on biodiversity. During this time he helped Mark Howden and Lesley Hughes run a workshop on biodiversity and climate change. Mike then joined the task group that developed the National for Biodiversity and Climate Change Action Plan for the Natural Resource Management Ministerial Council.

Implications of climate change for biodiversity management
Michael Dunlop and Mark Howden - CSIRO Sustainable Ecosystems

The significant threat posed to Australia's biodiversity from climate change has been recognised for well over a decade. However, other than the listing of anthropogenic climate change as a "key threatening process" by some jurisdictions, very little attention has been given in Australian biodiversity conservation policy and practice to addressing the impacts of climate change. The release of the National Biodiversity and Climate Change Action Plan 2004-2007 by the Natural Resource Management Ministerial Council, and this conference, may indicate the tide is beginning to turn. In this presentation we describe a set of five strategies for reducing future climate impacts on biodiversity. They were developed by assessing the possible responses of biodiversity to climate and CO_2 changes and the needs and imperatives of biodiversity policy and management. The strategies were designed to build the capacity of existing conservation programs to deal in a practical way with the challenge of managing biodiversity under climate change.

1. Reassess the objectives of biodiversity conservation programs in light of inevitable changes
We suggest that two goals are appropriate for conserving biodiversity under climate change.
- in the short-term, protect species that are particularly vulnerable to climate change, and
- in the long-term, facilitate adaptation to future climates.

2. Reduce other pressures on biodiversity
This will frequently be the most effective way of increasing the resilience of species to future climates.

3. Understand and manage for climate variability
This will provide critical information about the dependence of biodiversity on climatic factors thus improving assessments of future impacts and possible adaptation actions.

4. Monitoring, research and policy development
Good links between policy makers, researchers and managers are needed so information about climate impacts is reviewed, made usable and used; and that monitoring programs are targeted and effective.

5. Reduce the magnitude of future climate change
Reducing global greenhouse gas emissions would make the tasks of preserving biodiversity under climate change and facilitating adaptation more successful and less costly.

These four *no-regrets* strategies (biodiversity will be better managed regardless of future climate impacts) and one *risk-management* strategy (the consequence of inaction is potentially very high) can be undertaken, starting today, to increase the effectiveness of biodiversity conservation in Australia under climate change. While there remain many questions about future climate change and its impact on biodiversity, uncertainty is no longer an excuse for inaction: *considering climate change can become core-business for biodiversity planning rather than an optional extra*.

Stella Whittaker

Director Environment and Conservation Policy
Department of Environment and Conservation (NSW Government)

B Hons Environmental Sciences. M Sc European Environmental Policy and Regulation

Stella has over 25 years professional experience in the environment, both in the United Kingdom and in Australia, particularly in public administration at a senior executive level. Her area of expertise is environmental and sustainable development policy, including Agenda 21. She is published widely in international journals in her field. In 2004 she joined the newly formed Department of Environment and Conservation (DEC) as Director of Environment and Conservation Policy. Before that she was Executive Director Sustainable Regions in the Victorian State Government Department of Sustainability and the Environment (DSE) where she lead the Department's sustainability, catchment planning and land use policies throughout Victoria's regional areas Sustainability and the (DSE). Previously she lead the Environment Division at Hornsby Shire Council (HSC) as Executive Director Environment. Prior to this she established the Local Government Group for the Institute for Sustainable Futures, University of Technology Sydney, where she worked with a large number of councils, State agencies and businesses. In the UK she has managed the Sustainability Unit of Manchester City Council, and worked as a Lecturer in Urban Policy Studies at Lancaster University. Over the years Stella's work has covered many aspects of environmental protection in a number of different roles and circumstances. Most notably this has included Ministerial appointment as a UK Board member and advisor to the UK National Government on European Eco-labelling, providing expert advice on triple bottom line and sustainability reporting and coordination of ISO 19001 and 14001 environmental and quality systems in Australia and Europe.

Development of State Implementation Plan in NSW

Climate change has serious impacts on biodiversity conservation in NSW. It is recognised that the State government has an essential role to play in terms of adaptation to climate change. In this talk, the speaker would like to discuss issues in relation to development of State Biodiversity and Climate Change Implementation Plan in NSW.

Up to date, NSW has made considerable progress on development of a State Implementation Plan. For example, the NSW Greenhouse Plan is in its final stage; the NSW stocktake report on implementation of the National Biodiversity and Climate Change Action Plan is completed; some research programs are being undertaken by government agencies; and contributions have been made to national research and information gap workshops. However, a number of issues have arisen eg. the variation in regional scale modelling: the great uncertainty of ecological responses at all scales; lack of knowledge on species ranges, lack of an integrated approach in planning and management systems; limited resources and the need for risk management frameworks.

In the future, arguably, State government agencies need to: analyse gaps and identify new priority actions in NSW based on the State Stocktake Report; so that we can better integrate climate change consideration into planning and management and facilitate research, monitoring and modelling. In addition we need to closely work with local governments and broad communities to expand awareness, commitment and capability in responding to the risks of Climate Change.

Peter Cosier

Deputy Director General
Department of Natural Resources

Peter Cosier became the Deputy Director General, Office of Knowledge, Science and Information of the Department of Natural Resources in February 2003, following a short stint as Director of Conservation at WWF Australia.

Peter previously spent 6 years as an advisor to the Australian Environment Minister, Senator Robert Hill, where he was responsible for the design and management of the Natural Heritage Trust, National Action Plan for Salinity and Water Quality, native vegetation and water reform, biodiversity conservation programs and international greenhouse policy.

