Australian Government

Wetlands Australia

NATIONAL WETLANDS UPDATE 2009

Issue No. 17

ANNUAL UPDATE FOR AUSTRALIA'S WETLAND COMMUNITY

Australia's largest aerial survey
of wetland health

Indigenous rangers fill knowledge gaps
on Gulf of Carpentaria plains

Australia's northern tropical rivers:
Determining assets and threats

River Murray floodplain:
Prioritisation and environmental watering

Contents

Produced by the Australian Government Department of the Environment, Water, Heritage and the Arts
ISSN 1446–4845
Cover photograph: Invertebrate sampling in a sumpland wetland, WA. Photo: Christina Mykytiuk.
Back cover photo: Pick Swamp, Piccaninnie Ponds Conservation Park, SA. Photo: Dragi Markovic.
Editorial, artwork and project management: Georgia Curry
Printed by Union Offset

Ministers' foreword

Wetlands are vital features of our environment, providing habitat for birds, animals and plants, and ecosystem services for people. Wetlands connect us all. Our actions in turn affect the health of wetlands. This interconnected relationship is the theme for 2009 World Wetlands Day - "Upstream Downstream" - and is the focus of this edition of *Wetlands Australia.*

The Australian Government has recognised the importance of wetlands through Caring for our Country, a $2.25 billion, five year initiative to deliver a new, coordinated approach to environmental management in Australia, built on a set of consistent national targets. Funding will target the most efficient and effective ways to take action and the organisations that are best placed to deliver this. Our goal is an environment that is healthy, better protected, well-managed, resilient and provides essential ecosystem services in a changing climate.

Wetlands and healthy rivers are also a priority under the $12.9 billion, 10 year *Water for the Future* plan, which will help prepare Australia for climate change and reduced water availability. Through *Water for the Future*, the Australian Government is investing in more efficient water use and developing new sources of water to reduce our reliance on rainfall, including desalination, stormwater harvesting and recycling.

The government is also purchasing water entitlements from willing sellers to return water to the environment. These water purchases are underway in the Murray-Darling Basin where water has been overdrawn for many years. This over-allocation along with the drought and impacts of climate change have resulted in severely stressed rivers and wetlands. Restoring their health will improve the outlook for water-dependent species and ecosystems, and for the communities that live in the Basin.

Wetlands are among the most productive ecosystems on Earth and provide important ecosystem services for people: good quality water for irrigation and domestic use; removal of wastes and contaminants; habitat for fish and other important aquatic fauna and flora; and aesthetic, cultural and recreational benefits. As a border between terrestrial and aquatic environments they provide strategic refuge for many species in times of drought. Wetlands contain a wide diversity of life and often support plants and animals that are found nowhere else.

Without enough water, rivers, wetlands, floodplains, riparian areas, springs and other water-dependent ecosystems will deteriorate and the services these ecosystems provide will be compromised. In some cases, these changes may be irreversible; in others, they may be difficult and costly to reverse.

In this edition you can see the true spirit of the nation's environmental actions, not of government alone but a partnership of the Australian, State, Territory and Local Governments, communities, industry and landholders. Whether it's planting trees, monitoring water quality in a local stream or helping to protect endangered species, every action makes a difference. This publication acknowledges these efforts.

These stories here are a snapshot of thousands of inspiring stories around the nation. As you read them, think about your local wetland and its interconnections with the environment around it: look at how the wetland benefits your surroundings and how activities throughout the catchment affect your wetland.

Senator the Hon Penny Wong
Minister for Climate Change and Water

The Hon Peter Garrett AM MP
Minister for the Environment, Heritage and the Arts

National aerial wetland survey

A national aerial survey carried out by the University of New South Wales in October 2008 incorporates 56 Ramsar-listed wetlands. Photo: Ashley Carlson.

Wetland and Rivers Research Laboratory, University of NSW

In an Australian first, a team of researchers has taken to the skies above each state and territory to conduct a massive aerial survey of the country's 907 high conservation value wetlands and rivers

The ground-breaking project, funded by the National Water Commission and carried out in October/November 2008 by the University of New South Wales, will deliver a national assessment of our wetland health, a national database of waterbird information, and a record of the quantitative relationships between waterbird numbers and diversity and river flows in eastern Australia.

The logistics of this project are impressive: three aerial survey planes flying concurrently, travelling 80,000 kilometres over eight weeks, with researchers spending seven hours a day in a plane counting all waterbirds and breeding events in nationally-significant wetlands.

Waterbirds are excellent indicators of river and wetland health, and the survey will develop national methodologies, guidelines and assessment protocols to measure conservation value and success of environmental water delivery to water-dependent ecosystems.

The project brings together disparate waterbird monitoring programs across Australia through the establishment of a publicly-accessible database as a repository for current and past waterbird monitoring projects. It also builds on existing waterbird monitoring programs throughout eastern Australia, Western Australia and the Northern Territory.

The national assessment incorporates 56 Ramsar-listed wetlands and 851 of Australia's 904 listed wetlands of national importance. Water-dependent ecosystems with high concentrations of waterbirds (more than 20,000 waterbirds) are recognised within Australia and some are internationally-listed as being of high conservation value.

The aerial surveys use the abundance and diversity of waterbirds to assess the condition of high conservation value aquatic ecosystems. The surveys also collect information on up to 50 waterbird species including threatened species and migratory shorebirds, as well as their breeding activity. The project also utilises long-term data to determine environmental flow requirements for wetlands throughout eastern Australia.

The methodology involves recording the waterbird counts with digital voice recorders, which are then transcribed on to data sheets, checked and then entered into the newly-developed national waterbird database. At the same time teams of counters head out to a number of wetlands to conduct ground surveys of waterbirds. The information from these ground counts will also be included in the national database and the results compared with aerial survey counts.

Information: www.wetrivers.unsw.edu.au/docs/rp_nws_home.html

A recent study by the University of NSW has revealed that migratory shorebirds and Australia's one million resident shorebirds have suffered a massive collapse in numbers over the past 25 years.

A large-scale aerial survey study covering a third of the continent has identified that migratory shorebird populations plummeted by 73 per cent between 1983 and 2006, while Australia's 15 species of resident shorebirds (for example avocets and stilts) have declined by 81 per cent. This is the first long-term analysis of shorebird populations and health at an almost continental scale and reveals a disturbing trend of serious long-term decline.

The study also revealed for the first time that Australia's inland wetlands are particularly important for migratory shorebirds, along with the better-known coast sites such as Roebuck Bay in Western Australia, Port Phillip Bay in Victoria, Hunter River estuary in New South Wales and Hervey Bay in Queensland. Of the 10 wetlands supporting the highest number of shorebirds within survey bands across eastern Australia, eight were inland and only two were coastal, making shorebirds vulnerable to the effects of damming rivers and water extraction. Four of the ten wetlands surveyed had been substantially reduced in size during the survey period.

Water for the Future
the Australian Government's water sustainability plan

The Australian Government's *Water for the Future* plan will help to secure water supplies including water to restore the health of Australia's river systems that have deteriorated because of over allocation, drought and climate change. Photo: Georgia Curry.

The decline of rainfall across large areas of Australia in the past decade has given rise to many challenges. It has caused hardship for farmers and rural communities, brought long-term water restrictions to many cities and towns, and stressed many rivers, water-dependent ecosystems and species.

Reduced water availability has made all of us more aware of how much we depend on reliable water supplies. Projections of reduced water availability as a result of climate change have reinforced the importance of using water wisely and of ensuring there is sufficient water for a healthy environment.

To help Australia put water use on a sustainable footing the Australian Government has developed a 10 year, $12.9 billion plan to help secure water supplies.

To help Australia put water use on a sustainable footing the Australian Government has developed *Water for the Future*, a 10 year, $12.9 billion plan. It will help secure water supplies for Australian households, businesses and farmers, as well as provide water to restore the health of Australia's river systems that have deteriorated because of over allocation, drought and climate change.

Water for the Future is founded on four key priorities: securing our water supplies, tackling climate change, using water wisely, and supporting healthy rivers. It will help prepare Australians for the impacts of climate change – including reduced water availability in many of our highly populated cities and important agricultural districts. At the same time, the Australian Government is working with communities and businesses and with other nations to reduce future carbon emissions and climate change impacts.

Our rivers, wetlands, floodplains and water-dependent species have been particularly hard hit by decades of rising water demand and the impacts of drought and climate change. We need to return water to the environment and the Australian Government is spending $3.1 billion over 10 years to buy back water entitlements from willing sellers. These entitlements will be managed by the Commonwealth Environmental Water Holder, a statutory office created under the *Water Act 2007* to protect and restore the environmental assets of the Murray-Darling Basin, or assets outside the Basin where water is held.

Environmental water will be used in accordance with the environmental watering plan, which will be part of the Basin Plan developed by the Murray-Darling Basin Authority. The first Basin Plan will be finalised by 2011. In the meantime, the Commonwealth Environmental Water Holder will allocate the available water to achieve the maximum environmental result including at internationally-recognised wetlands and areas that support listed migratory and threatened species.

Information: www.environment.gov.au/water/action/index.html

Indigenous rangers survey Gulf of Carpentaria Wetlands, Queensland

A survey by Indigenous rangers of remote Gulf of Carpentaria catchments in Queensland is empowering local communities to manage their key biodiversity assets. Photos: Roger Jaensch.

By Roger Jaensch, Wetlands International - Oceania

The remote coastal plains of the Gulf of Carpentaria catchments are dominated by vast and complex intertidal flat, saltmarsh, estuary, riverine and freshwater swamp wetlands. Few people experience these wetlands because they are sparsely populated and isolated from major urban areas. On the Queensland side, the 1,300 kilometre coastline is accessible by road at very few places, notably Karumba Point and Weipa. During the wet season, access across the plains on station tracks is often impossible for several months.

Consequently, scientific understanding of wetlands biodiversity and ecology in the Gulf plains is inadequate for management planning. There are huge gaps in even the most basic knowledge - where wetland species occur and which sites are important for critical stages in their life cycles.

During 2008, a cooperative partnership formed to help fill these knowledge gaps and to empower local communities to manage their key biodiversity assets. Locally, Indigenous rangers of Gulf communities at Pormpuraaw and Kowanyama near the eastern Gulf coast, and Burketown near the southern Gulf coast, became involved. External support was provided by Wetlands International, a not-for-profit non-government organisation focused on applying science to conserve wetlands, using resources from the Australian Government-funded project, Wetland Management Solutions.

Many of the rangers had recently started full-time employment under the Queensland Government's Wild River Rangers program. Program managers hoped to identify biodiversity survey work that would complement the activities of these new rangers and rangers that were already active. Wetlands International saw the opportunity to engage skilled local people in new wetland inventory activity that would improve knowledge and ultimately benefit wetland management.

The proposed new activity involved survey and surveillance of breeding colonies of waterbirds, particularly egrets and their allies. In good seasons, feeding habitat for these birds has been extensive on Gulf coastal plains yet little has been documented about where these birds bred. Normally, Egrets and several related species nest in dense colonies and on the tropical coasts these tend to be situated in mangrove forests and inundated Melaleuca swamps. Often, colonies comprise five to 10 species and include thousands of nesting pairs. However, colonies naturally occur at very few locations so recruitment of young birds to the population could be drastically reduced if any one colony fails or is destroyed.

> Rangers are revealing biodiversity hotspots to help understand the network of sites used by waterbirds around the Gulf. This knowledge was rarely - if ever - possible for local Indigenous groups.

The colonies are usually in full swing during the wet season. At this time, local people are unable to freely traverse much of their country due to inundation. So, searching for colonies by boat, or occasionally by light aircraft, was identified as a timely activity for the Indigenous rangers, complementing different work done in other seasons. Dedicated searches would focus on the coastal floodplains and estuaries within about 50 kilometres of each community by rangers at least once every wet season. This would be supplemented by opportunistic efforts during other project work in the wetlands, such as monitoring of crocodile nests.

During the first half of 2008, a Brisbane-based waterbird specialist of Wetlands International met with Indigenous rangers and their support teams in Cairns, Kowanyama and Burketown to promote and initiate the colony surveys. Training in identification of colonial waterbird species was provided, including provision of laminated photographs for carrying in boats.

At Kowanyama, nearly 500 kilometres north-west of Cairns, techniques for aerial survey were discussed and a short helicopter survey was arranged for two rangers over the surrounding Mitchell River Delta country. Having experienced a very good wet season, there was much swamp country to search but with ranger knowledge and support staff from the Kowanyama Land Office, two active colonies were located in the Mitchell estuary.

The largest of these breeding colonies, in mangroves only a few bends up the estuary channel from the open sea, held an estimated 10,000 if not 20,000 waterbirds comprising mainly Intermediate Egret, Great Egret, Royal Spoonbill, Pied Heron, Australian White Ibis and Little Pied Cormorant. Many nests held advanced young; others were hidden under the tree canopies. The other active colony had only a few hundred nesting Australian White Ibis.

One of the rangers had seen the large colony active in previous years. There was little or no activity at several other colony sites that had been noted in earlier years. This year it seemed that most breeding was at a single site. It is one of the largest water bird colonies to have been documented in the Queensland Gulf Plains bioregion.

Ranger teams from the Pormpuraaw and Burketown communities indicated that there were colonies also in their country in the late wet season of 2007-08 so in the following wet season it is hoped that further survey work and mentoring can be undertaken. At Kowanyama this will be integrated within an existing wetlands program.

There is great potential for Indigenous rangers to enhance natural resource management in northern Australia.

In addition to revealing these biodiversity hotspots, which are assets to consider in regional conservation planning, this work will contribute to our understanding of the network of sites used at different times by waterbirds around the Gulf, possibly linking to wetlands in the Top End and Papua New Guinea. Knowledge of waterbird linkages beyond the local area was rarely - if ever – possible for local Indigenous groups. Now, this knowledge helps explain why at times birds may be absent from a local site regardless of its habitat condition.

The Wild River Rangers program and other initiatives will see Indigenous rangers of the Gulf country perform a range of surveillance, research and management tasks. There is tremendous potential for this skilled and enthusiastic workforce to substantially enhance natural resource management in northern Australia.

Information: Roger Jaensch, Wetlands International
roger.jaensch@wetlands-oceania.org
http://oceania.wetlands.org

A helicopter survey over the Mitchell River Delta country revealed one of the largest waterbird colonies documented in the Queensland Gulf Plains bioregion.

Assets and threats to Australia's northern tropical rivers

East Alligator River, Northern Territory, is one of the tropical rivers comprehensively documented by the National Centre for Tropical Wetlands Research.

By Rick Van Dam, National Centre for Tropical Wetlands Research

A $1 million project to document what is currently known about the ecological assets of, and the key threats to, Australia's northern tropical rivers has just been completed by the National Centre for Tropical Wetland Research, which recently disbanded in October 2008.

The Tropical Rivers Inventory and Assessment Project (TRIAP) was funded by the Australian Government Department of the Environment, Water, Heritage and the Arts, and Land & Water Australia, and led by the Environmental Research Institute of the Supervising Scientist in Darwin, with contributions from James Cook University, the University of Western Australia, Charles Darwin University and the University of Wageningen in the Netherlands.

TRIAP consisted of three sub-projects: mapping and inventory, risk assessment of key threats, and assessment of a framework for evaluating ecosystem services. The first two sub-projects covered 51 catchments across northern Australia from Broome in the west to the western tip of Cape York, covering more than one million square kilometres, but focused on three catchments: Fitzroy River (Western Australia), Daly River (Northern Territory) and Flinders River (Queensland) (Figure 1).

The key aim of the first sub-project was to collate and analyse existing spatial data for key biophysical attributes of the northern tropical rivers including: water quality, hydrology, geomorphology, estuaries, riparian vegetation, macro invertebrates, fish, aquatic reptiles and waterbirds. In gathering and consolidating a large amount of data, the study highlighted the extent of information gaps across the region.

Despite the lack of data, a number of useful products came out of this sub-project: a hydrologic classification based on stream flow and catchment characteristics; geomorphic classifications at two scales (whole of study area and catchment) based on landform and soil characteristics; a preliminary model for prediction of the distribution of riparian vegetation; and an in-depth discussion of key water quality variables driving ecological function in tropical rivers and how they could be used for future classification schemes. This study provides the most comprehensive descriptions yet of key biophysical attributes of the northern tropical rivers, and highlights where further research is required.

The second sub-project demonstrated a tiered assessment for ecological risk assessment of tropical rivers. This involved gaining a broad understanding of the extent and status of the ecological assets and the threats they face, followed by formal semi-quantitative methods to assess and compare the significance of the threats, followed by detailed quantitative risk analyses of high-priority threats to specific ecological assets.

These assessments built on the information base compiled during the first sub-project, and were guided by information obtained from stakeholders. Highlights included: the first comprehensive description of the key ecological assets of, and threats to the northern tropical rivers; the advantages of adopting spatially-explicit risk modelling to prioritise catchments by relative risk of multiple threats or pressures to multiple ecological assets; and the utility of Bayesian approaches (a type of quantitative risk modelling that can integrate quantitative information with qualitative expert knowledge) in quantitative risk assessments.

Focusing on one aspect of the study, the spatially-explicit, relative risk modelling across the whole study area identified

eight catchments at higher relative risk of impacts from multiple threats/pressures. These were the Adelaide River (NT); Finniss/Darwin River (NT); Mitchell River (Qld); Leichhardt River (Qld); Flinders River (Qld); Gilbert River (Qld); Daly River (NT); and Mary River (NT). No catchments in WA were identified as being at higher relative risk; however, this may have been due to issues associated with spatial data resolution and quality for this region.

The five most significant threats to the ecological assets of the region's aquatic ecosystems were (from a total of 19): cattle grazing (on natural vegetation); feral pigs; poorly managed fire; aquatic weeds; and mining. Additionally, climate change and sea level rise are emerging problems for the region's aquatic ecosystems that threaten to cause much greater impacts than currently exist. Various sensitivity and uncertainty analyses were also undertaken to test the rigour and robustness of the modeling approach, and identify areas for improvement.

Undertaken by six Masters students from the University of Wageningen, the third sub-project focused on two regions: the lower Mary River (NT) and the Daly River (NT). Using stakeholder interviews and existing information, a framework for analysing the ecosystem services provided by the wetland and riverine ecosystems was populated and trialled. The analyses drew on the conceptual framework provided by the Millennium Ecosystem Assessment (www.millenniumassessment.org) where ecosystem services are defined as "the benefits people obtain from ecosystems."

