



**Australian Government**

**Department of the Environment and Energy**

# Wetlands Australia



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# Introduction

Welcome to Wetlands Australia 2017, celebrating our country's diverse wetlands and the people that care for them.

This edition highlights *Wetlands for disaster risk reduction*, the theme for World Wetlands Day 2017. Under projected climate change scenarios, extreme climatic events, including floods, droughts and storms are expected to increase in frequency and intensity. Natural features, including wetlands, can lessen the impacts of these events on communities, built infrastructure and other ecosystems.

You will also find articles about internationally significant Ramsar wetlands, wetland restoration in urban, rural, coastal and inland settings, methods for modelling, mapping and assessing wetlands, cultural values, environmental flows and wetland restoration.

Above all, *Wetlands Australia* tells the stories of communities working together to make sure our amazing wetlands and the people, plants and animals that rely on them are well looked after.

We hope you enjoy this edition of *Wetlands Australia*. [Fact sheets](#) highlighting the importance of wetlands are also available.

If you would like to contribute to future editions of *Wetlands Australia*, please contact [wetlandsmail@environment.gov.au](mailto:wetlandsmail@environment.gov.au) and if you would like to subscribe to *Wetlands Australia* to receive new editions please go to our web page to sign up: [www.environment.gov.au/water/wetlands/publications/wetlands-australia](http://www.environment.gov.au/water/wetlands/publications/wetlands-australia)



*Hunter Wetlands Centre Australia, Newcastle, looking west towards Hexham Swamp in Hunter Wetlands National Park (Hunter CMA)*

# Working together for the Great Barrier Reef

Tulsi Rajyaguru, Reef Trust and Kate Lilley, Greening Australia

Wetland areas provide vital ecosystem services and play a key role in the health and resilience of the Great Barrier Reef. Historical changes in land-use along the Queensland coast have resulted in significant loss of these vital wetlands. In instances of extreme climate events, this loss impacts the ability of local ecosystems to naturally restore and rehabilitate themselves.



*Wetlands and waterways along the Great Barrier Reef catchment are vital for improving water quality on the Reef. They're also beautiful natural ecosystems that support many threatened species including a plethora of bird life. (Greening Australia)*

This is particularly the case in events of extreme rain and flooding, where the lack of ecosystem connectivity and limited wetland areas results in greater flooding and sediment run-off, increased spread of invasive species and poorer quality of water flowing into the Great Barrier Reef lagoon.

To address this issue, the Reef Trust and Greening Australia are partnering to deliver priority restoration and repair of wetland areas along the Great Barrier Reef coast. Through the Reef Trust, the Australian Government is providing \$2 million to match dollar-for-dollar funds raised from private contributors by Greening Australia. Around 200 hectares of priority wetland area will be restored through a Reef Trust project. Greening Australia will deliver the project in collaboration with local landholders, Indigenous communities, research institutions, regional bodies and other non-profit organisations.

Greening Australia's Reef Aid initiative has committed to raise \$20 million over the coming years, with the long-term view to raise \$100 million to support major on-ground restoration in the Great Barrier Reef catchments. Reef Aid will raise funds from

multiple sources to maximise the value of investment in the Great Barrier Reef and help deliver large scale restoration efforts through partnership and collaboration.

On-ground restoration actions delivered by Greening Australia through its partnership with Reef Trust will be based on best-available science and include restoration of natural hydrology, in-stream and overland water management, establishment of vegetation filter strips, buffer planting, creating habitat corridors, and reinstating floodplain wetlands. Supporting fire management, feral animal and weed control, extension and community engagement will also be delivered to enhance restoration outcomes and support on-going management.

Find out more about the Reef Trust on Department of Environment and Energy website [www.environment.gov.au/marine/gbr/reef-trust](http://www.environment.gov.au/marine/gbr/reef-trust)

Find out more about Reef Aid on the Greening Australia website [www.greeningaustralia.org.au](http://www.greeningaustralia.org.au)



# Ridding the river of blackberries: revegetation for climate change resilience

Lee Fontanini, Warren Catchments Council

It started by accident—two natural resource management officers were on their way home from a project when, with a bit of time up their sleeves, they decided to drop in and inspect a past project site. At the site they stumbled upon what could be a major breakthrough in the fight against a significant environmental weed in Southern Australia—the blackberry (*Rubus* sp).