As convenor of the Wentworth Group of Concerned Scientists, Peter led the development of the 'New Model for Landscape Conservation', which was adopted by Premier Carr as the basis for the government's $400m native vegetation reforms. He has a background in science, specialising in natural resources management and urban and regional planning and a strong interest in the long term health of Australian landscapes.

Dr Peter Cowell

Lecturer
Institute of Marine Science
The University of Sydney

Peter Cowell's research at the University of Sydney Institute of Marine Science involves modelling coastal impacts of climate change in collaboration with scientists, engineers and coastal managers from Australia, Europe and the USA.

Abstract

Governments now emphasise adaptive management in climate-change policy. For some this means business as usual ('economy first'). This approach envisages dealing with problems if and when they arise (the New Orleans model). This model is a high-risk approach both for society and nature. For example, policy that avoids 'sterilising' developable land potentially at risk from marine inundation and coastal erosion makes two negative outcomes more likely. The first is a shift in costs to future generations through eventual loss of property and infrastructure, the need for remedial engineering works, and through loss of life, health and livelihoods. The second outcome entails loss of beaches and estuarine intertidal environments, squeezed out of existence as rising sea levels encroach upon artificial levees and seawalls. Sydney Harbour has already lost 18 percent of its 1788 intertidal wetlands due to such land-reclamation works. A further 25 to 40 percent is set to be squeezed out by 2100 due to increased sea levels. At Collaroy and Belongil, seawall debates have raged over whether to preserve private property or public beaches. Until recently, the legal standing of the beaches has been subordinate.

On the other hand, a precautionary model of adaptive management means planning to avoid climate-change impacts. This model requires prediction of hazard-prone areas that should be excluded from property and infrastructure development. This model is about ensuring that future generations are spared the burden of our excesses and a legacy of environmental degradation. This objective is the intergenerational-equity plank of the precautionary principle. Pursuit of this objective requires science-based predictions, but their application is currently flawed. Traditional methods employ single best-estimates for future conditions. These predictions ignore scientific uncertainty. In risk-management terms, such an approach tacitly accepts a 50:50 chance that predictions will fail to identify areas of land subject to future climate-change impacts. Ignoring 50 percent of the risk is hardly industrial strength quality assurance.

Risk management is about quantifying uncertainty. Take sea-level rise for example. The current approach adopts the mid-range sea-level estimate for year 2100 in planning and engineering design to anticipate marine inundation and coastal erosion. The IPCC (2001, p. 642) project "a sea level rise of 0.09 to 0.88 m for 1990 to 2100, with a central value of 0.48 m" based on the range of results from climate models. From this, we currently plan for a 0.5 m higher sea level by 2100.

But this narrow approach is a gamble. The IPCC specify a range of increased sea levels to indicate predictive uncertainty. This uncertainty can be readily converted into the probabilities needed for estimating risk. Adopting the IPCC sea levels as the bounding and central values in a probability distribution gives a 50 percent risk that sea level will be 0.5 m higher by 2100. But a 50 percent risk remains that the sea will rise by more than 0.5 m: eg, there is a 10 percent probability that the sea will be 0.8 metres higher by 2100. To put this into perspective, we expect Sydney beaches to erode at least 30 metres further landward than occurs at present if sea level rises by 0.5 metres, which extends to more than 50 metres for a 0.8 metre sea level rise: a 10% risk (ignoring other effects). The upshot is, we currently accept property development on land with up to a 50% risk of loss due to future erosion. Only time will tell whether incredulity about New Orleans 2005 is a mirror on how future generations will judge of our policies and planning for climate-change impacts.

Cate Faehrmann

Director
Nature Conservation Council of NSW

Cate Faehrmann is the director of the Nature Conservation Council of NSW.

She has been active in environmental and social justice politics for more than a decade across four Australian States and also in New Zealand.

She has been a media adviser in NSW State Parliament and has also worked for the Greens party, managing media and campaigns for state elections in NSW, Victoria and South Australia. Cate also spent time in New Zealand as Campaign Manager for the NZ Green Party for their 2002 General Election.

Cate is on the Board of the Environmental Defender's Office, the Climate Action Network Australia and, more recently, the online campaigning organisation GetUp which is urging people to get active online for a more just, compassionate and sustainable Australia.

One of Cate's passions is working with other organisations and activists to build a broad-based movement around climate change.

Dr Bob Pressey

Private Consultant

Bob Pressey has been involved in conservation planning for about 25 years and, for most of this time, has led the field scientifically. He has received national and international awards for his research and applications. Regions covered by recent and current collaborative planning projects include parts of New South Wales, the Cape Floristic Region of South Africa, south-western China, and the Amazon floodplain. His continues to work with South African conservation planners, particularly Richard Cowling and Mathieu Rouget who are co-authors on this presentation.

Conservation planning for climate change: emerging methods and conflicting priorities

Bob Pressey[1], Richard Cowling[2] and Mathieu Rouget[3]
[1] Consultant, [2] Department of Botany and Terrestrial Ecology Research Unit, Nelson Mandela Metropolitan University, [3] South African National Biodiversity Institute.