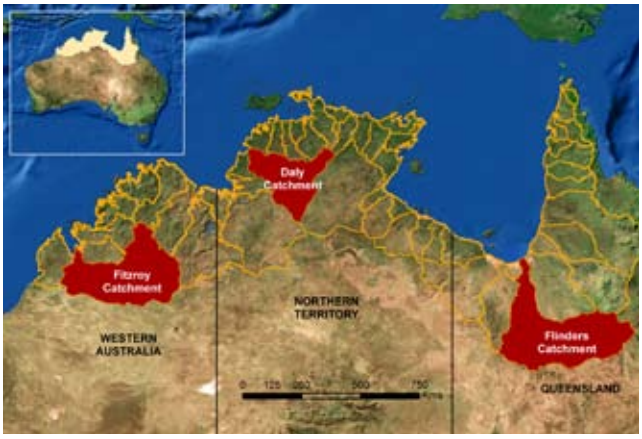


Figure 1: The Tropical Rivers Inventory and Assessment Project focused on three catchments: Fitzroy River, Daly River and Flinders River.

It was established that local communities and other stakeholders were highly dependent on the wetlands in many ways, including for ecological (wetlands of national importance, rare and endemic species), socio-cultural (cultural heritage, spiritual and existence values, sense of place, recreation) and economic reasons (water use, agriculture, carbon sequestration, tourism). The ecosystem services framework also considered the trade-offs and competing interests between these values in the context of the current policy setting, and evaluated the associated management implications.

TRIAP final report www.environment.gov.au/ssd/tropical-rivers or visit www.track.gov.au

National Centre for Tropical Wetland Research disbands

Nine years after being established (in 1999) by the Australian Government, the National Centre for Tropical Wetland Research (NCTWR) was disbanded in October 2008. NCTWR was a research and training partnership between the Environmental Institute of the Supervising Scientist, the Charles Darwin University, the James Cook University and the University of Western Australia.

Its goal was to provide, through research and training, information and expertise to assist managers and users of tropical wetlands to use them in a sustainable manner. The research directions of NCTWR included describing the values and benefits derived from wetlands; assessing existing and potential threats to wetlands; developing procedures and standards to survey and monitor wetlands; sustainably use and restore wetlands; and understanding essential physical, chemical and biological processes operative in wetlands.

Many of the inventory, monitoring and assessment approaches collaboratively developed with NCTWR partners since the mid 1990s have been adopted internationally by the Ramsar Convention on Wetlands of International Importance as well as other environmental NGOs. The primary research role of NCTWR in Australia has been fulfilled by the Tropical Rivers and Coastal Knowledge (TRaCK; www.track.gov.au) Research Hub established in 2007.

TRaCK, which has attracted $20 million in research funding over four years, comprises more than 70 researchers from 17 institutions, including all four partner organisations of the NCTWR. Thus, the essential science and knowledge that is required to ensure the sustainable use and management of Australia's tropical rivers will continue, now with even greater capacity.

NCTWR partners would like to thank stakeholders and participants who contributed to the development and collaborative efforts of NCTWR during its nine years. Along with other research efforts, the knowledge base created by the centre's activities will provide an enduring legacy for aquatic ecosystem conservation and management in northern Australia.

River Murray floodplain prioritisation and environmental watering plans, SA

Yarramundi wetland, South Australia, is one of the River Murray wetlands being ranked to determine which wetlands require protection or rehabilitation. Photo: SA Department for Environment and Heritage.

By Debra Frankiewicz and Paul Wainwright
SA Department for Environment and Heritage

The River Murray is one of the most iconic and valuable waterways in Australia. Fresh water resources are becoming incredibly scarce for the Murray, particularly during these drought conditions, and the ecological costs of providing water for economic use are causing us to question the meaning of sustainability. To better understand the threats to and condition of these wetlands, a prioritisation project has been developed based on sound ecological considerations.

The project, initiated by the South Australian Murray Darling Basin Natural Resource Management Board, separates and ranks wetlands into those that require protection and those that need rehabilitation. It also identifies wetland values to inform broader floodplain prioritisation and environmental watering plans.

Often, river systems are thought of as relatively predictable linear ecosystems but their associated wetland complexes create much more functional heterogeneous communities. Wetlands also require a hydrological regime with natural variability to function optimally. The hydrology of the River Murray has been grossly modified over time, which affects natural fluctuating water levels and many wetlands now require management intervention to maintain their productivity and biodiversity value.

Long-term modifications to flow are just one of the many threats to the River Murray. Others include net losses in water quantity, the effects of secondary salinisation, altered land use and loss of habitat associated with the current drought. The extent of these threats is unknown for many wetlands and with limited water and financial resources, wetland managers need to make decisions about how to efficiently allocate these resources.

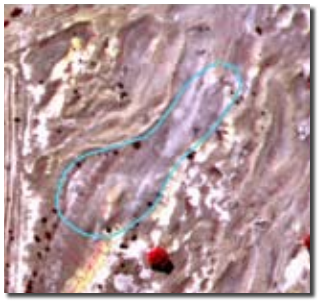
The project's methodology, developed by Waters Edge Consulting and carried out by the SA Department for Environment and Heritage, was designed as a Geographical Information Systems desktop assessment. A range of biological and topographic geospatial datasets were used during analyses including South Australian vegetation mapping, Biological Database of South Australia flora and fauna records, land-use mapping, a floodplain inundation model, fish barriers data and high-resolution aerial photography.

The study area covers the River Murray floodplain inside the 1956 flood level from the Chowilla floodplain at the South Australian border to the Lower Lakes at the Murray Mouth and was broken into four geomorphologic reaches. The upper three reaches make up the floodplain corridor wetlands and the fourth reach includes wetlands of the Lower Lakes. There are about 2,700 wetland polygons in total, 1,400 in the upper three reaches and 1,300 for the Lower Lakes reach. All wetland polygons were assessed for the corridor but only a representative subset were assessed for the Lower Lakes due to the quality of the wetlands mapping and current drought conditions.

The methodology involved assigning scores, then rankings (high, medium or low) to wetland polygons resulting from an assessment of a range of criteria. The first two phases were to determine the ecological value ranking and threats ranking using the criteria listed in the following table.

Class	Criteria
Ecological value ranking	Threatened flora and fauna Habitat structure Habitat extent Hydrological regime for complex wetland classification (*Directory of Important Wetlands in Australia*)
Threat ranking	Secondary salinisation Altered hydrology – hydroperiod Altered hydrology – connectivity Land-use intensity Wetland buffer
Feasibility ranking	Manipulation or hydrology through entitlement flows, weir pool manipulation or changes in lake levels Secondary salinisation Manipulation of hydrology using infrastructure

All wetlands with a low threat ranking, no matter what the conservation value ranking was, were listed for protection. A wetland was included in the protection ranking if it had structural complexity, an extensive vegetation buffer and no signs of secondary salinisation, indicated by bright red healthy vegetation on infra-red aerial photography (below left). A wetland was excluded from the protection ranking if there was evidence of vegetation clearance, little vegetation buffer and signs of secondary salinisation, revealed by bright salt scalding (below right).



The remaining wetlands with medium and high-level threats continued into the third phase, the feasibility for rehabilitation ranking, using a range of criteria. The ecological value ranking was then compared with the feasibility ranking to produce a final prioritised list of wetlands suitable for rehabilitation.

Wetlands prioritised for rehabilitation are those that are impacted by regional-scale threats, ranked by ecological value and are feasible to rehabilitate. Wetlands prioritised for conservation are those that are not impacted by regional-scale threats and are ranked by conservation value. Analysis revealed that more wetlands are prioritised for rehabilitation (73 per cent) than for protection (25 per cent), which reflects the high and medium-level threats to the floodplain.

Threats were found to be unevenly distributed across the study area. The Overland Corner to Mannum reach had the highest percentage of wetlands ranked for rehabilitation because the cumulative impacts of secondary salinisation, intensive land uses, habitat fragmentation and altered hydrology are relatively more acute.

The other reaches, in particular the SA border to Overland Corner reach, have higher ecological value and lower threats because they are in a more natural state with less urbanisation and have intact conserved areas. It may not be feasible to draw any conclusions from the results for the Lower Lakes reach given the current drought situation.

Reach	Rehabilitation ranking	Protection ranking
SA border to Overland Corner	557 (69%)	237 (29%)
Overland Corner to Mannum	423 (82%)	76 (15%)
Mannum to Wellington	52 (72%)	18 (25%)
Lower Lakes and tributaries	108 (63%)	63 (37%)
TOTAL	**1140 (72%)**	**394 (25%)**

Results of prioritisation

This prioritisation project is a valuable tool for wetland managers. An improved understanding of the wetlands with high conservation value will help the SA Government make informed decisions about future acquisitions to the protected areas network. For the SA Murray Darling Basin NRM Board, it will provide the basis for future rehabilitation efforts at wetlands along the River Murray. It also provides contextual advice for policy and planning, on-ground works and community management.

Information: Debra Frankiewicz, SA Department for Environment and Heritage 08 8222 9207 frankiewicz.debra@saugov.sa.gov.au

Restoring environmental flow to Mulcra Island, River Murray, Victoria

Environmental water pumped into a wetland on Mulcra Island, Victoria. Photo: Victorian Department of Sustainability.
Below: Growling Grass Frog recorded at Mulcra during environmental watering. Photo: Mallee CMA.

By Anna Chatfield and Lauren Murphy.
Mallee Catchment Management Authority

A multi-million structural development is taking shape at one of the Murray River's most environmentally significant sites – Mulcra Island - near Mildura, north-west Victoria. The construction project, part of the Murray-Darling Basin Commission's $270 million Living Murray Environmental Works and Measures program, will enable more efficient and effective use of environmental flows at the island.

Mulcra Island is one of three islands that make up the Chowilla Floodplain (including Lindsay-Wallpolla Islands) Living Murray Icon Site. Mulcra Island occupies more than 3,000 hectares of floodplain with watercourses, wetlands and freely draining floodplain, supporting a range of threatened flora and fauna species including the Regent Parrot, Crimson-Spotted Rainbow Fish and Growling Grass Frog.

The island is an important place for the Latji Latji, Wergaia, Ngintait and Nyeri-Nyeri Indigenous people, with records showing Aboriginal inhabitancy dating back three to six thousand years. Wildlife on the island provided a reliable food source and cultural sites at the island offer an insight into Aboriginal settlement patterns and lifestyles, diet, trade and how these changed over time.

The lack of flooding caused by river regulation, coupled with the on-going drought, has resulted in a significant decline in the health of this iconic floodplain. The poor health of the floodplain is clearly visible through the widespread death of River Red Gums and ephemeral wetlands that are becoming increasingly dominated by terrestrial species.

Emergency environmental watering of wetlands on the island over the past five years has been implemented to ensure the maintenance of key refuge areas. However, a larger, more permanent solution is needed to restore the balance to the broader floodplain.

Six years of ecological investigations managed by the Mallee Catchment Management Authority is expected to culminate in February 2009 with a package of environmental water management structures.

Seven environmental regulators and other associated works have been designed to improve surface water management across Mulcra Island, increasing the frequency, duration and extent of wetland and floodplain inundation. The structures will enable natural resource managers to use environmental water in a more flexible way, allowing a range of river heights and allocation levels to be utilised.

By implementing these works, flows will be restored to Mulcra Island's main creek system – Potterwalkagee Creek – and allow flooding of more than 600 hectares of River Red Gum forest, Lignum swamps and wetlands. Environmental regulators will be used in tandem with artificial raising of Lock 8 on the River Murray to deliver various flow scenarios that mimic natural variation.

The capacity to deliver an annual spring fresh flow through Potterwalkagee Creek will increase the extent and quality of flowing habitat by 20 kilometres and provide important habitat for small and medium-sized native fish.

Filling wetlands and inundating floodplain areas during early winter through to late spring will provide breeding opportunities for waterbirds and frogs and stimulate germination of wetland plants, increasing the diversity and robustness of the floodplain.

In regard to consultation on these proposed works, a Cultural Heritage Management Plan has been developed in partnership with Indigenous stakeholders, identifying more than 100 cultural sites on Mulcra Island. Management recommendations have been developed to protect these sites during construction.

In addition, a Community Reference Group for the Victorian component of the Chowilla Floodplain (Lindsay-Wallpolla Islands) Living Murray Icon Site, which includes Mulcra Island, has been established to guide community consultation on the proposed works.

Information: Mallee CMA 03 5051 4377

Extent, condition and threat to coastal saltmarshes, Victoria

An example of Victorian coastal saltmarsh, which may be completely lost within the next few decades if current trends continue. Photo: Tim Allen.

By Professor Paul I Boon, Institute for Sustainability and Innovation, Victoria University

Coastal saltmarshes are amongst the most abused of all of Victoria's wetland ecosystems. Altered hydrological conditions, impacts from sea-level rise, clearing, reclamation for coastal development and weed invasion have led to significant declines in these wetlands for at least a century. Current trends suggest that saltmarshes will be almost completely lost within the next few decades, particularly due to climate change, unless there is a concerted effort to address these environmental issues.

Coastal saltmarsh and mangrove plant communities are scattered along Victoria's coast, on sheltered (low-energy) flats, associated with bays, estuaries, barrier islands and spits. Coastal saltmarsh and mangrove environments support several distinctive plant communities, forming herbfields, shrublands, sedgelands and grasslands. These are only partly described in the Department of Sustainability and Environment's current Ecological Vegetation Class typology.

These and adjacent environments also provide habitat for native fauna, (endangered species such as the Orange-bellied Parrot), ecosystem services benefiting commercial and recreational fisheries, and are foci for recreation and coastal development.

The Victorian coast is one of few places where saltmarsh and mangrove co-exist: mangroves are frost-limited further south and saltmarshes are reduced in extent and floristic diversity to the north. In a national and global context, Victorian saltmarshes are well developed and have high local and regional diversity - more than 120 vascular plant species have been recorded from these ecosystems across the state.

Mangrove and saltmarsh communities are spatially restricted in Victoria because they require sheltered, low-energy coastlines. Although discrete patches of saltmarsh along the coast are typically less than 100 hectares, larger continuous areas more than 1,000 ha occur in Westernport Bay, Corner Inlet and along the lower Barwon River.

It is estimated that there is less than 12,000 ha of saltmarsh and mangrove vegetation remaining in Victoria. What proportion of the original extent of intertidal vegetation this represents is difficult to determine. It is clear, however, that extensive areas of saltmarsh have been lost as a consequence of the development of salt production facilities and reclamation works such as coastal drainage schemes and seawall construction. Key areas of direct loss include the northern shoreline of Corner Inlet, the eastern shoreline of Westernport Bay and the western shoreline of Port Phillip Bay.

Professor Paul Boon, from the Institute for Sustainability and Innovation at Victoria University in Melbourne, leads an Australian Government-funded project to help address the decline in extent and condition of coastal saltmarshes. The project is a collaboration between Victoria University, Ecology Australia, Biosis Research, the Arthur Rylah Institute, Pathways Bushland and Environment, and Ipsos.

The project will provide the first comprehensive state-wide assessment of Victoria's coastal saltmarshes, assess the extent and condition of existing saltmarsh remnants, identify specific threats to the survival of these communities and, most importantly, provide clear strategic guidance to management authorities on the necessary on-ground actions to halt the decline. It will also assess the current extent of the exotic weed Spartina in Victoria's estuaries and embayments and help to develop a coordinated control plan.

Information: Professor Paul Boon, Victoria University
Paul.Boon@vu.edu.au

Recovering the Macquarie Marshes and Gwydir Wetlands, NSW

The Macquarie Marshes and Gwydir Wetlands, New South Wales, have undergone a four-year wetland recovery program. Photo: Dragi Markovic.
Opposite page: Wildlife at Gwydir Wetlands. Photo: Neal Foster.

By Renee Shepherd, NSW Department of Environment and Climate Change

The final six months of a four-year NSW Wetland Recovery Program of the Macquarie Marshes and Gwydir Wetlands heralds a time to reflect on the impact of the completed activities and an assessment of what is still required to "recover" these wetlands.

Numerous studies have provided critical information on key aspects of the systems. A study on the impacts of grazing in the two wetlands indicated that inundation rather than grazing was the key driver of vegetation change and a diverse seed bank in the Gwydir Wetlands demonstrated the wetland's resilience.

Investigations into trophic pathways have shown that short-duration flood events trigger the commencement of plant and aquatic species life-cycles, however completion of the full cycle often does not occur. Over time this leads to a depletion of the seed and egg bank, reducing the resilience of the system. Floodplain inundation has shown to be vital to ensure nutrient and carbon flow throughout the system, particularly given that nutrient release varies between sites.

Predictive mapping of the two wetlands shows that the invasive plant lippia has spread at alarming rates since its introduction 20 to 30 years ago. In terms of long-term control mechanisms, research into potential biological control agents is ongoing and more than 21 arthropods and 16 pathogens of interest have been discovered and are undergoing further testing. In the shorter term, investigations into the impact of grazing on the weed shows that maintaining a cover of native species can be effective in reducing lippia biomass.

Addressing the 95 per cent larval and juvenile fish mortality rate at the Marebone Weir upstream of the Macquarie Marshes is a step closer. Concept designs for a new fishway have been completed and detailed designs, funded under the NSW Rivers Environmental Restoration Program, will see the fishway constructed within 12 months.

The capacity to deliver larger daily volumes of environmental flows to the Marshes will now be possible thanks to construction works commencing on Gradgery Lane

Gwydir Wetlands and Macquarie Marshes can be restored through land and water management activities, physical works and legislative compliance actions.

(Marebone Choke). These works will increase the flexibility of environmental water managers to deliver flows to key ecological assets including important vegetation and aquatic ecological communities, and to enhance colonially nesting waterbird breeding events.

Willows spanning more than 70 kilometres of the Macquarie River have been removed and native species re-planted. These works, coupled with weed management and feral animal control, are improving the river system upstream of the Marshes.

Within the Gwydir Wetlands, three properties are subdividing paddocks to allow for more strategic grazing management of core wetland areas. Agreements to remove

stock during and following flood events will allow wetland plants to set seed. Construction of a Gwydir Wetlands Education Centre on private property will allow the wetlands to be accessed by the general community, which will play a vital role in promoting the importance of the wetlands. Ecological and hydrological studies have commenced along Mallowa Creek to increase our understanding of this important, yet poorly studied component of the wetlands.