Paul Yeoh (CSIRO) and Lee Fontanini (Warren Catchments Council [WCC]) were revisiting an historic blackberry control rust release site within the Warren River catchment in south west Western Australia. The project, which commenced in 2007, was randomly inspected and had mixed results at the time. But to their surprise at this river crossing site the blackberries had disappeared—completely. Investigation showed that this was not caused by the previously introduced rust in action nor herbicide application. The infested site, which covered approximately 0.5 hectares, was originally dominated by 3 metre high impenetrable blackberry but was now a picturesque blackberry free picnic site. Other noticeable observations included dead canes that disintegrated on touch and the crowns had rotted away.

‘Decline Syndrome’ is the phrase that has been coined to describe these blackberry death events and is most probably the result of a combination of new plant pathogens and a variety of auxiliary factors that include summer rainfall, waterlogging and flooding, introduced rust, grazing, red berry mite and bacteria.

As a result a multi-faceted action plan was created and was accepted as a funded project by the Australian Government National Landcare Programme. The WCC has coordinated a three pronged project that includes scientific research and on-ground action.



Eight months after planting, *Eucalyptus rudis*, *Agonis flexuosa*, *Poa porphyroclados* and *Microlaena stipoides* are growing well (Warren Catchments Council)

CSIRO and a Murdoch University PhD candidate researched the cause of the disease and complexity of the decline and have successfully identified the major pathogen (*Phytophthora* sp). They have also studied the resilience and dormancy of the blackberry seeds, effects of shade and grazing on blackberry recruitment.

In order to select the revegetation species with the highest probability of climate change resilience, the Department of Parks and Wildlife researched the genomic variation and adaptability of endemic plants to be used in river revegetation with climate change resilience (lower rainfall adaptors).

WCC mapped the Warren River catchment blackberry infestations and identified the decline zones, developed a specialised restoration project that has seen 600,000 seedlings planted in the decline zones of public estate and private property river foreshore.

For further information contact:

Warren Catchments Council Inc.  
52 Bath Street,  
MANJIMUP WA 6258

(08) 9777 1105 [www.warrencc.org.au](http://www.warrencc.org.au)



*A typical example of post blackberry decline on the Warren River, Carex appress is just being planted*  
(Warren Catchments Council)



# Climate risk and adaptation strategies at a coastal Ramsar wetland

Dr Stuart Blanch, CEO, Hunter Wetlands Centre Australia, Newcastle

If a coastal Ramsar wetland's ecological character changes from freshwater to estuarine values due to rising sea levels and other impacts from climate change—leading to a loss of the Ramsar values for which it was designated as internationally significant—is the owner in breach of their Ramsar responsibilities, and what can practically be done?

Such is the dilemma facing Hunter Wetlands Centre Australia (HWCA), and perhaps dozens of other Ramsar sites in Australia.

However, a recent elevational survey of the site confirmed long-held concerns that the ecological character of the formerly estuarine—now largely freshwater—site, including the two Ramsar values for which it was listed (endangered Australasian bittern and egret nesting) plus as many as five endangered ecological communities on coastal floodplains protected under NSW threatened species laws, are at risk from degradation and loss due to climate change.

Yet HWCA committed in 2002 to maintain the ecological character of the site when the site was Ramsar listed, and we are obliged to do so under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the Ramsar Convention.

The survey found that approximately one half (or 1.1 kilometres) of the site's boundary road (total 2.14 kilometres) is less than 1.1 metres above sea level and arguably at risk from over-topping by rising seas this century.



*Hunter Wetlands Centre Australia, Newcastle, looking west towards Hexham Swamp in Hunter Wetlands National Park (Hunter CMA)*

What *should* we do? What *can* we do?

What will we *be allowed* to do?