Systematic conservation planning began in the 1980s with innovative methods developed in Australia, South Africa and England. Two key characteristics of this type of planning are explicit goals, usually expressed as quantitative targets, and transparent decisions about which areas should be protected. Much of the research and development in systematic conservation planning has dealt with biodiversity pattern (e.g. vegetation types, species locality records). A recent trend is an increasing emphasis on biodiversity processes or dynamics. These include population dynamics, migration, patch dynamics and, of course, climate change. Biodiversity processes present difficulties for conservation planning. Planners need to understand processes well enough to identify areas over which they operate and configure conservation areas so that processes can persist. Among the design considerations for processes are the size, shape, alignment and replication of conservation areas.

From our experience in planning for biodiversity processes, we will discuss three levels of conservation design for climate change. An example of the first comes from the Cape Floristic Region of South Africa, a global biodiversity hotspot. As part of a conservation plan for the region, we recommended conservation areas that included topographic interfaces and environmental gradients to facilitate adjustment of species ranges to changing climates. In a later exercise, two of us (MR and RC) designed “megaconservancies” for South Africa’s Thicket Biome. These were climatic gradients integrated with considerations of biodiversity pattern, habitat for space-demanding mammals, and threats to native vegetation. We have also discussed the possibility of mapping conservation value for climate change as a continuous variable across the whole landscape, including presently cleared areas. Such a measure would not be limited to discrete, predefined corridors but apply to all parts of a planning region by integrating data on climate gradients and species distributions.

Although methods for considering climate change in conservation planning are developing, a major set of issues remains unresolved. Valid considerations for conservation action include diverse aspects of both biodiversity pattern and process as well as values related to amenity and ecosystem services. Spatial priorities for these individual values typically direct conservation resources to different parts of regions. Priorities for climate change are therefore just one of the many demands on conservation resources. How should we reconcile differences between areas important for climate change and areas important for other conservation values?

Roger Lembit

National Parks Association

Roger Lembit is an independent ecological consultant. He was formerly a member of the National Parks and Wildlife Advisory Council and chaired the Council's Management Planning Sub-Committee.

Climate Change – Implications for Management of the Reserve System

Roger Lembit and Andrew Cox
[1] Ecological Consultant, [2] National Parks Association.

Some scientists claim that the reserve system is flawed as it fails to recognise that landscape scale conservation is needed if biodiversity is to be protected. This paper addresses the challenges facing a protected area system subject to rapid climatic change and variability. Mechanisms to provide for landscape scale conservation based on a core reserve system are discussed.

Using the reserve system in New South Wales, the ability of current management planning to anticipate and respond to the climate change challenge is considered. There are innovative programs being trialled by the National Parks Association of NSW which are designed to promote conservation linkages across the landscape. Future application of these programs is discussed.

The climate change management proposals for National Parks in NSW, and particularly in Kosciuszko National Park, are critically reviewed and new proposals made which could form a model for reserve system management.

The need for firm decision making on the basis of best available knowledge and the application of the precautionary principle is stressed.

Dr Stephen Williams

Principal Research Fellow
Project Leader - Climate change impacts on rainforest biodiversity
Rainforest-CRC
School of Tropical Biology
James Cook University

Dr Williams completed his PhD at James Cook University in 1998 on spatial patterns of vertebrate biodiversity. He has worked with the Rainforest-CRC on vertebrate biodiversity almost since its inception in 1995 and has continued this research theme to the present, trying to gain an understanding of the determinants and threats to rainforest biodiversity. He is now a project leader with the Rainforest-CRC examining the impacts of climate change on rainforest biodiversity and ecosystem function. He has, over the last 15 years, contributed significantly to the understanding of rainforest ecology in the Australian Wet Tropics World Heritage Area, particularly in understanding biodiversity, endemism, spatial scale, species distributions, fauna/habitat relationships, ecotones, the declines in rainforest amphibians and impacts of climate change on biodiversity. His international recognition in the field of biodiversity and climate change is demonstrated by invited participation on these topics at a number of international events including the IPCC 4th assessment procedures, UNEP DIVERSITAS, World Ornithological Congress, IUCN Vth World Parks Congress.

Macroecology in the mountains of the Australian Wet Tropics: the impacts of global climate change on rainforest biodiversity

The Wet Tropics World Heritage Area in north-east Queensland Australia was established largely to protect the high levels of endemism and primitive taxa in the regions rainforests. We will present results that suggest that tropical montane systems are severely threatened by climate change. The extent of upland forest types will shrink and become more fragmented and there will be significant changes to ecosystem processes. Bioclimatic models of vertebrate species distributions predict that climate warming could cause catastrophic losses of biodiversity. Analyses based on spatial patterns of population abundance suggest even more severe declines than the bioclimatic distribution models. However, investigation into the foraging ecology, microhabitat utilization and thermal ecology of rainforest lizards, coupled with data on ecophysiological temperature tolerances suggests that there is some scope for ecological characteristics to buffer some reptile species from increasing temperatures. Broad altitudinal patterns of species richness, local abundance and assemblage structure of rainforest birds were explored using data from extensive standardized abundance surveys throughout the region. Species richness followed a humped-shaped pattern with altitude. Species richness is a direct function of underlying net primary productivity in the uplands. We suggest that the increase in net primary productivity that could be expected in upland areas due to increasing mean temperature associated with global warming could ameliorate some of the impacts on biodiversity previously predicted that were based on spatial models of distributions and population size that did not account for species-energy relationships. However, these relationships are complex and require further investigation and considerable improvement of the empirical data on net primary productivity, the reliability of current spatial climate layers and more detailed analysis of the energy flow within different functional groups.