Impacts of dry seasons on the wetlands have been well documented and environmental flows are playing an increasingly important role in maintaining the wetlands' ecological assets. Almost 5,300 megalitres (ML) of general security entitlement and 1,200 ML of supplementary access entitlement has been purchased in the Macquarie valley, and 2,190 ML within the Gwydir valley, for ongoing environmental management in conjunction with other environmental water held within the valleys.

Despite the successful completion of these projects and the benefits they will provide, the activities themselves have not led to a "recovery" of the wetland systems, particularly in the context of an enduring dry climatic period. A longer-term, consolidated effort is required. As a result, Adaptive Environmental Management Plans (AEMPs) have been drafted to guide the actions required to restore and maintain critical ecological functions and habitats in the Macquarie Marshes and Gwydir Wetlands.

The AEMPs provide a sobering snapshot of the state of the wetlands. Comparisons of vegetation mapping undertaken in the Macquarie Marshes from 1991 to 2008 show a clear trend towards dryland vegetation communities dominating increasing areas of the wetlands. Where wetland communities once occurred, chenopods now comprise the understorey. River Red Gum woodlands throughout the Marshes are highly stressed and the once vast reed beds have contracted enormously.

The frequency of inundation of core areas of the Marshes has decreased since the late 1970s. Key wetland indicator species such as the iconic Red-bellied Black snake no longer occur in large numbers, and since a large colonially nesting waterbird breeding event in 2000, the only other similar event to occur in the Marshes has been one colony of egrets in 2008.

The story in the Gwydir Wetlands is no less concerning. The wetlands are under pressure from dryland and irrigated cropping, often succumbing to clearing for these activities. The ongoing infestation of lippia also results in clearing and cultivation of wetland areas in a desperate attempt to control the weed. Substantial areas of Coolibah woodlands, Water Couch and Marsh Club-rush have all declined between 1996 and 2008. Inundation patterns from the late 1970s highlight that flooding of a magnitude to support wetland communities is limited to distinct watercourses. Fish populations do not appear to be as degraded within the Gwydir system compared to other systems in New South Wales. However, the ability of colonially nesting waterbirds to successfully breed within the wetlands has been limited by a lack of flows in recent years.

To focus future efforts most effectively, the key ecological assets of the two wetlands have been identified and their broad water needs determined. Areas of inundation from known inflow volumes under dry, moderate and wet conditions can now be estimated and inform future decisions.

The component of the AEMPs that consolidates this valuable information and provides a clear direction on how the wetlands' functions can be restored and maintained lies in the action plan. The action plan lists land and water management activities, physical works and legislative compliance actions that are required to affect change. Feedback on the two AEMPs is strongly encouraged from all interested parties. A copy of the AEMP is expected to be available from January 2009. Feedback will be accepted until early April 2009, prior to the final versions of the AEMPs being released in mid 2009.

The NSW Wetland Recovery Program is jointly funded by the NSW Government and the Australian Government's Water Smart Australia Program. The program is delivered by the Department of Environment and Climate Change, in partnership with the Department of Water and Energy, Department of Primary Industries, and the Border Rivers-Gwydir and Central West Catchment Management Authorities.

Information: Program coordinator, Renee Shepherd, 02 6883 3047 renee.shepherd@environment.nsw.gov.au
www.wetlandrecovery.nsw.gov.au

Worldwide decline of migratory shorebirds

Shorebird populations are declining worldwide, such as the Red-necked Stint (above), which is the smallest and one of the most numerous shorebirds in Australia. Photo: Chris Tzaros.

By Joanne Oldland, Birds Australia

Every year, as many as two million migratory shorebirds leave Australia's shores throughout March and April to begin a 10,000 kilometre journey along the East Asian Australasian Flyway to their breeding grounds in the Northern Hemisphere (Russia, Siberia, Alaska, Mongolia and northern China). There they squeeze the entire breeding cycle into six short weeks to take advantage of good weather and plentiful food, before embarking on the return journey to Australia where they spend the non-breeding season (our summer).

Unfortunately, shorebird populations are declining worldwide and threats to their survival are increasing dramatically. Forty four per cent of global shorebird populations with known trends are decreasing. It seems the greatest challenge these birds face is not the epic journey half way across the world and back, but the destruction of their habitats through coastal and urban development and climate change. The wetlands and intertidal coastal mudflats that these birds rely on for food and recuperation are disappearing along their migratory paths.

Shorebirds using the East-Asian Australasian Flyway share the region with almost half of the world's human population. As these birds wing their way to the Northern Hemisphere, many shorebirds will stop at "staging areas" to rest and refuel before completing their journey. One of the most important staging sites for migratory shorebirds leaving Australia is the Yellow Sea, on the East coast of Asia. Here, nearly a third of the tidal habitat has been lost to large coastal reclamation projects.

Saemangeum, on the west coast of South Korea, was once the Yellow Sea's most important shorebird stop-over site, used by about 400,000 migrating shorebirds. It is now three years since the completion of a 33 kilometre sea wall, which cut off the life-giving tides to 40,000 hectares of tidal mudflat. In 2007, 80,000 Great Knots (30 per cent of the world population) went missing from the Saemangeum Estuary, the majority of which didn't turn up in neighbouring estuaries.

The destruction of these habitats, which seem far removed from our shores, is affecting the number of birds returning to spend their summers here. As home to 38 species of migratory shorebird during the non-breeding season, Australia is uniquely placed to assess the impacts of these threats on shorebird numbers. Within Australia also, migratory and resident shorebirds are under increasing pressure from coastal development and water shortages in inland wetlands, as a result of over-extraction and climate change.

Recent analysis by Birds Australia and the Australasian Wader Studies Group found that shorebird species such as the Curlew Sandpiper and Eastern Curlew have declined throughout southern Australia by 75 per cent and 50 per cent respectively over the past 25 years. Migratory shorebirds are listed as "matters of national environmental significance" under the *Environment Protection and Biodiversity Conservation Act 1999*.

Shorebirds are excellent indicators of environmental health and values of coastal areas and wetlands, including many of Australia's 65 Ramsar-listed wetlands. They are also highly visible natural icons that have the capacity to engage the community in international biodiversity conservation. To effectively conserve shorebirds and their habitats we need to know how, where and why they are in trouble. While

volunteer groups such as the Australasian Wader Studies Group have been monitoring shorebird populations for 27 years, there are limitations to overcome to deliver robust, reliable long-term data capable of detecting shorebird population trends.

The Shorebirds 2020 program, run by Birds Australia and the Australasian Wader Studies Group in partnership with WWF-Australia and the Australian Government, was initiated in 2007 in response to growing worldwide concern over declining shorebird populations. It is designed to reinvigorate community effort in monitoring Australia's migratory shorebirds, and record shorebird numbers to aid their conservation and management. The program also contributes to certain objectives and actions of the Australian Government's Wildlife Conservation Plan for Migratory Shorebirds. Shorebirds 2020 has initially been funded for two years until June 2009, with plans to continue for a further three years.

During its first year, the program has developed a tractable, improved method for counting shorebirds that identifies statistically significant declines in shorebird species numbers in Australia, and collects information on disturbance, threats and habitat condition to help explain trends at sites. The program has also produced a shorebird counters toolkit with "how to count and identify shorebirds" resources, count forms, instructions and site maps.

The program has also identified and GIS mapped important shorebird sites in Australia to include in the national monitoring program. There has been volunteer recruitment and the development of training resources and workshops on how to identify and count shorebirds. In summer 2008 several national shorebird counts were coordinated, attracting about 500 volunteers (more than 56 organisations and groups) conducting shorebird counts at more than 70 sites around the country, totalling over 5,000 volunteer hours.

The East Asian Australasian Flyway passes through 22 countries, where 38 species migrate from the Northern Hemisphere to Australia each year.

Recent analysis has revealed that in order to identify statistically-significant declines in shorebird species populations, the number of regularly-monitored sites around the country needs to increase to about 150. The first three years of the project will focus on expanding the current monitoring scheme and recruiting, training and coordinating more volunteer shorebird counters.

Information: Joanne Oldland, Birds Australia
03 9347 0757 j.oldand@birdsaustralia.com.au
www.shorebirds.org.au

The Red-necked Stint migrates an incredible 13,000 kilometres from its breeding ground in Siberia. Photo: Dean Ingwerson.

Traditional fire management in Kakadu Wetlands, NT

Fire management is being used by traditional owners Peter Christophersen, Violet Lawson and their family to manage wetlands in Kakadu, Northern Territory. Photo: Randy Larcombe. Right, red lily. Photo: CSIRO.

By Barbara McKaige, CSIRO

Traditional fire management has returned to the Northern Territory's Kakadu wetlands in a meeting of two cultures: Traditional custodians and Western science. Fire management has been used by Indigenous Australians to manage their environment for more than 50,000 years and Violet Lawson and her family, traditional owners from Kakadu National Park, are drawing on this ancient practice to manage wetlands on the South Alligator River.

They are collaborating with CSIRO, Parks Australia and the Environmental Research Institute of the Supervising Scientist on the Bushfire CRC's Burning for Biodiversity Project, which has transformed the Boggy Plain and Yellow Water wetlands into habitats rich in biodiversity and cultural resources for Aboriginal people.

"You look after country and the country will look after you," Violet said. Her daughter Sandra McGregor, a CSIRO research officer, has also taken up the firestick with her partner and fellow CSIRO research officer Peter Christophersen, and Sandra's aunty Judy Alderson.

Magpie goose eggs, traditional food for Aboriginal people. Photo: Peter Christophersen.

The need for this action is because for most of the past century, Kakadu's wetlands were home to large herds of feral Asian water buffalo. Since buffalo were removed from the park in the 1980s, the native grass Mudja (*Hymenachne acutigluma*) has spread unchecked and taken over many wetlands in Kakadu. Mudja chokes out other wetland plants, reduces the variety of habitats, which prevents water birds from feeding, and limits access for hunting and food gathering by Aboriginal people.

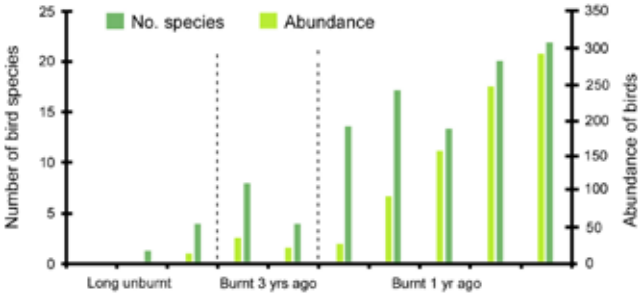
Sandra's family uses fire to control the density of Mudja. It is thought that the water buffalo controlled Mudja in much the same way that Aboriginal fire management did before European settlement.

"Before we burn the wetlands, we need to burn the surrounding woodland, springs and paperbark forest edge," Sandra explained. "The woodlands that surround the wetlands are prepared by burning throughout the early dry season (April-May) to make sure that the late dry season wetland fires don't escape into the woodland and create late hot burns. The spring lines are also prepared in this way. Many visits are required to ensure the wetland has been secured. The paperbarks around the floodplain margins are burnt as early as possible to protect them from the floodplain fires later in the year. As the water dries up we burn into the wetlands. The whole family helps out.

"When the wetlands start to dry up the hot dry southerly winds carry the fire through the grasses and over the water.

Later in the year the winds shift during the late afternoon, with 'Mupilil' winds coming from the north. This helps to drive the fire back and forth over the wetlands. The wetlands may smoulder for weeks. Many areas will burn two to three times over, especially if they haven't been burnt for years." Vegetation changes are being monitored using satellite imagery, ground-based transects, fixed photograph points and historic aerial photos. Waterbird abundance at Yellow Water is being monitored in fixed plots and the results are dramatic.

"We've significantly enhanced biodiversity in these wetlands and improved their cultural values for Aboriginal people by increasing the availability of food resources." Peter said. "The vegetation changes and the increase in the number of waterbirds from several hundred to several thousand birds at Yellow Water simply from burning have been amazing."



Areas that were once densely covered in Mudja now support a variety of habitats, with more water lilies, (*Nelumbo nucifera, Nympahaea violacea, Nymphoides hydrocharoides, Nymphoides indica*), wild rice (*Oryza meridionalis*), spike rushes (*Eleocharis dulcis*) and larger areas of open water. The number of waterbirds and Magpie Geese has increased dramatically. Historically, up to 85 per cent of the total Northern Territory's Magpie Goose population has gathered here to feed at times.

The project has also helped transfer traditional knowledge to younger generations. "Our whole family is involved in burning the wetlands," Peter said. "Our kids love to learn about looking after country, burning, hunting and collecting bush tucker. It is important that people maintain their links with the land, animals and plants to develop an understanding of their interactions."

Equally as important is having time to listen to Aboriginal elders, who hold much of this knowledge. "Aboriginal people hold a wealth of ecological knowledge that could profitably be applied to current day land management," Sandra said. "Unfortunately this has rarely happened and a large amount of knowledge is being lost as elders pass away before the knowledge can be recorded or passed on."

Peter and Sandra currently work with CSIRO ecological modeller, Dr Adam Liedloff using Bayesian Belief Network modelling for capturing traditional ecological knowledge and applying it to fire management in Kakadu's wetlands. The Bayesian approach can use more qualitative information than the quantitative data of conventional process-based models.

According to Dr Liedloff, once a model is developed, it will provide a tool for recording traditional ecological knowledge, applying it to wetland management, and providing an interactive educational experience for a diverse audience, from traditional owners to tourists.

Information: Peter Christophersen and Sandra McGregor CSIRO Sustainable Ecosystems 08 8944 8411.

Traditional knowledge such as fire management is being transferred to younger generations. Photo: Randy Larcombe.

Saving the Southern Bell Frog, NSW

Ecologist Dr Skye Wassens monitors the Southern Bell Frog. Photo: Catherine Scougall.

By Margrit Beemster, Institute for Land, Water and Society, Charles Sturt University

The Southern Bell Frog (*Litoria raniformis*) has its own band of "champions" doing their utmost to ensure the survival of this internationally endangered species. An informal group of landholders, scientists and staff from the NSW Department of Environment and Climate Change (DECC) has successfully secured an allocation of environmental water, funding for research projects and drought refuges for the frogs.

Thirty years ago the Southern Bell Frog - a pretty frog with iridescent green with splotches of gold and black - was found throughout south-eastern Australia. Its call sounds like a motorbike and it is closely related to the endangered Green and Golden Bell Frog.

Today, the frog is rare in New South Wales with populations known at a few locations along the Murrumbidgee and Murray Rivers. Southern Bell Frogs have been hit hard by changes to their natural environment caused by river regulation and altered flooding regimes. Recent successive dry years have further reduced and fragmented the wetlands on which the frog depends.

In 2007, the NSW Minister for Climate Change, Environment and Water agreed to deliver an "emergency wetland watering" allocation of 10 gigalitres of environmental water (from water that had been set aside in the Water Sharing Plan for the Murrumbidgee River) to save the frogs, which were in dire straits due to the drought and subsequent halt to all environmental water allocations in NSW for the 2007-08 season.

Dr Skye Wassens, an ecologist with Charles Sturt University's Institute for Land, Water and Society, said the frogs were "weeks away from disaster". Dr Wassens had been asked by the DECC to assess the Lowbidgee region and the impact of the drought on Southern Bell Frogs in September 2007. "The numbers were extremely low," she said. "All the wetlands were dry. We were unable to find the frog in sites that used to have thousands."

With the release of a small amount of environmental water, Dr Wassens (with input from State Waters, landholders, DECC and Yanga National Park staff) determined which sites were still likely to have Southern Bell Frogs and could be watered. Between December 2007 and January 2008 six key wetlands were flooded: Warwaegae Dam, Avalon Swamp, Eulimbah Swamp within the Nimmie-Caira System, and Two Bridges, Mercedes and Pocock's Swamps within Yanga National Park. "We were able to save four populations," Dr Wassens said. "But by the time we watered Avalon Swamp it was too late."

In the process of monitoring the key populations, landholder Steve Blore identified a large group of Southern Bell Frogs in a farm dam used for watering stock. "That dam had hundreds if not thousands of Bell Frogs in it," Dr Wassens said. "It was

basically a refuge site for the frogs but the dam was beginning to dry up. We were able to get some water into a channel between it and another site so the frogs could move."

Dr Wassens first became concerned about the Southern Bell Frog's fate when working in consulting after graduating in 1997. "I realised that even though they were an endangered species, nothing was really known about them," she said. In 2001 she commenced a PhD study looking at how Southern Bell Frogs responded to flooding and used different parts of the landscape at different times of the year. Since completing her PhD in 2005 Dr Wassens has continued her research into flooding responses and the impacts of altered flooding regimes on frogs in general.

"Frogs have just been ignored in planning for environmental flows even though we know they are a really sensitive group to altered flooding," she said. "A lot of my work has been trying to identify what the requirements are for different groups of frogs."

A lot has been learned from the emergency watering in 2007-08 and the follow-up monitoring and surveys. While there was good frog breeding in Yanga National Park in the open River Red Gum wetlands, the responses were poor in some of the Black box-lignum wetlands in the Nimmie-Caira system, which is on private farmland.

"We had a lot of adults calling but didn't get many tadpoles," Dr Wassens said. "This seems to have been caused by the high density of carp, which eat the frog's eggs and probably the tadpoles as well. The carp would also be competing for food."

In 2008, a group of Lowbidgee landholders wanting to save the frogs left on their properties successfully applied for a

Dr Wassens has studied how the Southern Bell Frog responds to flooding. Photos: Sascha Healy.

Southern Bell Frog (*Litoria raniformis*).

$50,000 Threatened Species Network Community Grant to exclude carp from stock and domestic dams. The funding, matched by a similar contribution from the landholders, will be used to modify existing dams, build turkey nest dams, put in pumps to exclude carp, and eradicate carp from existing dams.

The monitoring carried out after the emergency watering showed that the Southern Bell Frog was more sensitive to changing flooding frequency and to drought periods than previously thought. "Annual flooding of key sites is essential for the frogs to survive," Dr Wassens said.

Southern Bell Frogs have been hit hard by changes to their natural environment caused by river regulation and altered flooding regimes.