We are pondering the following strategies:

**1A. Protect Freshwater Values Strategy:** raising the height of low sections of the boundary road to <1.0 meters above sea level with relatively inexpensive road base to maintain freshwater values. This should work for at least a few decades

**2A. Saltmarsh Transition Strategy:** managed retreat of freshwater wetlands to proactively allow estuarine inflows to two of our wetlands (Ironbark Marsh, Reed Marsh), with re-establishment of five hectares of endangered coastal saltmarsh a consolation prize. This strategy would appear to breach HWCA's requirements under EPBC Act and the Ramsar Convention to maintain the site's ecological character, and risks losing one or both values for which the site was Ramsar listed.

**2B. Freshwater Wetland Offset Strategy:** owning and restoring other freshwater wetlands at elevations greater than 1.5 metres above sea level in the Hunter estuary, or elsewhere, to seek to replace those wetlands at HWCA that become estuarine.

A strategic and coordinated national approach is needed to underpin realistic, data-driven responses by jurisdictions and Ramsar wetland managers for Ramsar sites at risk from rising seas and other climate change pressures.

For further information, contact  
Dr Stuart Blanch, CEO, Hunter Wetlands  
Centre Tel: 02 4951 6466, [ceo@wetlands.org.au](mailto:ceo@wetlands.org.au),  
[www.wetlands.org.au](http://www.wetlands.org.au)



Sea level rise impacts & adaptation strategy options at HWCA (Hunter CMA)



# Managing coastal wetlands under climate change

Janet Holmes, Department of Environment, Land Water and Planning and Sarah Heard, Jacobs Group Australia

As the climate changes, natural resource managers face challenges in setting the future management direction for coastal wetlands. The Department of Environment, Land, Water and Planning (DELWP) funded a project which was undertaken by Jacobs Group Australia in partnership with Dodo Environmental to develop a decision support framework (DSF) to assist natural resource managers in understanding the potential impacts of climate change on coastal wetlands, identifying their adaptive capacity and in setting realistic objectives and planning for their future management.

The *Climate Change Vulnerability Assessment and Adaptive Capacity of Coastal Wetlands Decision Support Framework* is presented in a two volume report available on the DELWP website: [www.depi.vic.gov.au/water/rivers-estuaries-and-wetlands/wetlands](http://www.depi.vic.gov.au/water/rivers-estuaries-and-wetlands/wetlands). The DSF (volume 1 of the report) guides users through a step by step process using a template (A4 booklet) to assess the vulnerability and adaptive capacity of an individual wetland type at the site or local landscape scale. Volume 2 presents supporting technical information required to apply the framework. It presents the logic and assumptions behind the DSF.

The first step of the DSF focuses on identifying different types of coastal wetlands in terms of vegetation, hydrology and geomorphic features. The physical characteristics of the wetland and the type of vegetation present are factors which influence the exposure of the wetland to climate change and its sensitivity to the changes to which it is exposed.



*South Gippsland Seawall* (Paul Boon)

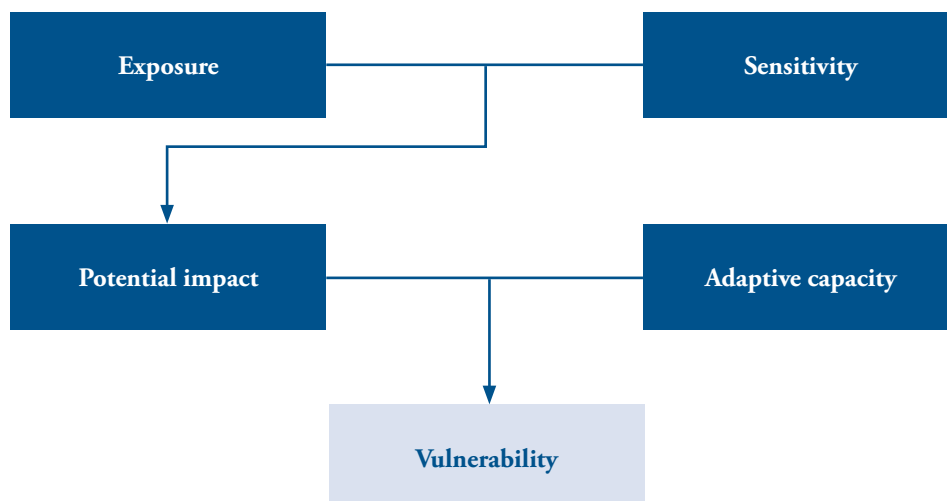


Figure 1. Vulnerability assessment approach for coastal wetlands.