Dr David Hilbert

Principal research scientist and Officer in Charge
CSIRO Tropical Forest Research Centre

Dr Hilbert is a principal scientist with CSIRO Sustainable Ecosystems. Previously he was a professor in the Department of Biological Sciences, Université du Québec à Montreal and a fellow of the Centre for Climate & Global Change Research, McGill University. He has broad experience studying terrestrial ecosystems including grasslands, shrublands, peatlands, arctic tundra, boreal and tropical forests. Previous areas of research include plant growth modelling, modelling insect phenology and population dynamics, the effects of resources (especially elevated CO_2) on the allocation patterns and growth of plants, and simulation of ecosystem processes. His current research interests include climate change impacts on biodiversity, nonlinear systems dynamics, and landscape ecology.

Overview and Recommendations from the National Biodiversity and Climate Change Action Plan, Research and Information Gaps Workshop (June 2005)

David W. Hilbert
CSIRO Tropical Forest Research Centre and the Rainforest CRC
Atherton, Queensland

There are many examples in Australia, and more globally, of changes in species distributions, abundances and life cycles that are probably due to recent climate change. Experimental studies and modelling also demonstrate that a variety of ecological responses to climatic and atmospheric change are likely in the future and most responses are expected to reduce biodiversity and alter ecosystem function.

In October 2002, the Biological Diversity Advisory Council (which reports to the federal Minister of the Environment) sponsored a workshop and report that collated information about current and potential impacts, modelling approaches, and possible policy responses to global warming, including an initial assessment of information needs. That process provided input into the *National Biodiversity and Climate Change Action Plan* that was launched in late 2004. A further workshop was held recently in Canberra, June 2005, to identify research priorities related to four, key themes within the Action Plan (aquatic, marine, terrestrial ecosystems and invasive species). Scientists, natural resource managers and planners from a variety of disciplines and all states and territories, including non-government organisations, participated. This presentation will provide an overview of the information gaps and research priorities that were identified as priority investments for government, at all levels, in order to minimize threats to Australian biodiversity due to future climate change.

Georgina Woods and Paul Winn

Hunter Community Environment Centre and Rising Tide

Georgina Woods is a PhD student at the University of Newcastle. She is an environmental activist and founding member of both the Hunter Community Environment Centre and Rising Tide Newcastle -- a grassroots climate change group -- and seeks to involve biodiversity protection in her climate activism. Georgina has contributed to campaigns for the protection of forests in the Hunter Region and, more recently, in the Central West of NSW. She has also worked for marine biodiversity protection, especially in the area of fisheries management. She is currently working, with Paul Winn, for the protection of high conservation value land under the Lower Hunter Regional Strategy. Both hope to use the Strategy to prepare long-term plans for cross-landscape connection and restoration for the future and evolution of biodiversity in the Hunter region.

Paul Winn is one of the founding members of Rising Tide, and Chair of the Hunter Community Environment Centre. He has been an active environmental advocate in the Hunter for 12 years, represented the NSW Nature Conservation Council on the Lower North East Regional Forest Forum between 1996 and 1998, on the Hunter River Management Committee between 1996 and 2001, and on the Tomago Tomaree Groundwater Management Committee between 1997 and 1998. He is currently campaigning on the Lower Hunter Regional Planning Strategy for the protection of regional conservation priorities, as well as the end of Australia's fossil fuel dependence. He has degrees in Law and Science from the University of Sydney.

Changing direction: the Lower Hunter Regional Strategy as a case study in planning for a climate change future

Georgina Woods, Paul Winn and Steve Phillips

NSW is undergoing enormous changes as development pressure mounts while at the same time, climate change begins to make its presence felt. There is an investor-backed revolution radically changing how the government plans infrastructure and human settlement. While little interest is apparently being paid to stopping the practises that are causing climate change and adapting to climate change impacts, there is opportunity, while the wheels are still spinning, to take advantage of the situation and make real gains toward truly future friendly policy and planning. It is vital that environmental advocates concerned with biodiversity protection begin factoring climate change effects into their campaigns. Most of us have begun adding the words "… and climate change is happening" to the ends of our sentences, and have begun thinking in terms of the movement of ecosystems through landscapes, but the alterations in vegetation cover, rainfall and other weather patterns that our landscapes will accommodate in the next fifty to a hundred years is not yet a major component of biodiversity protection for environmentalists or governments.

While governments and businesses pride themselves on planning strategies for future economic and social threats and opportunities, there is a startling lack of such foresight paid to looming environmental crises. The Lower Hunter Regional Strategy is a case in point. In that document, major infrastructure hubs have been planned in areas that are not only covered currently by high conservation value bushland and wetland, but which may be submerged in fifty years time. Bringing the reality of the changing climate into planning Strategies like the one being prepared for the Lower Hunter will have a dual benefit. It will hopefully prevent the biodiversity protection mechanisms we have in place from being rendered wholly useless by the onset of climate change, and it may also help in the short term, contextualising the impacts of climate change, perhaps providing leverage for policy changes in other areas, like energy production and transport.

We believe that is possible to map the areas that will require protection to ensure that biodiversity in NSW can respond to climate change. Such work must become the basis for future conservation campaigns. We have used the Lower Hunter Strategy as a case study for these ideas, drawing attention to the changes required in government focus and in the focus of environmental advocates

Felicity Wishart

National Strategic Development Coordinator
The Wilderness Society

Felicity Wishart is currently National Strategic Development Coordinator for The Wilderness Society (TWS), based in Melbourne. This position coordinates campaign strategy and planning nationally, with particular focus on two emerging campaign areas for TWS – climate change and marine protection.