With this in mind, for the 2008-09 season, the landholders will use some of their stock and domestic water allowance to manage their Southern Bell Frog sites. Landholders were not able to do this in 2007-08 as there was very limited stock and domestic water allocation.

"We also have a small environmental water allocation of 500 megalitres to try and hold the populations in Yanga National Park, which may not be quite enough," Dr Wassens said. "We will be working to do a much more detailed assessment of fish and frog interactions in the wetlands. At the same time we will do a much more comprehensive study of the stock and domestic system to work out where the Southern Bell Frog is. We need to find out the best way to use environmental water."

Information: Dr Skye Wassens, Charles Sturt University, swassens@csu.edu.au

Rediscovery of endangered species in the Ballina Shire, NSW

The endangered Sophora tomentosa. Photos: Adam Gosling.

By Adam Gosling, WetlandCare Australia

The NSW endangered coastal shrub Sophora tomentosa was thought to be extinct in the Ballina Shire - until the chance discovery of a single population of five plants on Crown land on the banks of North Creek Ballina. The exciting find was made by Adam Gosling as part of WetlandCare Australia's Estuarine Wetland Assessment and Prioritisation Project.

S. tomentosa is an important climax species in coastal environments, facilitating the regeneration of disturbed environments. It also plays an integral role in dune and riparian stabilisation and reduces the incidence of erosion of these unstable substrates. Additionally, the pollen produced in the flowering season is potentially an important nectar source to avifauna, bat and insect populations within coastal and estuarine ecosystems.

Historic records suggest that S. tomentosa was relatively common from Port Stephens northwards. Previously recorded populations from Tweed Heads, Coffs Harbour and Iluka are now thought to be extinct (DEC 2004). Its distribution is both extremely limited and in severe decline. Generally only small, isolated populations exist within NSW. The southern limit of this species is the Sea Acre Nature Reserve in Port Macquarie and it occurs north into Queensland and Papua New Guinea.

A vital recovery plan has been put in place by WetlandCare Australia in consultation with NSW National Parks and Wildlife Service, Department of Lands, Northern Rivers Catchment Management Authority and Ballina Shire Council to conserve the newly-discovered population. The aim is to secure the immediate future of this population, address the threats that compromise its survival and investigate ways to ensure that S. tomentosa will contribute to the biodiversity values of Ballina Shire into the future.

The Northern Rivers Catchment Management Authority has contributed funding to eradicate the immediate threats posed by ground asparagus (*Asparagus aethiopicus*) and climbing asparagus (*Asparagus plumosus*) and to erect temporary fencing to restrict the threat posed by grazing cattle.

Coming across the population along North Creek was unexpected given the considerable distance from the coast - about 3.2 kilometres west of the nearest beach (Sharps Beach) and more than 6.5 kilometres from the mouth of the Richmond River. The normal habitat of S. tomentosa is in recent sands on coastal frontal dunes.

The banks in the vicinity of the population contain extensive middens as the area was incredibly abundant in shellfish and marine life. These middens stretch for hundreds of metres and it is thought that this substrate provided the calcitic platform preferred for the species to establish.

A cultural heritage officer from the NSW National Parks and Wildlife Service inspected the site and recommended restoration works to minimise impacts. WetlandCare Australia is working with the Jali Aboriginal Land Council to ensure both the cultural and environmental sensitivities of the area are observed. It is hoped that the presence of these middens will further ensure the protection of this extremely valuable area.

Until recently, North Creek wetlands were unprotected Crown land and were not under management. The areas have now been included in the Ballina Regional Crown Reserve and will be preserved for their high conservation values, which include a number of Endangered Ecological Communities (coastal saltmarsh, Swamp Oak floodplain forest, Swamp Sclerophyll forest on coastal floodplains and Littoral Rainforest) and threatened flora and fauna (Stinking Cryptocaria, Scented Acronychia, Red Lilly Pilly, Grey-headed Flying-fox, Mangrove Honeyeater, Osprey, Terek Sandpiper, and other bat and shorebird species).

Although some funding has been secured to protect the immediate future of the S. tomentosa population, the wetland complex in which it exists is in desperate need of resources to protect its ecological and cultural heritage values. Additional funds will also ensure the population has every chance of survival.

Without remedial action the population would almost certainly have become extinct due to the pressures from invasive weeds such as ground asparagus, climbing asparagus and cattle. Stumbling upon this small but significant population has provided a small coup in this era of rapid decline in Australia's threatened species populations.

Information: WetlandCare Australia, 02 6681 6169
www.wetlandcare.com.au

Conserving Sydney's White's Creek Wetlands, NSW

The artificial Whites Creek Wetland in suburban Sydney, New South Wales, has been restored by the local council and community. Photos: Aurora Sice.

Sydney's Whites Creek Wetland expands the biodiversity of inner suburbs

By Ted Floyd, Creekcare

It is not easy for wetlands and people to co-exist in a city. Whites Creek Wetland is just three kilometres from Sydney's CBD in the old, densely-populated suburb of Lillyfield, void of original swamps, creeks and native bushland.

There is intense pressure for survival. Whites Creek Wetland is artificial, constructed by Leichhardt Council six years ago beside a concrete stormwater canal. The original concept was initiated by a non-government organisation and the community continues to reintroduce native bushland into surrounding areas.

In these old suburbs, all original native bushland was cleared more than 100 years ago. Swamps were filled in and creeks disappeared under concrete stormwater drains. It is difficult to find suitable land where new wetlands can be established, not to mention the prohibitive price of land and the unavailability of vacant land.

The creation of artificial wetlands is time-consuming and expensive. However, the success of Whites Creek Wetland relied on the co-operation of local and state governments, non-government organisations and community support.

The wetlands do not stand alone, surrounded by a hostile environment of concrete and steel. The lower reaches of Whites Creek flows through council parkland to Rozelle Bay and Sydney Harbour. In the valley, new native bushland continues to be planted and beside the wetland a labyrinth of weeds is disappearing under native plants. The creation of a variety of bushland types helps to restore biodiversity in a combined ecosystem. Frogs and native fish are bred successfully including the Striped Marsh Frog, Common Eastern Froglet and Perons Tree Frog.

Often, people need to be excluded from wetlands to ensure their survival. However, these wetlands are in the middle of a busy city and need people to ensure protection from competing forces. It may be only 1,000 square metres in size (wet weather flows bypass the system) but this small wetland is a valuable urban asset worth more than its small size would indicate.

Initially the wetlands were built to control water pollution, particularly to remove nutrients. Today, it has a number of functions: a teaching aid for school children, public awareness raising of water pollution, understanding of water cycle, a complementary addition to a council park and expansion of biodiversity in a densely-populated inner suburb. Stormwater harvesting and the creation of carbon sinks will be valuable in the future. With global temperatures rising and severe droughts occurring, wetlands are crucial.

Information: **www.ramin.com.au/creekcare/whitescreek.shtml**
newsletter: **www.wetlandlink.com.au**

Providing drought refuge to water-dependent flora and fauna, Victoria

The Moodies Swamp Golden-headed Cisticola, a water-dependent bird that relies on wetlands for strategic drought refuge. Photos: Keith Ward

By Keith Ward, Goulburn Broken Catchment Management Authority

At a time of continuing drought where most wetlands in south-east Australia are dry, the urgency to identify and provide strategic drought refuge to wetland-dependent plants and animals has been recognised by the Goulburn Broken Catchment Management Authority (CMA) in Victoria and the Victorian Department of Sustainability and Environment.

Goulburn Broken CMA has developed a shortlist of potential sites in the local catchment based on: ability to physically deliver water to the wetland; best potential to respond to water; public funds spent previously on improving the water regime (and associated management plan); and a relatively broad geographic spread in the catchment.

This was supported by a chartered flight to ascertain where remaining flooded wetlands existed within the catchment on private and public wetlands. The flight also helped to identify particular concentrations of waterbirds. Ground surveys then targeted sites showing the most promise.

A proposal was prepared outlining the selected wetlands within the catchment and the water requirements. This was then considered as part of a broader northern Victorian annual environmental watering plan. Development of the plan was overseen by an Environmental Water Allocation (EWA) Project Control Board to prioritise the provision of water to wetlands. To be selected as a priority, sites had to meet at least one of three criteria: prevent critical loss of species; avoid catastrophic events or irreversible change; or provide drought refuges to allow for future re-colonisation.

Water for the priority Goulburn Broken wetlands came primarily from a Victorian legal entitlement of water that has been set aside for environmental purposes – the Murray Flora and Fauna Bulk Entitlement.

In April/May 2008, more than 1,000 megalitres (ML) of environmental water was released into Reedy, Black and Kinnairds wetlands. All of these wetlands are on the Goulburn irrigation system therefore water had to be back-traded from the Murray EWA entitlement into the Goulburn system for this allocation to occur.

About 544 ML of water was gravity fed into the 130-hectare Reedy Swamp (near Shepparton) and 413 ML was gravity fed into the 93 ha Kinnairds Swamp (near Numurkah), while about 90 ML was pumped into the 27 ha Black Swamp due to an inability to gravity feed water into that wetland at the time. Other wetland sites in northern Victoria (North Central and Mallee catchments) also received water.

A high diversity and number of waterbirds quickly become evident once the water returned, as well as a number of frogs and wetland plants. A succession of waterbird species utilised the wetlands with some species such as Hardhead (White-eyed) duck in large numbers early in the season, and the Grey Teal later in the season.

To date, breeding outcomes include: Black Swan, Mountain Duck, Wood Duck, Black Duck, Grey Teal, Purple Swamphen, Masked Lapwing, Peregrine Falcon, White-fronted Chat, Sacred Ibis and Straw-necked Ibis. Breeding was suspected from Swamp Harrier, Ballions Crake, Coot, Little Grassbird, Reed Warbler, Chestnut Teal, Whistling Kite, and Spotless Crake.

Black Swan cygnet .

Important feeding opportunities were provided to Brolga, Australasian Bittern, Little Bittern, Lathams Snipe, Blue-winged Shoveller, Freckled Duck, Blue-billed Duck, Musk Duck, Pink-eared Duck, Pied Stilt, Red-kneed Plover, Black-fronted Plover, Glossy Ibis, Black Falcon, Pelican, Intermediate Egret, Great Egret, and a variety of herons, spoonbills, cormorants, and grebes.

Red Dragonfly Wandering Percher.

However, support for the use of water has come from previously disenchanted sectors of the community upon seeing the impacts of the drought on the environment and the results from drought refuges using a relatively small volume of water. Monitoring is continuing and a report is currently being compiled to document the project's outcomes.

Bush birds have also benefited from the water through improved feeding opportunities (insects, flowering, water), with a number successfully breeding. Snakes, turtles and an abundance of aquatic invertebrate life (including multitudes of dragonflies and damselflies) also benefited.

Complementary management actions from Parks Victoria have been carried out, primarily fox control to minimise impacts on waterbirds. Media promotion has also been undertaken relatively delicately given the sensitivities of using water for environmental purposes during a drought.

Information: Keith Ward Goulburn Broken CMA
03 5820 1121 keithw@gbcma.vic.gov.au

The wetland-dependent Moodies Swamp Spider on Craspedia.

Assessing ecological condition of Fleurieu Peninsula wetlands, SA

A property on the Fleurieu Peninsula, SA, and right, 12 months later, the same property showing the power of natural regeneration in swamps. Photos: A Abley.

The link between ecological condition and recovery potential

By Alys Stevens, Conservation Council SA

Wetland ecosystems provide a vast range of ecosystem services yet are being disproportionately removed from our landscapes. The recognition of the environmental importance and the imperilled status of wetland systems is generating interest in wetland restoration.

The drive to restore impacted systems is shadowed by continued land management practices that threaten our wetlands. This can be seen on the Fleurieu Peninsula, in the southern agricultural zone of South Australia. Currently, for newly-proposed development activities that will impact on remaining remnant vegetation - including wetlands - a condition rating is applied to the target site. The condition of the remnant is often a critical factor in subsequent decision-making processes. It is therefore crucial that this condition assessment considers a range of ecological parameters and longer-term environmental goals such as restoration.

Swamps of the Fleurieu Peninsula (FPS) are densely-vegetated wetlands on highly-organic soils that occur on the Peninsula. They are home to a range of flora and fauna species. Fifty per cent of the wetland-dependent flora species have special conservation status (regional, state or federal) and the many threatened fauna that utilise the swamp habitat including the endangered Mount Lofty Ranges Southern Emu-wren (*Stipiturus malachurus intermedius*) for which FPS are one of its main habitat types.

Additionally, swamps are often the only remaining vegetation in a given area, which results in irregular usage by mobile fauna, particularly birds, as habitat supplements or refugia. The swamps have been severely affected by detrimental land management practices since European colonisation and as a result are listed as a critically-endangered ecosystem under the *Environment Protection and Biodiversity Conservation Act 1999*. The Mount Lofty Ranges Southern Emu-wren and Fleurieu Peninsula Swamps Recovery Program works towards its recovery through extension, education, research and on-ground works.

Assessment of wetland condition is important for conservation scientists, land and natural resource managers and planners alike. However, the interpretation of particular condition classing can differ greatly among this group of users. To the conservation scientist, the relegation of particular ecological communities into condition classes is to allow and inform the observation of patterns – whether that be broadly over bioregions in terms of the delivery ecosystem services, or at a species specific level to describe habitat preferences/suitability. Basically, it is another tool employed to further understand the natural world, particularly in response to human impacts.

> We are looking to improve understanding of swamp recovery in and of itself, but also as a component of landscape-scale ecological restoration.

To land and natural resource managers and planning bodies, condition is used as a tool to prioritise effort and management activities, and make decisions regarding planning issues. Managers must contend with much ecological uncertainty, often with varied scientific or on-ground expertise. Condition class therefore needs to be a culmination of relevant ecological indicators, which are amalgamated in a way that allows appropriate prioritisation.

In the Recovery Program, we recognise how important it is to get this information right. We also recognise that for recovery of the swamps and for the health of the Fleurieu landscape, we need to consider the recovery potential or biodiversity

future contained in wetlands, which may be impacted (as all swamps on the Fleurieu have been affected by human impact and landscape change to some extent) and exist in less than pristine condition. However, they are certainly not expendable in a development context.

Over the past few years we have supported many on-ground works and developed a monitoring program to track trajectory of change within these systems as a result of our works program. From this information, we will be better informed about what elements are critical for restoration through natural regeneration, and fit this information into the state-wide natural resource management framework. In the meantime with the imperfect knowledge we have now, we are developing a rapid condition assessment method, which recognises that the Fleurieu Swamps are not just vegetation, but an ecological community that contains significant present and potential biodiversity value.

The condition assessment is part of an entire community assessment and classification process. The floristic indicators collected are native plant species diversity, per cent cover native vegetation, per cent cover bare ground, per cent cover weed species, structural diversity, presence of zonation, recruitment and expansion of key structural layers, width, continuity and structural diversity of fringing vegetation and evidence of grazing.

Indicators relating to the substrate quality, which is of great conservation importance to the Fleurieu Swamps' peat or peat soils (which cannot be recreated over short time scales) include the assessment of peat and organic matter accumulation, current degree of pugging by stock, evidence of past substrate damage and documentation of erosion events. Other disturbance-related indicators including current grazing pressure and man-made structures (dams) are also recorded.

The fauna of the site is recorded but as a descriptive and optionally scored indicator. Additionally, an assessment of the landscape context looks at the proximity and connectivity to other swamps, remnant vegetation and emu-wren populations. This assessment is descriptive as we do not have the information to quantitatively score the impact of degrees of connectivity to swamp functioning across the complement of swamp ecological attributes. However, it is important for this thinking to occur and for the information be recorded for decision makers to consider.

A spatial planning tool developed by the Recovery Program showing the prominence of swamps across the Fleurieu Peninsula, SA, in pink sections.

The ecological condition rapid assessment can be used in two ways. The first is to complement our on-ground works monitoring. This will test how effectively the method documents swamp condition and assess change through time. By pairing with more quantitative and detailed ecological data we can improve the method as our knowledge grows and expand our understanding of vital ecosystem components for restoration processes.

Secondly, the method will be available for site-based assessments so that decision-makers will have a more holistic, documented and repeatable picture of what is occurring at a particular site, while considering restoration and landscape-scale processes.

The Recovery Program is planning a workshop and field day to test the method with a range of users. We want to know: where large degrees of observer bias lie, if target users find the method appropriate, where problems may lie and what extra training might be required. We will provide a form for structured feedback to help us improve the method and keep it relevant. Importantly, we are looking to improve understanding of swamp recovery in and of itself, but also as a component of landscape-scale ecological restoration.

Information: program coordinator, Libby King
libby.king@ccsa.asn.au
www.ccsa.asn.au/emuwren

Risk of eutrophication to coastal wetlands, NSW

Almost one third of NSW's important wetlands are at risk of being lost or degraded through development. Above, Lake Illawarra and surrounding catchment. Photo: NSW Department of Natural Resources.

By Jocelyn Dela-Cruz, Senior Environmental Scientist, NSW Department of Environment and Climate Change

The *Directory of Important Wetlands in Australia* (DIWA) identifies 178 important wetlands in New South Wales - a third of which are located along the coastal zone and at risk of being lost or degraded through coastal development.

Degradation often results from alterations in the natural water cycle of the wetland and increases in land-based exports of toxic substances, pathogens, sediments and nutrients. A recent assessment by the NSW Department of Environment and Climate Change has shown that since pre-European times, sediment and nutrient exports to coastal wetlands listed in DIWA have increased by six and nine times respectively. These excessive exports have the potential to reduce water clarity and increase production of macro- and micro-algae. The net effect, eutrophication, may lead to losses in critical wetland habitats such as seagrass beds, which act as nurseries for juvenile fish.

With Australian Government funding, the Waters and Coastal Science Section of the NSW Department of Environment and Climate Change has developed a coastal eutrophication risk-assessment tool (CERAT) to help identify and prioritise management actions that protect and preserve coastal ecosystems. CERAT is a series of models that estimate the amount of nutrients and sediments exported from land-based activities. It also assesses the potential extent these exports impact on the ecological condition of the estuary or coastal wetland.

The simple models can be used by non-technical experts and are built from readily-available or routinely collected monitoring data and information. CERAT is best applied at the regional scale such as a catchment management authority or natural resource management region. The need for regional assessments is best illustrated in the Southern Rivers natural resource management region, which covers almost half of the NSW coast and is made up of 113 coastal ecosystems including some of the most productive and diverse coastal wetlands in NSW (for example Clyde River Estuary). The maps produced from CERAT help to identify which of the coastal wetlands is most at risk to eutrophication.