Prior to joining TWS, Felicity was Coordinator of the Queensland Conservation Council (QCC). Over that time, the close partnership of QCC and TWS, with other groups resulted in the success of the campaign to end land clearing and protect 20 million hectares from the bulldozers in Queensland, reducing Australia's greenhouse emissions by up to 10%. QCC was also very involved in climate campaigning, protecting Queensland's rivers and stopping sea cage fish farming in Moreton Bay.

Felicity has been involved in environmental advocacy at the state, national and international levels for 20 years. Having protested as a teenager at the Franklin River in Tasmania, she cut her teeth on the successful campaign for World Heritage Listing of the Wet Tropics and subsequently worked to protect rainforests in SE Asia. In Victoria, she worked in government, academia and with industry on diverse policy issues such as development of the National Strategy for Ecologically Sustainable Development, ecotourism, sustainable transport, 'green jobs', energy efficiency and national park management.

As someone who loves hot weather and calls Queensland home, it remains a mystery to her that she is again living in the chill of Victoria. Consequently she is delighted to travel anywhere north of Melbourne for any reason such as this conference.

WildCountry and its role in addressing Climate Change

Whilst energy production is the largest contributor of greenhouse emissions in Australia, land use change is a significant contributor. Land clearing has been contributing over 10% of Australia's emissions nationally and native forestry operations area also a net emitter. The potential for our natural ecosystems to cope and adapt to changing conditions of global warming have been severely affected by habitat destruction and fragmentation. The Wilderness Society is developing a new vision for nature, based on large-scale connections across the landscape; a science-based continent-wide approach to conservation planning to protect and restore natural ecosystems. This has the potential to both reduce emissions and better inform how we respond to human-induced climate change and to ensure the long-term survival of Australia's plants and animals.

Philip Stewart

Lecturer/Research Scientist
Applied Behavioural Ecology & Ecosystem Research Unit,
University of South Africa, and
School of Sciences & Primary Industries
Charles Darwin University

Philip Stewart has spent 24 years working in Nature Conservation in Namibia and South Africa in reserve management and research. He accepted a TAFE lecturing position with the Northern Territory University in January 1999 and coordinated the Lands, Parks and Wildlife Management Programme. In 2001 he took over co-ordinating and lecturing the Earth Sciences (HE). He is a Lecturer in Conservation & Land Management; Topical Environments; Field Studies in Tropical and Desert Landscape Processes and Coordinator Earth Sciences. School of Science and Primary Industries; faculty of Education, Health and Science, Charles Darwin University (CDU). Philip's main interests: climate modelling, precipitation and environmental change and hydrogeography. He was seconded by CDU to the Australian Federal Government (Environmental) for two days a week as an Environmental Officer to conduct environmental impact assessments on Federal Government Airports (Darwin).

(Anticipated) Climate-Change Impacts on Biodiversity of the Top End of the Northern Territory of Australia

P.Le C.F.Stewart[1], CJ de W Rautenbach, L.R. Brown & SR Vemuri

In this paper the measurements of anticipated impacts on biodiversity due to climate-change are investigated with the use of General Circulation Model (GCM) with Special Report on Emission Scenario (SRES) runs. As GCMs have coarse spatial resolutions they are limited in their application for local and regional scale impact assessments. In this study model resolutions and parameterisations of sub-grid level data for predictions of future climates and the uncertainties that exist with climate modelling are focused on with reference to Australia's climate variability and the problematic assessment of local and regional impact assessment of the Top End of the Northern Territory of Australia (TENTA).

Data of six climate models were used from the Intergovernmental Panel for Climate Change (IPCC) using emission scenarios A2 and B2 SRES for analysis. The data were statistically normalised and compared to observed climate data from nine coastal weather recording station of the TENTA. This data were used in trend analysis for past and future climate variables to 2050.

It was found that impact assessments on local scale biodiversity are not reliable due to uncertainties caused by the complexity of the atmospheric system as expressed by models, scale and parameterisations. Trend analysis on past atmospheric variables may indeed be more valuable than the use of modelling especially in capturing possible future climate change in temperatures and precipitation. However limitations of trend analysis where past trends are projected forward into future is that they are not based on future enhanced greenhouse gas forcing, changes in human population numbers and future technologies.

In spite of these limitations in impact assessments at the local scale, this study shows that the use of modelling and trend analysis give positive results when used at regional or larger scale studies and are therefore important in predicting future climatic variables. Further advancements in technologies and a greater understanding of atmospheric dynamics will result in improved modelling resolutions.

Andrew Jones

Senior Consultant
Hyder Consulting Group

Andrew Jones is Senior Consultant for Climate Change for the Hyder Consulting Group. He has extensive experience in the development and implementation of policy and has assumed advisory positions on a variety of climate change projects on a local and international level, relating both to greenhouse gas mitigation and adaptation to the impacts of climate change. His most recent activities have involved the development of strategies and projects relating to greenhouse gas mitigation for both private and public sectors. Andrew has a particular interest in market mechanisms, and has worked with a number of industries both in Australia as well as internationally.

Climate Change Impacts in New South Wales: issues for local government and potential management mechanisms

This paper seeks to discuss implications of climate change for NRM and planning for local government in New South Wales. The presentation will include a brief overview of the climate hazards to be faced, and likely impacts. These include state of indicators and monitoring, knowledge of scope of impacts, and values.