This initial assessment provides a systematic and scientific basis for prioritising wetlands before allocation of (often limited) resources for monitoring and mitigation at smaller operational scales (such as farms).

Through CERAT, risk is specified by the product of the hazard and vulnerability. Specifically, the hazard is the total amount of pollutant (nutrient or sediment) export from land-based activities and is quantified by catchment-scale water quality models. Vulnerability is given by the hydrological characteristics of the system, which is quantified through simple models of flushing, transference of heat and transport of the pollutants out of the system. The hydrology of a coastal wetland is often used as a measure of vulnerability because it is inherently sensitive to small changes in wetland morphology, vegetation, rainfall, evapotranspiration and tidal fluxes.

For example, the vulnerability of coastal wetlands that are brackish or saline lagoons with narrow connections to the sea, changes depending on the state of their connections to the sea. The wetland is considered more vulnerable to land use activities if the connection is closed (often by a sand barrier resulting from the action of waves and littoral currents) because the rate of flushing and the amount of transport of the pollutants out of the wetland is limited. Hence, some coastal wetlands are at more risk to eutrophication than others because of their hydrology.

The catchment of Lake Illawarra, for example, is relatively more developed than the catchment of Durras Lake, yet long-term field observations show that annual median concentration of micro-algae (an indicator of ecological heath) in these two lakes is not as different as expected. Specifically, the micro-algae concentrations for Durras Lake are about 1.5 to 2 times greater than the trigger values reported in the ANZECC (Australian and New Zealand Environment and Conservation Council) guidelines, as well as well-flushed pristine systems.

The ratio between the catchment area and waterway area may be used to predict the dominant state of the lake entrance and hence the extent of transport of nutrients out of the lake. As the ratio of catchment area to waterway area increases, the amount of nutrients delivered to the waterway also increases but the entrance is more likely to open. This means that exchange with the ocean is higher and more nutrient load is transported out of the lake. Using the simple model derived from this ratio, it can be predicted that Lake Illawarra is mostly open and Durras Lake is mostly closed. These predictions are consistent with long-term observations. CERAT will be accessible on the OzCoasts website www.ozcoasts.org.au in early 2009.

Information: Jocelyn Dela-Cruz
jocelyn.delacruz@environment.nsw.gov.au

New fishway at Loudon Weir, Queensland

By Katie Ferguson, Condamine Alliance

In an Australian first, a partnership has been struck between corporate and government – civil engineering firm Ostwald Bros. and Australian and State Governments – to construct a fishway at Loudoun Weir, near Dalby, Queensland.

Negotiated by Condamine Alliance, the partnership has seen Ostwald Bros. commit to more than $50,000 to complete the structure, with other major financial assistance coming from the Murray Darling Basin Commission and state and federal funding grants. Financial support has also flowed from GHD and Arrow Energy. This multi-partnership, including corporate investment, is a first for the country and has earned the project plenty of attention.

Loudoun Weir was designated a high priority by the Murray Darling Basin Commission, with an operational fishway now effectively opening up a 108 kilometre stretch of the Condamine River to fish migration. The importance of enabling fish to access the weir has become even more obvious during the recent prolonged drought. Often weirs are the last water resources to dry up so fish reaching these reserves have the best chance of long-term survival.

Earlier attempts to establish a fishway on this weir have failed as a result of hydrology, vandalism and flood damage; and rectifying this situation required considerable expertise and funding. Condamine Alliance rallied the necessary parties and the fishway will be opened in the next big flow.

The Murray Darling Basin's Native Fish Strategy estimates native fish populations have declined to less than 10 per cent of pre-European levels across the Murray Darling Basin. Programs like the Loudoun Weir fishway are aligned with the Native Fish Strategy and aim to increase the native fish population over time to 60 per cent of pre-European levels.

It forms part of the Condamine Alliance's River Rescue Program, which aims to rehabilitate the Condamine River from its headwaters high in the Great Dividing Range along its length of about 500 kilometres to the end of the catchment, west of Chinchilla. Weirs present the largest challenge in obstructing fish passage along the Condamine River. Other obstructions may include dry sections of river or rocks. Restoring connectivity to improve fish passage and protect populations of native fish is a key focus of the program.

Dalby Regional Council is responsible for managing the Loudoun weir and will be in charge of managing the weir and overseeing the operation of the fishway once it is completed. The Queensland Department of Primary Industries and Fisheries has been instrumental in design assistance to ensure the construction will effectively serve its function for our native fish.

New fishway at Loudoun Weir near Dalby, Queensland.

The Condamine River is home to the nationally-endangered Murray Cod and improving river health is a key requirement for sustaining the species over time. Looking after native species in Queensland will assist populations in southern parts of the Murray Darling Basin - some of which are currently in dire straits. In fact the current state of the environment brings home the importance of quality habitats along the entire length of the Basin to provide refuge to native species as the growing threat of climate change is tackled.

In ephemeral systems, like those of the Queensland Murray Darling Basin, weirs not only store water for human use but also provide important refuges that sustain biodiversity during the dry times. These are critical habitats for native fish. Climate change means an increase in extent and frequency of dry times and will place even more pressure on already struggling populations of native fish.

As the first operational fishway in the Queensland Murray Darling Basin and the first in Australia to be financially supported by corporate investment, the Loudoun Weir Fishway highlights the need for fish passage and the importance for native fish to access more secure aquatic habitats. Together with a number of established rehabilitation demonstration sites, the operational Loudoun Weir Fishway will be used to officially launch the Condamine River Rescue Program in early 2009.

Information: Francine Holt, Condamine Alliance
07 4620 0117 fran.holt@condaminealliance.com.au

Rapid assessment of significant wetlands, WA

A standardised method for assessing and reporting on the condition of significant wetlands in Western Australia, like Lake Ballard (above), is being developed by the WA Department of Environment and Conservation. Photo: Michael Coote.

By Glen Daniel, WA Department of Environment and Conservation

The lack of a standardised and readily applicable condition assessment method is an impediment to wetland management in Western Australia. It is difficult for wetland managers to compare their site to others because several different assessment techniques are used across the state.

There is also uncertainty about what data to collect, and when and how to collect it, in order to allow changes in condition to be tracked through time. The Inland Aquatic Integrity Resource Condition Monitoring (IAI RCM) project addresses these issues by developing standardised methods for assessing and reporting on the condition of significant wetlands in Western Australia. The project is funded by the Australian Government and delivered by the WA Department of Environment and Conservation.

The aim is to present wetland managers with a protocol for assessing the condition of wetlands, as well as standard operating procedures for the assessment techniques required. It is important that the proposed methods are suitable for Natural Resource Management (NRM) practitioners, and deliver data that is scientifically rigorous. The assessment technique is a "rapid" one, recognising the need for managers to visit large numbers of monitoring sites during what is often a limited survey period.

The rapid assessment method has been field tested at significant wetlands in each of the state's six NRM regions. The surveyed sites are listed under the Ramsar Convention or in the *Directory of Important Wetlands in Australia* or are considered, by local ecologists, to be critical contributors to regional biodiversity. Sites were also selected to represent the geographic and morphological diversity of wetlands within the state. This diversity of test sites is important to ensure that the proposed monitoring techniques will work across the state and in all types of wetland.

Forty eight significant wetlands were visited by the survey team between April and November 2008. These sites are in the Northern Rangelands (Kimberley, Pilbara, Gascoyne), Southern Rangelands (Murchison, Goldfields), Northern Agricultural, Avon, South West and South Coast NRM regions. The surveyed wetlands include systems that are permanent, seasonal and highly intermittent; groundwater dependant, surface water fed and even seawater fed in climates ranging from tropical to arid to the high rainfall zone of the state's south west. Vast arid zone salt lakes, permanent tropical lakes, artesian springs, coastal lagoons, freshwater claypans and many other unique wetland types were surveyed.

At each site, information was collected on hydrology, water chemistry, aquatic invertebrates, waterbirds, aquatic and riparian vegetation and threatening processes. Based on this data, an assessment is made of the site's current condition and recommendations are made for future management and monitoring.

This data will be uploaded to Wetlandbase, a publicly-accessible database, by April 2009. Wetlandbase is a spatially linked database maintained by the Department of Environment and Conservation. It houses an array of monitoring data collected by the department and is accessible at www.naturebase.net.

Information: Glen Daniel, WA Department of Environment and Conservation 08 6467 5314 glen.daniel@dec.wa.gov.au

Such ready access to historical information is an important asset for land managers when developing a monitoring program. As part of the project, training and documentation will be provided to NRM practitioners and other stakeholders to help them use Wetlandbase and the Wetland Monitoring Protocol. Training sessions will also consider how to develop wetland monitoring programs, what to do with the data and how to gain assistance if required.

The project will provide a significant contribution to the conservation of wetlands in WA. The monitoring protocol and standard operating procedures will allow wetland managers to develop monitoring programs to warn of any deterioration in the condition of their assets. The use of standardised methodologies will also ensure that wetlands can be reliably compared, thus facilitating better prioritisation decisions.

Collecting aquatic invertebrate specimens from Lake Eda in the north of WA. Photo G. Daniel.

Salvaging the Lower Murray-Darling wetlands from inundation, NSW

By Sarah Holmes, Lower Murray Darling Catchment Management Authority

An ambitious project is underway in the Lower Murray Darling Catchment, south west New South Wales, to salvage wetland systems from permanent inundation, isolation from floodwaters, salinity and negative land-use practices. A wetting and drying cycle is being reinstated to about 700 hectares of freshwater ephemeral wetland systems.

The project's aim, carried out by the Lower Murray Darling Catchment Management Authority's (LMD CMA), is to improve the health of native flora and fauna and biodiversity values of the Murray and lower Darling River systems.

The first step was to investigate priority wetlands along the Murray and lower Darling Rivers, looking into terrestrial flora and fauna, water quality and aquatic biological assessments, hydrological and hydrogeological assessments and Aboriginal cultural heritage surveys. This was carried out by GHD Pty Ltd, with sub-consultants and assistance from representatives of the Barkindji Elders community.

As a result, fish passage and environmental flow requirements were determined at each wetland to establish the necessary rehabilitation. Works such as the construction of culverts and regulators and the removal of earthen levees, helped to improve flow variability and fish passage to eight wetlands adjacent to the Murray and lower Darling Rivers.

Additional benefits from the project include improved water quality, enhanced ecological condition of the wetland and surrounding floodplain; and an increase in the diversity and abundance of native flora and fauna species.

The LMD CMA is working with local landholders through management agreements for the construction of fencing, installation of stock watering points and the ongoing monitoring and evaluation of all works. It is hoped that through appropriate wetland management, the ecological health of the lower Darling and lower Murray River floodplains will improve over time.

Information: Sarah Holmes, Lower Murray Darling CMA, 03 5021 9460 sarah.holmes@cma.nsw.gov.au

Restoring a natural cycle

to Margooya Lagoon, Victoria

Netting for aquatic invertebrates on Victoria's Margooya Lagoon, which is being restored to a natural wetting and drying regime. Photos: Mallee CMA.

By Deborah Bogenhuber and Lucy Forster, Mallee Catchment Management Authority

Staring across Margooya Lagoon, in north-west Victoria, during summer you could be forgiven for thinking that the dry, cracked Earth revealed yet another casualty of the drought. But you would be wrong. The lagoon has been dried out intentionally in a bid to restore a natural wetting and drying regime to a body of water that has been artificially inundated for about 60 years. This drying phase falls within dry inflow contingency planning for the Murray-Darling Basin, through reducing evaporative losses from the River Murray.

Like many wetlands in the Mallee region and along the lower River Murray, Margooya Lagoon was an ephemeral wetland prior to river regulation. River regulation along the Murray has ensured, through a system of locks and weirs, that the river remains at a constant level. Initially this was done to allow passage of paddle steamers transporting goods along the river and it has been maintained today to allow irrigation year-round. Regulation has eliminated dry phases in the river channel and associated wetlands, as well as small floods.

The project, managed by the Mallee Catchment Management Authority (CMA), aims to improve the overall health of Margooya Lagoon by reinstating wet and dry cycles. Going from a permanently inundated wetland to a wet and dry wetland, the goal is to move from a carp-dominated fish population to a fish population dominated by native species. Turbid water should be replaced with a solidified wetland bed, and clear water and vegetation surrounding the wetland should be broader with some submerged vegetation throughout. The low diversity and abundance of native fish, frogs, turtles, macro-invertebrates and waterbirds should also be enhanced.

A temporary regulator was built in late 2007 on the inlet creek to Margooya Lagoon, following recommendations from a report on water management options for the Murray River (*Water Management Options for the River Murray – Nyah to Robinvale Stage II*). The regulator was closed to allow water in the wetland to evaporate naturally - the first time the wetland has dried since 1948. Re-filling of the wetland began in June 2008 and plans are underway to install a carp screen to further benefit the new wet and dry cycle.

Before drying the wetland, the CMA ensured there would be no negative impacts on the lagoon's health. Assessments of groundwater levels and groundwater salinity and sulfidic sediments were carried out and suggested minimal risk of salinisation or acidification of Margooya Lagoon as a result of reinstating a wetting and drying regime.

Surface water monitoring of Margooya Lagoon was carried out by the Mallee CMA throughout the drying and re-wetting cycle, with guidance and support from the Mallee Waterwatch Program. The monitoring, which is ongoing, involved a comprehensive survey to detect changes resulting from the new hydrological regime.

Monitoring has already shown benefits from the introduced wetting and drying regime, with the solidification of the wetland bed and the regeneration of River Red Gums. Water quality results were in line with expectations during drying and re-filling phases and indicate no concern of salinisation or acidification to date.

Margooya Lagoon and the surrounding floodplain forest now supports a pair of White-bellied Sea-eagles and flocks of Regent Parrots, as well as four frog species (Spotted Marsh Frog *Limnodynastes tasmaniensis*, Pobblebonk or Eastern Banjo Frog *L. dumerili*, and two species of Froglet *Crinia signifera and C. parinsignifera*) and a diverse flora. The CMA expects to see the biodiversity increase in the future with continuing wet and dry cycles. Results from ongoing monitoring will help guide future directions for the Mallee CMA at other priority wetlands in the region.

Information: Deborah Bogenhuber, Mallee CMA
03 5051 4669 deborah.bogenhuber@dpi.vic.gov.au

Margooya Lagoon, in north west Victoria, has been artificially inundated for 60 years.

Acid sulfate soils in the Murray-Darling Basin wetlands

By Julie Anarov, Australian Government Department of the Environment, Water, Heritage and the Arts

Acid sulfate soils (ASS) occur in both coastal (tidal) and inland or upland (freshwater) settings. ASS are receiving increasing attention due to the actual or potential threats they pose to environmental values, particularly in wetlands across the Murray-Darling Basin. High profile cases include the Coroong and Lakes Alexandrina and Albert. However, there is evidence that ASS occur in other key wetlands throughout the Basin.

ASS are those soils and sediments that contain sulfuric acid, or have the potential to form sulfuric acid when exposed to oxygen in the air. Changes to the hydrology of inland rivers and wetlands have led to the accumulation of these sediments. If left undisturbed and covered with water, sulfidic sediments pose little risk. However, when exposed to oxygen, for example in response to drought conditions, chemical reactions may lead to the generation of sulfuric acid. When these sulfuric sediments are re-wetted, these sediments have the potential to release sulfuric acid, deoxygenate the water column and mobilise heavy metals. This further degrades water quality and presents a severe risk to both human health and wetland condition.

While ASS risks have been well known in coastal areas for some time, ASS in the Murray-Darling Basin have recently emerged as an issue warranting further assessment and investigation. The Murray-Darling Basin Commission is currently funding a project that is evaluating the extent of, and risk posed by acid sulfate soils at key wetlands (including Ramsar sites) in the Murray-Darling Basin. The project will also identify management options for those wetlands where acid sulfate soils pose a threat. Further information is available at www.mdba.gov.au

Systematic risk mapping of acid sulfate soils has been established through a National Atlas and Database for ASS that identifies high risk areas of occurrence of ASS to facilitate appropriate planning and control of development on these soils. The Atlas of Australian Acid Sulfate Soils provides a nationally consistent map of ASS across Australia to improve our understanding of the scale, size and magnitude of the problem.

Although significant areas of ASS risk mapping have taken place, further mapping is required to include the high-risk areas of ASS occurrence, particularly for inland ASS. The final stage will consist of refinement of the atlas starting with high risk areas including the Murray Darling Basin and the Western Australian Wheat belt. The Atlas is displayed on the Australian Soil Resources Information System (ASRIS) website and is expected to be completed in 2011. The atlas is available at: www.asris.csiro.au/index_ie.html

Acid sulfate soils threaten environmental values, particularly in wetlands across the Murray-Darling Basin. Above: Bottle Bend near Mildura, NSW. Photo: Murray Wetland Working Group.

Conserving wetlands on private agricultural land, WA

Crane Neck Lake, Gingin, Western Australia, is part of a pilot project to improve sustainable native vegetation management on farms. Photo: Michael Roache.

By Michael Roache, WWF-Australia

Striking a balance between agricultural production and conservation of wetlands in Western Australia's Gingin Shire, 80 kilometres north of Perth, was one of six projects piloted across Australia from 2006-2008 to improve sustainable native vegetation management on farms.

The Balancing Agricultural Production and Conservation (BAPC) Wetlands pilot, funded by the Australian Government and run by WWF-Australia, explored innovative ways to engage agricultural landholders in conserving high-value remnant wetlands on their properties. The setting was a highly-modified agricultural landscape and wetlands in the area are threatened by continued land clearing, intensive livestock grazing, altered water regimes, chemical and nutrient runoff, invasive weeds and feral animals.

In order to better conserve and manage high-value wetlands in this region, the project set out to foster long-term whole of property management changes by: rewarding stewardship; recognising landholder initiative rather than dictating terms; providing "seed" funding to trigger landholders to implement work using significant amounts of their own time or money; providing simple, flexible incentives that meet broad conservation needs, and increasing knowledge within the community for biodiversity conservation as part of sustainable land management.