The main focus of the paper will be elaborated, namely dealing with the likely impacts on the assets and services provided by local government, both natural and physical, as well as on the broader community, and what mechanisms might be available to address these issues. Such mechanisms include the identification of vulnerable assets and systems, and how these might prioritised for adaptation mechanisms. A brief assessment of existing methods and means will provide insight into possible building blocks for action.

Some analysis will be provided of initiatives at the local level both in Australia and internationally? including a review of some of the tools and analysis undertaken internationally, such as regional scoping studies for impacts & adaptation assessments. The approach of the MONARCH climate change biodiversity analysis in the UK and the practical implications of the Australian biodiversity action plan will be discussed in terms of local level NRM management practice.

This paper will draw on examples from Australia and elsewhere, and will point to possible areas for future investigation concerning local initiatives to manage biodiversity impacts. It will raise for discussion the options for local authorities to address climate change impacts on natural resources.

Cr. Ian McKenzie

Chair
Local Government Association of NSW Urban Forest Working Group

Ian is a Greens councillor on Newcastle City Council and an executive member of the Local Government Association of NSW (LGA). Ian is the chair of the LGA Urban Forest Working Group.

Ian has been interested for a long time in the roles and functions of trees, both in natural and built environments. He has worked in various environmental organisations including The Wilderness Society and Greening Australia. Ian believes sufficient healthy trees in urban areas are fundamental to sustainable living.

The Role of Urban Trees in Mitigating the Effects of Climate Change

Urban forest is defined in the LGA Urban Forest Policy as, "the totality of trees and shrubs on all public and private land in and around urban areas (including bushland, parkland, gardens and street trees) and is measured as a canopy cover percentage of the total area, and is recognised as a primary component of the urban ecosystem."

Numerous aspects of climate change are directly affected by the urban forest. A planned and well managed urban forest will 1) aid in reducing the causes of climate change; and 2) help mitigate the effects of climate change.

"Urban trees are 15 times more effective than forest trees at reducing the buildup of carbon dioxide and aid in promoting energy conservation through mitigation of the heat island effect in urban areas."[1]

"Trees help to cool the air inside buildings by directly shading windows, roofs, and air conditioning units, and indirectly cool the air outside through evapo-transpiration. This leads to lower energy bills and reduced energy needs at the power plant. The energy savings model calculates the dollar amount and kilowatt hours (kWh) saved by this tree shade; it also determines the amount of carbon conserved (measured as "avoided carbon") when reduced region-wide energy consumption leads to reduced consumption of fossil fuel for power."[2]

Trees filter pollution and absorb carbon dioxide, which helps reduce the greenhouse effect generated in urban areas. They act as a carbon sink reducing atmospheric carbon.

The urban forest, as a primary component of the urban ecosystem, is a fundamental component of urban biodiversity.

However, the importance of the urban forest is forgotten as urban population densities continue to increase, living space per capita expands, and the space for trees diminishes to a point where the urban forest struggles to survive as a healthy ecosystem. The wires that distribute the ever increasing quantities of electricity generated from burning coal blaze a trail of destruction through the canopies of urban trees further reducing the benefits that could be derived.

The urban forests can help combat the causes and effects of climate change, but currently are disappearing at an ever-increasing rate.

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[1] US Congress, *Cooperative Forestry Assistance Act, 1978, Section 9,* http://www.treelink.org/nucfac/nfcfaa.htm [date visited: 30 August 2004]

[2] City of Boulder Water Conservation Office (2002), *Calculating the Value of Boulder's Urban Forest,* www.boulderutilities.net [date visited: 2 October 2004]

Julie-Anne Richards

Coordinator
Climate Action Network Australia (CANA)

Julie-Anne Richards has been the Coordinator of Climate Action Network Australia (CANA) since December 2003. CANA keeps member organisations up to date on climate change, and communicates and coordinates across the network. CANA is a network of organisations united in their determination to fight climate change. CANA members believe that it will take all of us to stop dangerous climate change, and that by working together we can achieve the goal of a safe and stable climate for this and future generations.

Climate change: What Role for the Environment Movement?

The environment movement has recognised that climate change is the most pressing environmental issue we face. Climate change will affect every ecosystem on earth - with potentially catastrophic results. Climate change has the potential to have catastrophic impacts on human life as well with water and food security in doubt for millions to hundreds of millions of people.

Julie-Anne's presentation will cover:

What has the environment movement been doing so far? And to what effect?

What change do we need to see happen to avoid dangerous climate change?

How do we get the change we need?

What is the current thinking on climate change?

One of the key next steps is to broaden climate change out further than the environment movement. This presentation will explore how a wider group of constituents could be involved in climate change - social groups, development groups and unions, as well as a wider cross section of the public.

Cate Faehrmann

Director
Nature Conservation Council of NSW

Cate Faehrmann is the director of the Nature Conservation Council of NSW.

She has been active in environmental and social justice politics for more than a decade across four Australian States and also in New Zealand.

She has been a media adviser in NSW State Parliament and has also worked for the Greens party, managing media and campaigns for state elections in NSW, Victoria and South Australia. Cate also spent time in New Zealand as Campaign Manager for the NZ Green Party for their 2002 General Election.

Cate is on the Board of the Environmental Defender's Office, the Climate Action Network Australia and, more recently, the online campaigning organisation GetUp which is urging people to get active online for a more just, compassionate and sustainable Australia.

One of Cate's passions is working with other organisations and activists to build a broad-based movement around climate change.