The project was devised as a simple conservation incentive scheme, with a total of $120,000 available to private landholders for on-ground works focusing on wetland conservation measures. Wetland conservation action was combined with farm production improvements to offset possible production losses from on-ground conservation work. Financial incentives complemented extension services provided by the project officer.

The project focused on sustainable land management works that provided direct or indirect benefits for wetlands and agricultural land. Due to limited funding, emphasis was placed on cost-sharing to ensure equitable and fair public versus private expenditure. Subsidies were tied to the landholder committing to a binding management agreement. All seven landholders involved in the project signed voluntary management agreements for a period of five years.

Wetlands for potential inclusion in the project were defined as being on private agricultural land, and having high biodiversity values. An existing wetland database (Geomorphic Wetlands Swan Coastal Plain dataset) was used to obtain information on wetland values, extent, type, and location. This was an invaluable resource in determining which wetlands to target.

While landholders were offered a broad suite of incentives to protect and manage wetlands, those of principal interest were fencing materials and off-wetland watering points. Soil tests, poster-sized aerial property photos, and property management plans were adopted by some landholders. Interestingly, surveys of landholders in the project area indicated the importance of: flexibility in which incentives were available, contribution towards production as well as conservation, and the retention of land management decisions by the landholder - particularly in times of emergency. In emergencies, landholders agreed to exclude livestock from wetlands, on the provision that they could crash graze during periods of extreme drought.

BAPC Wetlands successfully secured 367 hectares of high-value wetlands in management agreements, at an average cost of $332 a hectare. It is possible that a market-based incentive project could have reduced this cost per hectare. However, given the prevailing attitudes regarding private property rights in the Gingin area, such a project may not have achieved sufficient landholder interest to be successful.

Many landholders involved in the project had already undertaken some form of conservation work on their property, either through small government grants or private means. Perhaps the difficult process of reaching less receptive landholders in the area is yet to come. In this regard, personal contact with landholders was crucial to engendering trust and developing a mutually agreeable plan for conservation of wetland systems and surrounding native vegetation while ensuring production benefits.

The public benefit of having a healthy and well-connected mosaic of native vegetation across the landscape is difficult to quantify, particularly within a pilot project of this scale. However, the cost of restoring these areas from a completely degraded state, compared to the cost of early management intervention, would be high.

BAPC project report: http://wwf.org.au/publications/bapc-finalreport.pdf

Farmers managing wetlands, Queensland

Intensive agricultural industries in Queensland promote best-practice management.

By Angela Reed, Queensland Wetlands Program

Many of Queensland's wetlands are on private property. This ensures primary producers and landholders are among the most important managers of wetlands in the state.

The Queensland Wetlands Program is working with industry to facilitate the sustainable use, management and conservation of these complex and unique systems. The program is a joint initiative of the Australian and Queensland Governments and is one of the leaders in developing resources for wetland managers in Queensland.

Wetlands play a critical role in supporting agriculture and industry. However, some land practices can have a harmful impact on the systems upon which they rely. To highlight the economic and financial benefits of best practice farm and wetland management, the Program is collaborating with industry to produce a range of resources to help land managers meet their economic and social objectives.

There are about 40,000 wetlands in the Great Barrier Reef, an area of high-intensive agriculture. The Program approached Herbert River catchment sugarcane farmer Mario Porta jnr to showcase his management approach at Burnside, near Townsville. Mario had built three additional wetlands on his property to reduce erosion and run-off and protect against flooding. Through his actions, he boosted his farm returns by $50,000 a year.

Sugarcane was one of five intensive agricultural industries chosen in a series of case studies promoting the use of Farm Management Systems and best-practice wetland management. The others were cotton, dairy farming, ginger production and nursery production. **Information:** **www.epa.qld.gov.au/wetlandinfo**

Caring for our Country,

the Australian Government's funding initiative

A $2.25 billion Australian Government initiative is rolling out to safeguard our magnificent natural environment and productive farmland. Funding is for the first five years of Caring for our Country, an on-going national effort that integrates the programs generally described as natural resource management activities, under one umbrella.

The new initiative brings together previous Australian Government programs including the Natural Heritage Trust, the National Landcare Program, the Environmental Stewardship Program and the Working on Country Indigenous land and sea ranger program.

Six key national priorities are being targeted to ensure the most effective use of Australian Government investment in natural resources. These are: The National Reserve System; Biodiversity and natural icons; Coastal environments and critical aquatic habitats; Sustainable farm practices; Natural resource management in northern and remote Australia; and Community skills, knowledge and engagement.

The coastal environment and aquatic habitat priority was the focus of $22.5 million in Caring for our Country – Coastcare funding with projects announced in December 2008.With this support, community groups and volunteers, Indigenous groups and catchment management bodies will be able to work with universities, other research organisations and government agencies to help protect our exceptional coastal and marine environments including wetlands.

To improve monitoring and accountability, key outcomes have been identified for each priority area over the next five years, with specific short term targets being set to help achieve each of these. Projects funded under Caring for our Country will aim to meet one or more of these targets.

Major five year objectives include increasing the amount of protected areas under the National Reserve System by 25 per cent to 125 million hectares, as well as expanding the area of native habitat and vegetation managed to protect biodiversity, by at least one million hectares. Sustainable farming is another key focus and a target has been set of at least 30 per cent of farmers adopting sustainable land management in the first five years.

Caring for our Country also incorporates action on a number of election commitments under the six national priority areas. These include conserving the Great Barrier Reef, repairing fragile coastal ecosystems, improving water quality in the Gippsland lakes, stemming the migration of cane toads, protecting the endangered Tasmanian Devil and projects targeted to Indigenous Australians.

Although small-scale projects will be funded, Caring for our Country has a strong emphasis on larger landscape-scale projects. These will bring together partnerships of regional natural resource management organisations, businesses, community and industry organisations including landcare and coastcare groups, landholders, researchers, scientists and all levels of government. In November 2008, the government released the Caring for our Country 2009-10 business plan calling for funding applications to be submitted by 6 March 2009. **Information:** **www.nrm.gov.au**

Controlling Giant Rush infestations, Victoria

The Giant Rush has expanded its distribution within the Barmah-Millewa wetlands, Victoria, where two thirds of the floodplains have been taken over. Photos: Keith Ward.

One of the world's tallest rush species invades Victoria's Barmah-Millewa wetlands

By Keith Ward, Goulburn Broken Catchment Management Authority

Reportedly the tallest rush species in the world, Giant Rush (*Juncus ingens*) is common in Victoria's mid-Murray wetlands. This perennial indigenous wetland plant reaches heights of 4.5 metres, although 2.5 – 3.5m is more commonly encountered in the Barmah-Millewa Forest, between Echuca and Deniliquin.

The rush has expanded its distribution within the Barmah-Millewa wetlands ever since river regulation in the 1930s created new opportunities for the species. Giant Rush thrives in locations where the flooding regime is annual (up to 1.5m deep) and lasts between 6-10 months. However it is an adaptable species that can tolerate a wide range of flooding regimes, with the species occurring in many locations outside of its preferred regime. It seems its seed germination has a relatively narrow window of opportunity, requiring damp ground in late-winter/early-spring and not over-topped by floodwaters until established.

Under the natural (pre-regulated) conditions, the flood regime of the Barmah-Millewa wetlands was dominated by frequent, deep flooding interspersed with dry, cracking clay periods. This was the domain of the Moira Grass (*Pseudoraphis spinescens*) plains and associated rich diversity of other wetland flora, which formed vast open plains that would transform into rich waterbird feeding grounds.

However, under current (regulated) conditions, the flooding regime is less dramatic, generally shallower and the drying regime frequently punctuated by irrigation events re-wetting the floodplain soils. This has formed ideal conditions for Giant Rush and within a 50-year period between 1930 and 1980, two-thirds of the plains had been taken over by Giant Rush and also Red Gum (this latter species also finding the reduced flooding better for establishment on once taboo ground).

The march of the Giant Rush has continued, often in small incremental steps without drawing too much attention. The occasional episodic expansion event has occurred however, especially on the flat Moira Grass plains, and this has caused consternation to wetland managers. An indigenous species expanding its distribution is not necessarily a good thing. The tall species dominates practically to the exclusion of all other species and its expansion is at the expense of many indigenous species. This loss is more than just reduced fish and waterbird feeding habitat. The invasion of the open Moira Grass plains could also threaten the Ramsar-recognised ecological character of Barmah Forest, which is of international significance.

Fire is being trialled to control Giant Rush in Victoria's Goulburn Broken Catchment.

Mowing has proved ineffective as it quickly re-grows from rhizomes. Cattle do not graze it and spray is problematic - particularly on a species with such a waxy cuticle. Flooding the species is problematic when the rush is 3.5m tall.

Fire is being trialled despite it being a human-resource intensive task given Giant Rush's high flammability when dry. Burning the rush without destroying the forest is also a risk.

The Giant Rush species dominates practically to the exclusion of all other species and its expansion is at the expense of many indigenous species.

While the species does regrow after fire, the aim is to then drown the re-sprouting plants with floodwater. Unfortunately the rain has not provided the subsequent floodwater so we wait another year.

In the interim, the drought has recently created a new conundrum for management – eradicating rush in some areas but promoting it in others. Barmah Lake has had 70 per cent of its surface taken over by Giant Rush in the past year. Attempts were planned to prevent the spread of the rush before it was too late, however the species has already formed impenetrable stands of over three metres within 12 months.

In other wetlands where the species already dominates and provides valuable habitat for colonial-nesting waterbirds (Sacred Ibis, Straw-necked Ibis and Royal Spoonbill), the rush is now in poor health from being uncharacteristically dry for three years - and continuing because of the drought.

In these locations, valuable environmental water allocations are being applied to re-invigorate the stands to regain their habitat quality. So at what point does one accept that climate change has manifested a new flooding regime to adopt rather than fight? The decision to risk known habitat values and management for untested new ones is not easy, although it is currently being forced upon us.

Information: Keith Ward, Goulburn Broken CMA
03 5820 1121 keithw@gbcma.vic.gov.au

Protecting the endangered Montane Wetlands, NSW

A swamp on a property near Tenterfield in NSW, part of the Montane Wetlands, boasts one of three populations of an unnamed Ozothamnus. Photo: Simone Haigh.

By Nic Cobcroft, WetlandCare Australia

From shallow ephemeral lagoons in open grassy woodland to peat swamps at the icy headwaters of mountain creeks, the Montane Wetlands of the New England Tablelands in New South Wales display incredible diversity. A remarkable suite of plants and animals are supported here - many of which are endemic and have an extremely limited distribution.

A large percentage of the wetlands occur in a highly-modified agricultural landscape, and as a consequence many have been irreparably damaged or destroyed. Most of the remaining wetlands are on private property and are critically important as they provide the only habitat for a range of interdependent species including the rare migratory Latham's Snipe (*Gallinago hardwickii*), Sphagnum Frog (*Philoria spagnicolus*), New England Gentian (*Gentiana wissmannii*) and Giant Dragonfly (*Petalura gigantea*).

Upland Wetlands and Montane Peatlands and Swamps of the New England Tableland are listed as endangered ecological communities (EECs) under the *NSW Threatened Species Conservation Act 1995.* Upland Wetlands are also listed as endangered under the *Environment Protection and Biodiversity Conservation Act 1999*. These listings recognise the vulnerability of the wetlands and aim to ensure their long-term survival.

Over the past three years WetlandCare Australia has been working with landholders, researchers, government agencies, landcare organisations and individuals to protect, enhance and highlight the importance of the EEC Montane Wetlands of the New England Tablelands.

Lagoons occur as permanent, intermittent or ephemeral wetlands in oval-shaped depressions above 900 metres. The majority have suffered extreme modification with more than 70 per cent having been drained or dammed. Most lagoons hold water only temporarily and communities have adapted to take advantage of this natural cycle of wetting and drying. Changes to hydrology, accumulation of sediment and weed infestation are some of the more obvious threats to these wetlands. Intact lagoons are so rare on the New England Tablelands that only about 15 of the documented 58 remain in a reasonable condition.

WetlandCare Australia has supported the protection of five of these intact wetlands through agreements with Northern Rivers and Border Rivers Gwydir Catchment Management Authorities. Dangars, Racecourse, Barleyfields and Thomas lagoons located near Uralla and another Barleyfields lagoon at Glencoe all now have management agreements in place.

Tenterfield Eyebright recorded at Torrington, NSW. Photo: Nic Cobcroft.

Funding has enabled the control of stock access and provision of alternative watering points. Other components of the agreements include fencing, feral animal and weed control, interpretative signage, hydrological investigation and revegetation of buffer zones. Other key stakeholders include Armidale Rural Lands Protection Board; Arding Landcare Group; Department of Conservation and Climate Change; Uralla Shire Council; Northern New England RLPB and Glen Innes Natural Resources Advisory Committee.

Montane Peatlands and Swamps (MPAS) can be found at the headwaters of high-altitude creeks where topography is relatively flat and runoff is slow. They are characterised by plant communities that live on peaty or organic sediments. Common plant families represented include Poaceae, Cyperaceae, Myrtaceae and Fabaceae. Species composition is quite variable and will differ according to the site and disturbance history.

Pressures such as overgrazing, clearing, draining, nutrient enrichment and high frequency or peat burning fires can all result in the destruction of seed banks and ultimately the death of the community. Many MPAS are facing a high risk of extinction particularly on the more fertile and productive agricultural land.

Both the NRCMA and BRGCMA have provided funding to promote the importance of the restoration and protection of MPAS. Through the EEC Montane Wetland projects, WetlandCare Australia has hosted a number of field days across the Tablelands. Staff and researchers from the University of New England Armidale have provided current information to increase community and landholder awareness and encourage land managers to protect their wetlands. This has led to more than 300 hectares of MPAS being protected.

Through the Australian Government's Maintaining Australia's Biodiversity Hotspots Program, WetlandCare Australia offered a number of stewardship payments to landholders in the Torrington and Ebor areas. Several MPAS, including an area with unique high-altitude mound springs, now have funding to control feral animals, weeds and maintain fire access tracks.

The high level of interest in the EEC Montane Wetlands of the New England Tablelands exhibited by private landholders at field days is extremely encouraging. With its ongoing projects WetlandCare Australia is confident in adding to the areas under protection in the future. It is hoped that increased knowledge and gathering momentum will ensure the continued existence of the New England Tableland Montane Wetlands.

Information: Nic Cobcroft 02 6681 6169
nicC@wetlandcare.com.au

Protecting the catchments of the Great Barrier Reef, Queensland

Magpie geese flock to the Goorganga Plains Wetlands in the Mackay Whitsunday region, Queensland. Photo: Cassie Price.

Wetlands play a major role in filtering and buffering catchments, helping to reduce sediment, pesticide and nutrient loads entering freshwater, coastal and marine ecosystems such as those found in the Great Barrier Reef (GBR) region. Rehabilitating and protecting wetlands is vital not only for water quality in the GBR lagoon but also for tourism. After all, the GBR is one of Australia's most sought-after destinations for domestic and overseas travellers and is important to commercial fisheries and a strong local economy.

With this in mind, Wetland Rehabilitation Guidelines have been developed for Queensland's GBR catchments by WetlandCare Australia, a not-for-profit organisation, as part of the Australian Government's Coastal Wetlands Protection Program. The guidelines aim to provide practical information on rehabilitation techniques such as ways to control feral pigs or options for successful revegetation. Techniques tackle a range of wetland issues such as feral animal damage, erosion, poor water quality or changed hydrology. The guidelines provide specific advice on how to plan and undertake activities, which can be used by all wetland managers in the GBR catchment community.

There are a wide range of wetland management options available, some are simple and inexpensive such as changing the timing of grazing pressure or planting a few trees, while others are more technical and require a greater level of planning and funds, such as changing water levels or flow regimes in the wetland. Also included are links and contacts to the latest information and resources.

The guidelines were derived from a literature review of current wetland rehabilitation practices, and local, technical, legislative and practical knowledge, which were gathered across Queensland during the course of the project. The Wetland Rehabilitation Guidelines will be available from: www.wetlandcare.com.au

Information: Cassie Price, WetlandCare Australia
02 6681 6169 cassieprice@wetlandcare.com.au

Restoring the Piccaninnie Ponds Wetland System, SA

Restoration on a landscape scale has taken place across South Australia's Piccaninnie Ponds Wetland system. Below, Brown Tree Frog. Photos: Steve Clarke.

By Steve Clarke, SA Department for Environment and Heritage

The sea wind whips across the dunes of a cattle property 30 kilometres south east of Mount Gambier, South Australia, and continues to blow over an ancient swamp. Sedges are bowed low to the water as the gusts force you to put your back to the wind and pull the jacket hood over your head. Only after you wade 500 metres and enter the dense Silky Tea Tree Swamp does the wind abate to nothing at all. Squelching in this primeval wonderland, you start to understand the complexity of the Piccaninnie Ponds Wetland system.

One-and-a-half years ago, that 500-metre wade would have led you through a cow paddock. The wetland restoration work being undertaken by the SA Department for Environment and Heritage has seen amazing changes in the landscape. Does the work reflect the pre-settlement image of the system? We will never be sure but we do have enough old reports and surveyor records to feel confident.

Six years ago, the vision of departmental staff was brave and radical. Restoration on a landscape scale was a new concept and 600 hectares covering six kilometres must have seemed daunting at the time. But persistence paid off and during 2005, two parcels of land (230 hectares and 28 hectares) were purchased and brought back into the original system.

A weir and fish passageway was constructed during the summer of 2006 in Piccaninnie Ponds Conservation Park allowing pre-1968 pool levels to be reinstated. They had been drastically reduced in the last attempt to drain the system at that time. Then in 2006 a wetland restoration ecologist was appointed to oversee the restoration of the Piccaninnie wetland system, primarily the 230-hectare addition known as Pick Swamp. Ten kilometres of fencing were removed and five kilometres of drains were blocked and after inundation, 1.7 kilometres of open water returned to the landscape. This water wells up from ancient limestone aquifer systems below the surface call karst systems. Karst wetlands are far from common and Piccaninnie is one of only two afforded legal protection in the bioregion.

With the success of the first weir and fish passageway a second was planned in Pick swamp, four kilometres from the Piccaninnie weir. Once completed, it will allow better management of the hydrological processes within the system as well as connecting the swamp with the sea. This connectivity is important for diadromous fish species found in the wetland such as Common Jollytails (*Galaxias maculatus*) and Spotted Galaxias (*Galaxias truttaceus*). These species have a marine larval stage in their life-cycle.