Getting Governments to notice

Where's the mass demonstrations around climate change? Where are the sit-ins? Where's the civil disobedience, the creative non-violent direct action? The suffragette movement didn't get women the vote by producing a few reports and talking quietly with decision-makers. Nor did the civil rights movement break down what seemed at the time like impenetrable barriers around race by holding a few summits and press conferences. This workshop will focus on the urgent need to start making a lot more noise around the biggest threat facing humanity.

Dr Chris Riedy

Research Principal
Institute for Sustainable Futures, University of Technology, Sydney

Dr Chris Riedy is a Research Principal at the Institute for Sustainable Futures, University of Technology, Sydney. In this role, Chris works on research and consulting projects relating to sustainable energy use, climate change response, sustainability science and citizen participation. He has a Bachelor degree in Environmental Engineering and recently completed his PhD in Sustainable Futures. His thesis – titled *The Eye of the Storm: An Integral Perspective on Sustainable Development and Climate Change Response* – examined Australian energy and greenhouse policy from behavioural, systemic, psychological and cultural perspectives. It proposed a policy development process designed to integrate these perspectives through expert, stakeholder and citizen participation. Chris has ongoing research interests in the politics of climate change response, the role of personal and cultural change in achieving sustainability and the social dimensions of energy use.

Developing a Culture of Climate Change Response

Australia's political response to climate change has attracted significant criticism, both domestically and internationally. Theoretically, in a democracy, the responsibility for the political response to climate change ultimately falls on the citizens that vote for political leaders. Of course, the practice of democracy falls short of the theory and it can be difficult for citizens to express their preferences in relation to a policy issue like climate change. Nevertheless, effective political action to address climate change is unlikely until there is significant cultural pressure on politicians to act.

There are several factors hampering the development of a culture of climate change response in Australia. First, climate change is a slow, intangible change that is difficult for citizens to directly experience. All too often, it is perceived as a problem that affects other people, in other places or times. In our busy lives, climate change seems to have low relevance and priority. Second, there are few avenues for citizens to express their preferences in relation to climate change response. Those avenues that are available, such as written submissions to policy development processes, limit the types of expression possible and place the citizen at a disadvantage compared to well-resourced business groups that have the time and money to develop familiarity with the issues. Third, there is little government support for citizens to come together to develop creative, innovative visions of low carbon futures.

One promising technique for addressing these factors is community cultural development. Community cultural development (CCD) is a collective process of artistic creation at the community level. It may involve a partnership between artists and the community, or direct artistic expression by the community. In this paper, I discuss the ways in which CCD can contribute to the development of a culture of climate change response. Through the immediacy of artistic expression, CCD processes can make climate change more tangible and relevant. CCD provides citizens with an alternative means of expressing their views on climate change response that may be more appealing than written submissions. Further, it offers a way for citizens to come together to imagine alternative futures that can feed into policy processes. While it is only one element of an effective climate change response, CCD deserves more attention than it has so far received from policy makers concerned about climate change.

Dr Annette Cowie

Program Leader New Forests, Forest Resources Research
Science and Research Division, NSW Department of Primary Industries

Dr Annette Cowie has a background in soil and plant science. She leads the New Forests research group within the NSW Department of Primary Industries' Science and Research Division. The New Forests program demonstrates and quantifies environmental services from planted forests, particularly in the areas of carbon sequestration, salinity mitigation and land rehabilitation. Annette's personal research program focuses on key aspects of greenhouse science: soil carbon dynamics, and greenhouse gas balance of forestry systems for carbon sequestration and bioenergy. Annette is a member of the management team for the CRC for Greenhouse Accounting, and National Team Leader for IEA Bioenergy Greenhouse Gas Balances of Biomass and Bioenergy Systems.

Greenhouse benefits from reforestation of agricultural land

Reforestation of agricultural land can contribute significantly to mitigation of greenhouse gas emissions through carbon sequestration. The greenhouse gas mitigation benefits of forestry are further enhanced by using harvested material for wood products that displace higher energy alternative building products, or for bioenergy, displacing fossil fuel energy sources. Besides greenhouse gas mitigation, planted forests can provide other environmental services including salinity management and biodiversity enhancement.

Bioenergy options from forest biomass include production of heat and electricity, or liquid fuels such as bio-oil. The mitigation benefits are highest for bioenergy options that have high conversion efficiency and for projects that displace fossil fuels with a high greenhouse gas emissions factor, such as co-firing in large coal-fired power stations. Although bioenergy is often referred to as carbon neutral, there are fossil fuel emissions associated with forest establishment, harvesting and transport, indirect emission such as from fertiliser manufacture, and non-CO2 emissions such as from methane produced in chip piles and nitrous oxide from application of nitrogen fertiliser. These fossil fuel and non-CO2 emissions are generally less than 10% of the emissions avoided, and differ considerably between technologies. Decisions on proposed sequestration and bioenergy projects should be based on a Life Cycle Assessment approach using standard methodology to determine the net greenhouse mitigation, considering upstream, downstream and indirect impacts.

Biomass for bioenergy can be produced sustainably as a by-product from timber plantations: harvest residues, processing residues and redundant wood products can all be utilised for bioenergy. Purpose-grown bioenergy forests could be viable in some circumstances.

Forests NSW species trials have demonstrated good growth rates for eucalypts planted on farms in the 500-700mm rainfall belt, not usually considered viable for forestry. The major objective of these trials is to identify species that deliver the environmental services of carbon sequestration, salinity management and biodiversity enhancement, and potentially a financial return. While forests provide an equal greenhouse mitigation benefit per unit carbon sequestered wherever they are grown, the salinity control and biodiversity enhancement impacts are dependent on location. Catchment scale planning is required to optimise the total environmental impact of reforestation.