Monitoring of other fish species such as the protected Yarra Pygmy Perch (*Nannoperca obscura*) and Dwarf Galaxias (*Galaxiella pusilla*) is ongoing and it is encouraging that their range within the system is increasing.

A year after the return of surface water in Pick Swamp, wetland ecological processes are in full swing. Sedgelands have

replaced paddocks of introduced pasture grasses and large areas of water ribbons (*Triglochin procerum*) have colonised the open water. Water Milfoil (*Myriophyllum sp.*), Water buttercup (*Ranunculus sp*.) and Pond Weed (*Potamogeton sp*.) now occupy much of the water column. Recruitment of icon species such as Silky Tea Tree (*Leptospermum lanigerum*) has been recorded and indications are that the large area this species occupied prior to clearance is starting to return.

Monthly bird surveys were first undertaken in May 2007 by Birds South East. These surveys were designed to understand the bird species using Pick Swamp prior to restoration and then during restoration. To date, 112 species have been recorded including migratory species such as Common Greenshank, Marsh Sandpiper, Latham's Snipe and Magpie Geese (*Anseranas semipalmata*). These birds have recently taken up residence and appear to be breeding. Breeding indications are the grouping of two females with one male goose and the building of "platforms" that are used as nests.

Other monitoring and survey work includes fish and vegetation surveys. A recent floristic mapping exercise identified 30 different vegetation associations within the Piccaninnie Wetland System. Such a large number of associations indicate the complexity of the wetland and gives a better understanding of why the system hosts more than 50 species of threatened flora or fauna. It is due to this complexity that Piccaninnie is in the preliminary stages of the Ramsar nomination process.

Hydrological monitoring of the system includes volumetric flows, water level recorders, observation bores, radon readings, water quality and precipitation/evaporation data through the onsite weather station. A water budget is soon to be calculated for the system, which will give more elaborate management options and a greater understanding of how climate change and local land management practices will impact on the system.

While all of the sedges and aquatic plant species in Pick Swamp have returned with the water after 50 years of drainage and grazing, the indigenous terrestrial species have not. There is too much competition with the exotic pasture grasses. To help this buffer that supports the wetland, 5,000 plants and seven kilometres of direct seeding were planted by volunteers in 2008.

Piccaninnie Wetland is one of the most significant Karst Wetland Systems in Australia. Reversal of its decline has been an important first step in its restoration. The response of the flora and fauna to the work undertaken so far has been astounding. The rejoining of the fragmented old wetland has started and nature has rejoiced.

Information: Wetland Restoration Ecologist, Steve Clarke, SA Department for Environment and Heritage. Clarke.Steve@saugov.sa.gov.au

Piccaninnie Wetland, above, is one of the most significant Karst Wetland Systems in Australia.

Rehabilitating Sydney's Eve Street saltmarsh wetland, NSW

Eve Street saltmarsh, not far from Sydney International Airport, is no longer inundated and fish can move freely between the estuary. Photo: Phill Birtles.

By Phill Birtles, Sydney Metropolitan CMA
and Daniel Cunningham, Sydney Water Corporation

Coastal saltmarsh is even more precious when it is forced to co-exist with the pressures of a city metropolis. Eve Street Saltmarsh Wetland - only a stones throw from Sydney International Airport - is a case in point. An ambitious project to reinstate its tidal regime and protect the remnant salt marsh habitat has just been completed.

The two-hectare salt marsh community is a relic of the once much larger Barton Park Wetlands, which used to be part of the hind dune system of the western margins of Botany Bay. The Wetlands once extended from Eve Street to the Cooks River both north and south.

Despite this, Eve Street Wetland still provides habitat for several migratory bird species such as the Eastern Curlew (*Numenius Madagascariensis*) and the Broad-Billed Sandpiper (*Limicola falcinellus*) amongst other wader and shore bird species. In the denser vegetation surrounding the wetlands rare frog species including the endangered Green and Golden Bell Frog (*Litoria aurea*) have been identified.

Nearby residents feel privileged to have a wetland with endangered plant communities and migratory birds in the middle of urban Sydney, and locals watch over the wetland constantly.

Gradually, the long channel system that connects the wetland to Cooks River silted up, resulting in poor tidal exchange and permanent inundation of the wetland by pooled rainwater. The lower salinity conditions and lack of exposed mudflats reduced foraging habitat for wading birds and resulted in a decline in salt marsh vegetation. All fish movement from the estuary to the salt marsh was effectively cut off.

A joint project between the Sydney Metropolitan Catchment Management Authority (CMA) and Sydney Water was developed to remove built-up sediment from the channel and pipe. This would allow the tide to pump water between the estuary and the wetland freely again.

In February 2008 the CMA provided funding from the Australian Government to help stabilise the channel with sandstone rockwork and re-contour the channel slope. The piped section was cleared of sediment with a water cannon and a headwall built at the pipe/channel interface to allow the easy removal of sediment in the future. By June, the tide was flushing the wetland again.

Local resident Ron Rayner, who is a keen bird watcher and president of the Rockdale Wetlands Preservation Society, said "I haven't seen it like this for about 15 years. It's a credit to all involved. I'm looking forward to seeing more migratory birds this summer".

Considerable investment in the project was made by Sydney Water, who first restored the wetland in 1991 and will continue to manage the wetland into the future. Eve Street Wetland is listed in the *Directory of Important Wetlands in Australia* due to its saltmarsh communities and migratory wading birds.

Community volunteers will conduct bird surveys over the 2008-09 summer in conjunction with Rockdale Wetlands Preservation Society to see if bird life increases in the wetland as a result of the rehabilitation project. The CMA and Sydney Water are also planning fish sampling as part of an ongoing program to monitor the ecological health of this important urban asset.

Information: Sydney Metropolitan CMA, 02 9895 6219
phillip.birtles@cma.nsw.gov.au

Monitoring, evaluating and reporting wetlands, NSW

A new focus on natural resource condition will help to enhance important NSW wetlands, such as the Macquarie Marshes (above). Photo: S. Ingraben. Below, Chocolate nodding lily. Photo: Christina Mykytiuk.

By Sonia Claus,
NSW Department of Environment and Climate Change

There has been a shift in focus for the NSW natural resource and environment agencies, with efforts now coordinated with Catchment Management Authorities, Local Governments, landholders and other natural resource managers to establish a system of monitoring, evaluation and reporting on natural resource condition.

Titled the NSW Monitoring, Evaluation and Reporting Strategy (MER), the aim is to meet the NSW State Target for Wetlands: "By 2015 there is an improvement in the condition of important wetlands, and the extent of those wetlands is maintained".

The NSW Department of Environment and Climate Change is charged with monitoring against this target. Another priority is developing indices that describe in simple terms the overall health of natural resources. Indices combine data from a number of sources into a single measure that summarises, for reporting and communication purposes, whether or not the condition of the resource is improving.

The MER strategy uses a combination of control and stressor conceptual models to underpin the monitoring and reporting program. The conceptual models will help to develop indicators, interpret monitoring data and communicate the outputs of monitoring to regional CMAs and guide their management actions.

The models used for MER will be non-quantitative planning and evaluation tools that identify the major ecosystem processes, along with the key anthropogenic and natural pressures and stressors on these systems, and the most appropriate indicators to measure condition and pressure. The models will also illustrate the effects of these pressures and indicate which management actions are appropriate.

The main purpose of the MER strategy is to provide information about the pressures on, and condition of, wetlands. The assessment of pressure indicators is beneficial in that pressure "levels" should respond to management actions earlier than "condition" does; and assessment of pressures allows management to determine which pressures to target for action and which water bodies are under the highest pressure "risk". Also, it helps identify which key condition indicators to monitor (only indicators relevant to the local situation are monitored); and helps identify and examine cause and effect relationships. It also allows justification for why and where work was carried out (for example: these areas had the highest pressures and hence risk).

To report on each indicator we have proposed a five point scoring scale and identified appropriate values for each level, with a score of 1 being the "best" and 5 the "worst". The assessment methodology used allows scores of individual indicators to be combined to give an overall pressure and condition score for a wetland.

The results of the MER strategy will be reported at two scales: CMA regional scale and sub-catchment scale through a series of individual State of the Catchments reports; and state-wide through the *NSW State of the Environment* report. These reports aim to be a simple means of communicating changes in resource condition to the community.

Information: Dr Sonia Claus, NSW Department of Environment and Climate Change 02 9995 5627
sonia.claus@environment.nsw.gov.au

Weed control

in the tropical Burdekin region, Queensland

By Amber Webster, WetlandCare Australia

In Queensland's tropical north, it is unfortunately common to see riverine and lacustrine wetlands choked with aquatic weeds. Weeds like water hyacinth (*Eichhornia crassipes*), water lettuce (*Pistia stratiodes*) and Salvinia molesta impact on irrigation systems, recreational fisheries, floods, mosquito control, waterbirds and fish habitat values. Due to the near perfect conditions for aquatic weed growth (warm ambient temperature and high nutrient permanent water supply) and the rapid growth rate of these weed species, re-establishment is fast unless an ongoing control method is established. The question is: If we obtain funds to remove the weeds, who pays for ongoing control?

On the Burdekin delta, about 90 kilometres south east of Townsville, co-operative weed control agreements have been trialled as a method for ongoing maintenance and are becoming standard practice. The financial partners include adjacent landholders (private and corporate), Burdekin Shire Council, Burdekin Dry Tropics NRM, and North and South Burdekin Water Boards.

There are currently five lagoons (Healey's, Horseshoe, Kalamia, Lillesmere and Collinson's) and one creek system (Sheepstation) covered by these agreements in the Burdekin delta. Ongoing costs for private landholders range from $150 to $600 a year. Pro-active landholders who have been undertaking weed control themselves spend several hundred dollars annually; hence the arrangement involves less effort, no additional cost and may even result in a saving. This helps create a critical mass of landholders, which is needed to gain popular support for the agreements. Corporate landholders such as CSR and SunWater contribute an amount equal to the sum of all private landholders. For example, at Collinson's lagoon, where there are six individual landholders, Sunwater contributes $1,500 (6 x $250).

There is a legal inducement for adjacent landholders to participate, despite the common misconception amongst landholders that their legal responsibility for weed control ends at the water's edge. In Queensland, each adjacent landholder has a responsibility for aquatic weed control under the *Land Protection (Pest and Stock Route) Management Act 2002.*

This co-operative agreement process is still in its infancy but the signs are promising. The agreement covers Sheepstation Creek, initiated in 2006 as a three-year trial. Landholders who attended an evaluation at the end of the trial period in 2008 unanimously agreed to continue with the arrangement.

The initial weed control is usually carried out with a weed harvester and an excavator with a weed rake. The following costs are typical: Lillesmere lagoon, about 50 hectares, required 300 hours of harvester and excavator time, each of which cost about $100 an hour. While this cost is substantial, the wetland can be retained free of weeds in the long term. There are less expensive but also less reliable methods of clearing such as spraying the edges of the weed mat just prior to the wet season. This method relies on strong flushing in the wet season to move the remaining weed mass out to sea, which may not occur every year in the dry tropics where rainfall is extremely variable from wet season to season. The biomass removed during weed harvesting is extraordinary. It is often utilised by one of the adjoining landholders as mulch on a sugarcane paddock.

These co-operative weed control agreements in the Lower Burdekin would not have been possible without the negotiation skills of the Burdekin Shire Land Protection Officer. Capacity to negotiate is a critical factor. The original agreement involving 31 landholders took more than two years of negotiation. Be patient and talk with all parties.

Information: Amber Webster, WetlandCare Australia
1800 504 699 amberwebster@wetlandcare.com.au

Above, aquatic weeds choke Queensland's Burdekin delta. Below, a weed harvester and excavator. Afterwards, Cotton Pygmy Geese enjoy the cleared wetland. Photos: Amber Webster.

Species-rich dampland on the Swan Coastal Plain, Western Australia. Below, Moaning Frog *Heleioporus eyrei.* Photos: Christina Mykytiuk.

community engagement, WA

By Michael Roache, WWF-Australia

In a bid to conserve and manage high-conservation-value wetlands on private land in urban and peri-urban areas of Perth, Western Australia, WWF Australia has initiated Wetland Watch.

The Swan Coastal Plain was once rich in wetlands and wetland-dependent flora and fauna. However, most of these wetlands have been lost. About 80 per cent of wetlands have been cleared, filled, highly modified or degraded by weeds, grazing and inappropriate fire regimes. Only 20 per cent of all the wetlands that were present on the Swan Coastal Plain prior to European settlement remain. Of these, an estimated 15 per cent retains high ecological values.

One of the features of wetland diversity in this region is the high number of seasonally or periodically filling wetlands that are extremely high in plant diversity. Unfortunately, this diversity is greatly undervalued by landholders who know little about the conservation value of damp lands with high levels of floristic diversity. This is particularly problematic as 50 per cent of conservation category wetlands (that support a high level of ecological attributes and functions) are under private ownership.

Between 2004 and 2008, WWF worked to raise awareness of the value of wetlands owned by private landholders in the Perth region. An 18-month pilot project based in several local government areas in Perth's southern metropolitan region showed that it was possible to take a "bottom-up" approach to wetland conservation on private land by working closely with landholders, community groups and local governments. Through community events such as FrogFests, Landowner Wetland Awareness Days and activities with school children, Wetland Watch increased awareness of the biodiversity value of wetlands.

Wetland Watch also provided incentives such as technical advice, flora and fauna surveys and grants for on-ground management such as weed spraying and the control of Phytophthora Dieback disease, to improve the management of wetlands. During the pilot phase of the project, Wetland Watch engaged 14 landholders in the management of their wetlands with a number of landholders signing voluntary five-year management agreements.

The partnership approach to the conservation of wetlands was critical to the success of the Wetland Watch pilot. Key partners included the Department of Environment and Conservation, the Local Governments of Cockburn, Armadale, Kwinana and Rockingham and the Swan Catchment Council. The success of the pilot project led to the implementation of an expanded Wetland Watch project funded by the Australian Government. Under this expanded project, Wetland Watch continued to engage landholders in the more urbanised southern metropolitan region, while at the same time expanding into the Ellen Brook and Brockman River catchments in the largely peri-urban northern part of the region.

A feature of the project was in the more urbanised area covered by Wetland Watch, which saw the successful engagement of a relatively high number of landholders with adjoining or nearby properties. This is an important result in a region where urban properties are small and it is necessary to engage a number of landholders to manage wetlands extending across multiple properties.

Since Wetland Watch was initiated in 2004, more than 130 landholders have benefited from advice and assistance to better manage and protect high conservation value wetlands. In consultation with wetland landholders, Wetland Watch developed 65 wetland management and restoration projects and allocated more than $200,000 in incentives payments for management actions. As a result more than 125 hectares of wetlands and fringing terrestrial vegetation are being managed and restored. Many landholders have also committed to ongoing management to maintain the conservation value of their wetlands. During the project, 45 Wetland Watch landholders signed Voluntary Management Agreements that cover more than 125 hectares.

While the provision of nature conservation covenants was highly valued by Wetland Watch, during the four years of the project no landholders committed to binding covenants. It seems likely that in urban and peri-urban areas, high land values act as a deterrent to permanent covenants attached to the title of the land. The challenge for government and non-government organisations in these regions might be identifying appropriate incentives or other mechanisms to provide permanent protection for wetlands of high conservation value.

Information: Michael Roache, Threatened Species Network Regional Manager, WWF-Australia
08 9442 1209 mroache@wwf.org.au

Protecting on of Australia's largest saltwater lakes, NSW

Volunteers weed out bitou bush from the coastal saltwater lakes near Lake Macquarie, New South Wales. Below, Osprey nest, Black Neds Bay. Photos: Rod Ingersoll.

By Rachelle McConville, Conservation Volunteers Australia, and Rodney Ingersoll, Lake Macquarie City Council

One of Australia's largest coastal saltwater lakes - Black Neds Bay and Salts Bay – lies at the southern entrance to Lake Macquarie, New South Wales. Here lies 84 hectares of NSW endangered ecological communities, consisting of coastal saltmarsh and littoral rainforest buffered by a diversity of significant woodland and foreshore communities. Since 2007, Conservation Volunteers Australia (CVA) has worked alongside Lake Macquarie City Council and the Hunter-Central Rivers Catchment Management Authority to protect the wetland systems from the pressures of development.

Black Neds Bay, named after a member of the local Awabakal tribe, is an isolated wetland area adjoining both urban residential housing and the sea. The significant wetland area represents 25 per cent of remaining saltmarsh habitat in Lake Macquarie and is an important nutrient filter for the lake. In addition, the area provides a recreational resource for the community, and is locally known as a "piece of paradise". The area is also a known nesting site to the vulnerable Osprey (*Pandion haliaetus*) and is an aquatic nursery and breeding habitat that provides a valuable food source for migratory birds.

As with so many of Australia's coastal wetlands, development, vegetation clearance and wetland drainage are adding pressure to the integrity and functionality of this fragile ecosystem. Surrounding urban development has increased the amount of sediments and nutrients entering the Bay through stormwater runoff, and decreased water quality through the removal of riparian vegetation and filling of wetlands.

In addition, the construction of breakwaters at the entrance to the lake in the 1890s and the removal of sand shoals have exposed the northern beach of the wetland area to significant foreshore erosion. Recession rates of 5-10 metres a year have been experienced since 2004. This erosion has narrowed the barrier dune system that protects the sheltered shallow wetland from prevailing oceanic influences coming from the southern Swansea Channel. The constant threat of weed invasion is also a threat to the biodiversity and stability of Black Neds and Salts Bay.

In 2007, CVA carried out weed removal and scientific monitoring to protect the area's native flora and fauna. This involved the removal of 80 per cent (660,000 square metres) of Bitou bush and other weeds within the project regeneration areas. Up to 300 metres of temporary wind barrier and erosion control fencing was installed to stabilise the dune foreshore and prevent a potential breakthrough from the channel foreshore into the Black Neds Bay wetland.

More than 2,000 foreshore plants were established, with an 80 per cent survival rate, covering an area of 2,500 square metres, and 250 kilograms of rubbish was removed. A total of 600 grams of seeds were collected, which were treated and seed dispersed throughout the site. Species included Acacia sophorae, Scaveola claendulacea and Canavalia maritima. In addition, two bird surveys were carried out with photo point monitoring and 12 vegetation quadrats. Monitoring techniques included establishing photo point stations within 20x20m quadrants, which allowed the change in species composition to be documented over time. Bush regeneration techniques included both cut and paint and physical hand removal.