The NSW Greenhouse Gas Abatement Scheme potentially provides an opportunity for landholders to receive payment for carbon credits for reforestation of rural landscapes, which will provide incentive for further reforestation. However, modifications to the current scheme will be required to overcome barriers to participation by individual landholders.

Realising the potential of reforestation of agricultural land will require development of a market for the products and services from these planted forests.

Patty Byrnes

Landholder
Wamberra Station

The Byrnes family, caring for Wamberra Station for almost a century

Wamberra Station is a family owned property situated in far south western New South Wales. Ned and Patty Byrnes are the fifth generation to own the property. Traditionally ran as a sheep station until 1993, Wamberra now has three main enterprises being:

- Beef Cattle Production
- Dry-land Cereal Production
- Private Conservation Reserves

In the year 2000, Patty & Ned Byrnes entered into a “Land Use Agreement” and established four permanent private conservation reserves that cover 21% of the property and equate to 11,000 hectares (27,000 acres).

The reserves were established as a “trade-off” or “off-set” for diversification and development on other parts of the property that targeted woody weed infested area’s.

Through more intensive agriculture over 10% of the property, namely dry-land cereal production, livestock can be moved to these paddocks during summer and autumn to graze, leaving up to 90% off the property to be spelled for months. Not only is biodiversity increased in the private conservation reserves, but also over the grazing country by allowing native species to seed and re-establish.

A change in farming practices to minimum tillage and the use of drought tolerant, high protein varieties that are sown very lightly have produced consistent, high quality grain yields every year, even in the lower rainfall years.

With careful management of our natural resources, diversification off land-use, a shift towards drought tolerant livestock breeds and crop varieties, farmers can remain viable while maintaining or improving their natural resources.

Paul Dargusch

Chief Executive Officer
Biological Farmers of Australia

Paul Dargusch is the recently appointed chief executive officer of Biological Farmers of Australia (BFA). Paul comes from a farming background and before joining BFA was manager of the Peanut Company of Australia's international business. He previously worked for Japanese trading giant Itochu Corporation and has extensive knowledge of international regulations as they pertain to organic and quality foods. He also has significant experience in people and financial management.

Biological Farmers of Australia (BFA) is Australia's largest representative organic body, and since the 1980s has been a voice for its members and the organic industry and movement in general – on matters relating to education, trade, promotion and advocacy.

The BFA network is one of the industry's best supports for sustainable development. BFA members include everyone from consumers through to producers and all sectors of industry in between. Among BFA's achievements are several key publications including the Australian Organic Journal as well as organisation of and representation at Australia-wide and international networking and trade events.

How Organic Farming is an Effective Solution for Reducing Greenhouse Gases.

Organic farming practices can help the removal of greenhouse gases, being a major sink for carbons in the atmosphere. Contrary to public perception, the building of soil humus - a major component and objective of organic farming - is arguably the best sink for greenhouse gases – soaking up more carbons from the atmosphere than trees.

Soil health and building humus requires increasing levels of organic carbon in soil. Some conventional practices however contribute to soil carbon depletion and attribute to increasing of greenhouse gases in the atmosphere.

Jenny Quealy

Acting Chief Executive Officer
Landcare Australia Limited

Jen has worked with Landcare at the State and National levels for the past 16 years, in various roles. Jen started with the Soil Conservation Service of NSW as the Decade of Landcare Coordinator, developing the strategic plan for landcare in NSW for the years 1990 to 2000, through community consultation and much development and change in catchment and natural resource management. Jen's substantive role is as National Manager Landcare Partnerships and Support, with Landcare Australia Limited, developing strategic partnerships with Corporate Groups to raise resources (funds, in-kind, IP and staff volunteers) for the Landcare and related care networks and projects.

Bush for Greenhouse - The Landcare Response

With over 4,000 landcare groups across Australia, Landcare's role, response and capacity to engage in carbon sequestration and reduced emissions is clear.

Landcare Australia worked with 120 farmers from 40 landcare groups to assess farmers' contribution to greenhouse gases and appropriate landcare actions for abatement. Landcare Australia works with corporate, community and government to both build capacity of community and farmers, to reduce greenhouse gases and is examining a carbon pool system linked to recognised natural resource and environmental plans and targets, particularly for conservation purposes.

Landcare Australia has released a document on greenhouse strategies for landcare, with production, environmental and other benefits.

Lorraine Cairnes

Principal
Fathom Consulting

Lorraine Cairnes is the principal of Fathom Consulting, Sydney, and is a consultant in the fields of natural heritage; natural resources and land use management; and management of conservation areas. She is the author of the Australian Natural Heritage Charter, and in recent years has chaired a review of the Native Vegetation Conservation Act, and development of the NSW Water Conservation Strategy. She currently chairs community advisory groups for the St Marys Regional Park, and the NSW Central Coast's future water supply plan. She is a member of the Premier's Urban Design Advisory Committee and the Environment Institute of Australia and New Zealand. In the past she has held senior executive positions in National Parks and Wildlife, the NSW Heritage Council, Planning, NSW Fisheries, and Sydney Water.

Conference Summary – future directions and focus

Lorraine will be providing a summary of the whole conference including principles for a climate change strategy and recommendations drawn and agreed upon by the conference as a whole.