From a cultural heritage perspective, the project was significant as weed removal uncovered sensitive cultural heritage. Two significant Aboriginal middens containing artifacts were unexpectedly located by the removal of Bitou bush. By working closely with the local Bahtabah Aboriginal Land Council, knowledge was shared between bush regenerators and council staff.

Results highlight the value of community involvement in managing wetland resources. Professional partnerships between CVA and Lake Macquarie Council will ensure a positive future for these wetlands.

Information: Conservation Volunteers Australia
1800 032 501 www.conservationvolunteers.com.au
Lake Macquarie City Council 02 4921 0142
www.lakemac.com.au

Hidden wetland in Canberra's industrial area, ACT

Angela Calliess of Greening Australia and Canberra businessman Andy Stodulka inspect a spring-fed wetland in the ACT's industrial area.

By Angela Calliess, Greening Australia Capital Region

A chorus of frogs can be heard reverberating from a small wetland in the industrial area of Hume, south of Canberra in the Australian Capital Territory. In 2005, local businessman Andy Stodulka realised there was a spring-fed wetland below the area where his new commercial premises were under construction. The site actually comprises two small natural wetlands and a constructed dam.

Noticing a lot of water flow originating from a spring higher in the hillside outside his boundary, Andy decided to maintain the flow into the wetland by installing drainage under the factory slab and directing water along its natural watercourse.

"I actually heard frog activity and thought we had a couple of species here," Andy said. "So I contacted a local natural resource management consultant, Donna Hazell, who has a PhD in the conservation of frogs in agricultural landscapes. She undertook a survey and to our surprise identified five swamp frog species in this area, which is about 50 metres in diameter. I thought, this is a valuable resource, so we cordoned off the area so they wouldn't be disturbed too much."

The five species identified were: Brown Striped Frog (*Limnodynastes peronii*); Common Eastern Froglet (*Crinia signifera*); Eastern Sign-bearing Frog (*Crinia parinsignifera*); Smooth Toadlet (*Uperoleia laevigata*) and Spotted Marsh Frog (*Limnodynastes tasmaniensis*). All five species were identified in the two natural wetlands and four of the five species were identified in the constructed dam. Two tree frog species were also identified another 50 metres away from the wetland: Whistling Tree Frog (*Litoria verreauxii*) and Peron's Tree Frog (*Litoria peronii*).

Andy said he recognised that the area provided a "valuable resource for the frog world". The rainwater from the factory roof is diverted to the natural drainage line, while the driveway run-off is diverted to keep the wetland clean. The retention dam at the front of the property catches run-off from the road as well as providing habitat for frogs, ducks and Egrets.

Donna's report, *Improving wetland habitat values at Tralee Road Hume,* also provided guidelines for revegetation of the wetland, which is dominated by introduced pasture grasses such as Phalaris. This led Andy to contact Greening Australia in mid-2006. Through the ACT Land Keepers program 200 native tubestock were provided to enhance the wetland and constructed dam areas. Species included grasses (*Poa labillardieri, Carex appressa, Lomandra longifolia*) and shrubs (*Leptospermum myrtifolium and Callistemon seeberi*). Andy had also previously planted several Casuarina cunninghamiania. A local Green Corps team assisted with the planting and helped Andy to construct a raised boardwalk to the main wetland to minimise disturbance of the site.

Development is planned for the land surrounding Andy's property including the area where the upland spring is located. Andy hopes that the development includes adequate drainage systems, which will maintain the spring flow. He plans to approach the relevant development agencies to discuss this.

The spring-fed wetland nestled in an industrial area provided a valuable resource for the frog world.

"It is so important to keep a balance," he said. "I see this is a real asset for even our own employees to just sit out here and enjoy it, as well as the general public who are invited to sit peacefully and listen to the frog chorus. You can't put a value on it, it's just too valuable."

The reason this site exists today is due to the enthusiasm and willingness of the owner to protect the site and to maintain and improve its ecological value. Andy has established buffers around the wetland to maintain water quality and intends to do more plantings to enhance the fringing vegetation. "It's the driest period in the last 100 years I'd say but even then this didn't dry up, which is encouraging," he said. Andy also learned that by leaving the Phalaris tall around the edges of the wetland, Egrets were unable to land and prey on the frogs.

Information: Andy Stodulka, 02 6260 1500
andystodulka@hotmail.com

Saving Cattai Wetlands from acid sulfate soils, NSW

Cattai wetlands, on the central coast of New South Wales, have been rescued from the threat of acid sulfate soils. Photos: Greater Taree City Council.

By Brett Currie, Greater Taree City Council

The Cattai wetlands, near the central coast of New South Wales, are home to an extraordinary array of wildlife and plants but until recently acid sulfate soil posed a major threat. A rescue plan has been adopted by the Greater Taree City Council with the purchase of the 486-hectare property fronting Cattai and Coopernook Creeks to secure the wetlands' future.

A program of fencing, replanting and bush regeneration is still underway to encourage natural regeneration of the site's hydrology. This is done by strategically placing sandbag sills in constructed drainage networks to accelerate sedimentation of these artificial systems and slowly restore the natural water regime. So far, the remedial action is working with the constructed drainage lines rapidly infilling over the past three years.

The Council received more than $10,000 from the Australian Government to help protect the area with support from the Hunter Central Rivers Catchment Management Authority, the then NSW Department of Land and Water Conservation, Environmental Trust and MidCoast Water. Greater Taree City Council Natural Environment Planner, Brett Currie, said the wetlands were in pretty good condition but had been cleared in the past. "Much of the landscape had been drained for agricultural production," Brett said. "An acid sulfate soil problem over much of the area was the main reason we wanted to acquire the land. We took the opportunity to help reduce the problem by rehabilitating the wetlands to improve water quality within the Manning Valley."

Some sites were fenced off to prevent cattle trampling vulnerable plants while others remained accessible for grazing. Conservation Volunteers Australia and a local Aboriginal Bush Regeneration Team removed weeds like lantana, blackberry and five-leaved morning glory. The areas were then replanted with more than 600 native trees.

As the project progressed, the environmental and cultural values of the wetlands became increasingly evident. "The amount of fauna and flora has been phenomenal - every time we go out there we find something new," Brett said.

The eight NSW endangered ecological communities that were identified include: Swamp Oak Forest, Swamp Sclerophyll Forest and Saltmarsh, Lowland Rainforest on Floodplain, Freshwater Wetlands on Coastal Floodplains, Eucalypt Forest on River Flats and Subtropical Forests on Coastal Floodplains. Significant flora includes the Swamp Raspwort (*Gonocarpus salsoloides*) and Climbing Maidenhair Fern (*Lygodium microphyllum*) - not rare but an unusual distribution record (normally north of Coffs Harbour). Some of the threatened animals identified were: the Giant Dragonfly (*Petalura gigantea*), Black Necked Stork (*Epphipiorhynchus asiaticus*), Koala (*Phascolarctos cinereus*), Square Tailed Kite (*Lophoictinia isura*), Glossy Black Cockatoo (*Calyptorhynchus lathami*), Green and Golden Bell Frog (*Litoria aurea*) and most recently the Swamp Lindernia (*Lindernia alsinoides*).

A cultural heritage survey discovered 11 Aboriginal sites and artifacts including stone flakes, a mudstone scraper and a massive flaked river pebble.

Council has just exchanged contracts for an additional 32 hectares of wetland habitat to expand the area of significant wetland that is preserved in perpetuity. The Council has acquired this habitat as public land, which will be managed by the Lower Manning Wetlands Advisory Group.

Ongoing bush regeneration work includes the removal of new weed growth, carried out by a two-person bush regeneration team that also works on an adjoining wetland site at Coopernook, with assistance from nine Conservation Volunteer Teams and support by the Australian Government.

Information: Brett Currie, Greater Taree City Council
Brett.Currie@gtcc.nsw.gov.au

Ramsar conference 2008

The 10th Meeting of the Conference of the Contracting Parties to the Convention on Wetlands (Ramsar, Iran, 1971) was held recently in the Republic of Korea.

By Cassie Price, WetlandCare Australia

I was recently selected by the Australian Wetlands Alliance (umbrella group of non-government organisations working with Australia's wetlands) to fill the role of NGO representative with the Australian delegation to the 10th Conference of the Contracting Parties to the Ramsar Convention, fondly known to delegates as CoP10. CoP10 was held in Changwon, in the Republic of Korea, between October 28 and November 4, 2008.

On arriving in Changwon, the presence of the Ramsar CoP10 was everywhere: with orange-shirted volunteers ready to direct you as you left the plane; Ramsar flags along the roadside all the way to the convention centre; and, a friendly smile at any mention of Ramsar anywhere in the huge city.

The magnitude of the convention centre and its organised set-up blew me away, over 130 countries (of 158) were in attendance at CoP10, it was no wonder the Ramsar Secretariat needed binoculars to see who wanted to speak from the floor!

With the fantastic performances of the opening ceremony, an honest yet positive speech from South Korea's President and an interesting but tasty welcome dinner, it was down to business. The Australian delegation went into overdrive at this point, with delegation meetings, regional meetings, side events, break-out group meetings and all of the happenings around the resolutions in plenary. The eight of us were scattered to all corners of the convention centre at the careful planning of delegation-head, Tony Slatyer. My delegation colleagues included Deb Callister, Ian Krebs, Vicki Cronan, Melissa Jaques (Australian Government Department of the Environment, Water, Heritage and the Arts), Stephanie Aeuckens (DFAT, based at the Australian Embassy in Seoul) and Russell Seaman (SA Department for Environment and Heritage).

From this point discussions with a range of countries and NGOs took place to formulate the wording of the resolutions. I am told this CoP was quite low key compared to some of the arguments seen between countries at previous CoPs. However, there were still some resolution topics that created quite a lot of discussion, and rightly so, as they signify some of the biggest issues facing wetlands worldwide. These included: climate change; extractive industries; migratory waterbird flyways; the status of Ramsar sites; 'biofuels'; and, human health. For more information on the outcomes on any of these topics see www.ramsar.org.

I kept the Australian Wetland Alliance NGO members back in Australia informed with regular updates throughout the conference and included their input in our discussions as the Conference proceeded. In speaking with many other NGOs attending CoP10, I realised I was in quite a unique situation. Many of the NGOs I spoke with praised Australia's delegation for including an NGO representative and, similarly, other Australian NGOs not on the official delegation commented on how useful it was for them to be an NGO representative.

Whilst at the conference, I did venture away from the convention centre to see some of Korea's showcase wetlands, including, Suncheon Bay and Upo Wetlands. Both sites were very impressive, equipped with enormous education centres and it was heartening to see all the Korean people flock to visit their spectacular wetlands every day.

Time passed very quickly and all of the meetings and discussions at the conference seemed to be over as quickly as it had begun. However, unlike at the beginning I was going away with a clear understanding of the Ramsar Convention and its workings, a range of NGO and Government contacts from around the world, some new friends and a keen sense of wanting Ramsar principles to be implemented at the ground-level within NGOs back in Australia. WetlandCare Australia is a non-Government, not-for-profit organisation.

Information: Cassie Price, WetlandCare Australia, 02 6681 6169 cassieprice@wetlandcare.com.au.

Outdoor school at Jerrabomberra Wetlands, ACT

Jerrabomberra Wetlands, Canberra, ACT, where Birrigai operates an outdoor school of environmental education programs. Photo: Steve J Miller.

By Sue McMurtrie, Birrigai

At the foot of the Brindabella Mountains in the Australian Capital Territory lies Birrigai, an outdoor school that delivers quality environmental education programs to local, interstate and international students. Owned by the ACT Department of Education and Training, the centre operates over several locations including its base at Tidbinbilla, 30 minutes from Canberra city.

After the devastating fire storm of 2003, Birrigai required sites away from the fire damaged areas to deliver new programs. Jerrabomberra Wetlands, close to the centre of Canberra, are managed by the Parks, Conservation and Lands section of the Territory and Municipal Services. The wetlands are rich in biodiversity, with 80 species of water birds, and act as an important drought refuge. There is a classroom on the site with state-of-the-art microscopes and other teaching resources.

The centre's original wetland program, Wetland Wonders, was developed for preschoolers by staff from Environment ACT and Birrigai teachers, to explore plants and animals that live in the wetland environment. Birrigai continues to provide one-day programs suitable for students from preschool through to high school.

Students build a model wetland in small groups before going out to experience the real thing. They attend a picnic and learn about some of the local residents and the food they like to eat. They go on a walk to collect pictures of the food and use a net to catch aquatic bugs and examine them under microscopes. This rich experiential program - one of Birrigai's most popular - ensures an enthusiastic resolve to care for the wetlands and wildlife.

The Wetland Friends program is suitable for Kindergarten to year 2 students and is a full-day program investigating wetland habitats with a particular emphasis on animal adaptations. Learning activities include a guided walk using binoculars to observe wetland birds as well as pond and microscope work. Students also play a game called "match the beak" using tools such as tongs, hooks and scoops to collect food for a specific wetland bird species. Each tool has a similar shape and function to the beak of the bird they are helping to "feed". This is an excellent hands-on way for students to learn how different beaks are adapted to collect different types of food.

In the Wetland Connections program years 3 and 4 students explore the inter-relationships between wetland animals and plants. Students assume the roles of plants and animals and join a giant wetland web of life using lifelines that represent sunlight, water, soil and air. Pollution is introduced into the system and students are able to see how all of the wetland plants and animals are affected by the broken connections. Students also become census collectors and go on a walk to learn about wetland plants and animals. The results are tallied and students discover the balance that exists in the wetland ecosystem.

Birrigai has received excellent feedback from schools participating in the wetland programs. Many teachers remark that the programs have switched their students on to the importance of wetlands. Each program delivered by Birrigai at the Jerrabomberra Wetlands incorporates ways to care for wetland ecosystems giving students the opportunity to take positive action for a sustainable future.

Information: Sue McMurtrie, Birrigai, 02 6205 6748
www.birrigai.act.edu.au

Artificial wetland in Adelaide schoolyard, SA

By Matt Cattanach, Waterwatch SA

A wetland oasis has been created in Adelaide's inner west by a small secondary school that supports 45 Indigenous students to re-engage with formal education. "Pudna" (the Kaurna word for "pond") is nestled on 900 square metres at the rear of Warriappendi School, adjacent to the imposing grey walls of an industrial complex. Over the past four years "pudna" has become a biodiversity hotspot and an important community asset.

School principal Chris Brandwood said the project started in 2004 when a group of students raised the idea of building a frog pond on school grounds. "As Principal, I was keen to embrace any student-driven idea. After initial investigations and obtaining a grant from the City of West Torrens we decided to scale up the design to a larger pond and include an indigenous garden containing a range of plants appropriate to the region and a wetland bog garden," Chris said.

With the school's purpose being to help students return to education, the pond project was seen as an important learning opportunity. "It was planned that students would be involved in all of the processes including the planning, building of the pond, irrigation, planting, paving, frog selection and ongoing maintenance," Chris said. "The students worked with school staff, one day a week over a 20-week period to build the first phase of the project. The whole school was involved in the planting of some 300 plants. It is still a work in progress, as each year the area requires regular maintenance, planting and monitoring. This also meant that students could gain Certificate 1 in Horticulture if they were committed to the project."

The successful completion of the project saw six students achieve their Horticulture 1 certificates. Two students went on to further study in horticulture courses. Careful planning, student involvement, financial support from a range of organisations (Urban Forest Biodiversity Unit, Western Futures, Maxima Training, Provenance Plants, and a range of frog experts), assistance from a Work For The Dole team and Chris's previous life as a landscape gardener were all ingredients to making the project a success.

Today, "pudna" garden is home to an abundance of indigenous fauna including Brown Tree Frogs, Spotted Grass Frogs, Rainbow Fish, skinks and a healthy macro invertebrate community. The indigenous plants, including threatened species such as the Holly Leaved Grevillia (*Grevillia ilicifolia*) and water plant (*Hydro cotlye vertisicillata*) are growing well.

The pond is filled from run-off from the art room and topped up with water collected in one of the schools water tanks. A pergola has been constructed providing a meeting space and outdoor learning area. "Pudna" garden visitors are greeted by a cacophony of frog calls echoing off the neighbouring factory walls.

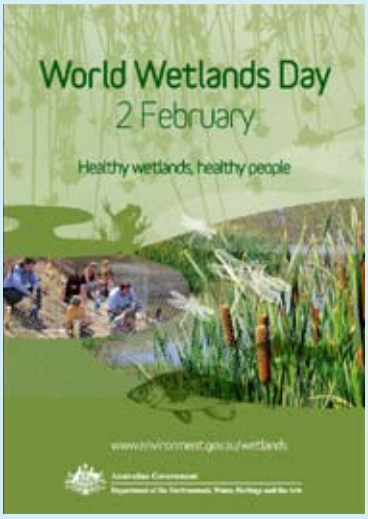
"The rainbow fish and frogs have bred so successfully that we have been able to supply surplus animals to local schools, community groups and breeders," Chris said. The pond has also become an important educational resource, with schools and the community visiting to learn how to build a pond of their own and learn about the wide diversity of flora and fauna that once inhabited the area before the encroachment of urban development.

Indigenous secondary school students create an artificial wetland at Warriappendi School, Adelaide, SA. Photos: Chris Brandwood.

Warriappendi School students use the "pudna" garden to explore concepts and topics including life cycles, water management, weed control, indigenous plant uses and foods, endangered species, solar power, revegetation and carbon foot printing. Regular tours are conducted with neighbouring primary schools, with many students stating that it was their first experience with live frogs.

Information: Chris Brandwood 08 8293 3137
chris.brandwood@warriappendi.sa.edu.au

To celebrate World Wetlands Day 2009 there are a range of products available from the Australian Government Department of the Environment, Water, Heritage and the Arts including posters, bookmarks, magnets, stickers and postcards. Free call 1800 803 772 or email ciu@environment.gov.au



If you would like to tell your story in the next edition of *Wetlands Australia*, or have any feedback on this edition, please contact the Wetlands Section of the Department of the Environment, Water, Heritage and the Arts on 02 6274 1111 or email: wetlandsmail@environment.gov.au

www.environment.gov.au/water/environmental/wetlands