The second step guides users through a vulnerability assessment framework to assess the potential impacts from climate change at an individual coastal wetland (Figure 1).

The vulnerability assessment involves identifying the various critical climate change components and their implications for coastal wetlands. Guidance is provided on how to determine the exposure and the sensitivity of the individual wetland to these components. Taken together, these two factors define the potential impact. The intrinsic adaptive capacity of the wetland is then assessed and considered alongside the potential impact. This defines the vulnerability of the wetland.

Step 3 frames the process of identifying management objectives and actions. It guides users to consider the adaptation mechanisms possible for a wetland and the key management constraints as the basis of setting management objectives and developing an implementation plan.

The framework was tested for the Powlett River Estuary which is presented as a case study at the end of volume 1.

For more information, contact Janet Holmes at [Janet.Holmes@delwp.vic.gov.au](mailto:Janet.Holmes@delwp.vic.gov.au) or visit [www.delwp.vic.gov.au/](http://www.delwp.vic.gov.au/)



Saltmarsh adjacent to housing, South Gippsland (Paul Boon)



# Inland wetland rehabilitation to mitigate climate change impacts

Authoring Organisations:

Murray Local Land Services

Victorian Catchment Management Authorities

Deakin University Blue Carbon Lab

Murray Darling Wetlands Working Group Ltd.

Department of Environment, Land, Water and Planning, Victoria

Recent work in inland Victoria and NSW has highlighted the potential for inland wetlands to help mitigate climate change by improving carbon stores and offsetting carbon dioxide emissions.

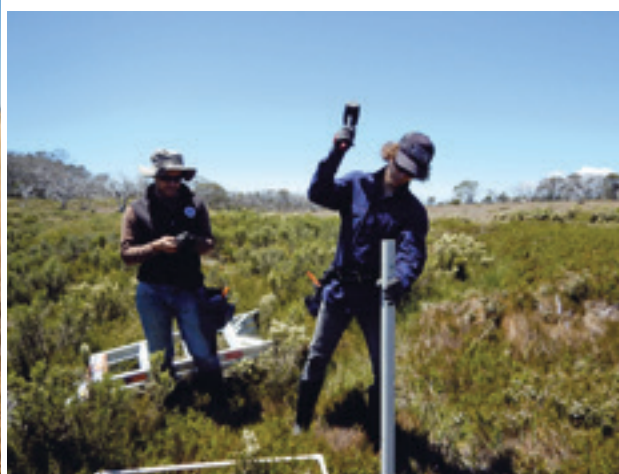
As the impacts of climate change are becoming increasingly realised, wetlands are drawing more and more attention for their vast potential to capture atmospheric carbon. Until recently investigations of the carbon sequestration capacity of wetlands have concentrated on coastal or 'blue carbon' wetlands. But in fact, estimates identify inland wetlands as the earth's largest store of terrestrial carbon. Inland wetlands contain 33 per cent of global soil carbon, despite only occupying 8 per cent of the land surface area, and are capable of storing 30 to 40 times more carbon than forests.

Deakin University, Department of Environment, Land, Water and Planning (DELWP) and the Victorian CMAs set about to understand the carbon sequestration capacity of Victoria's inland wetlands through Australia's most comprehensive investigation of inland wetlands carbon stocks to date.

The project found that Victoria's wetlands are storing substantial amounts of carbon, with an estimated carbon sequestration of 3,117,682 tonnes of CO<sub>2</sub> equivalents per year, equivalent to the CO<sub>2</sub> emissions produced by 659,129 cars or emitted by 176,538 Australians in a year. The project also found that permanent open freshwater wetlands had the lowest carbon stocks, freshwater meadows and shallow freshwater marshes were in the mid-range, and the highest carbon stock values were in alpine peatlands.



*Left: The field team measuring greenhouse gas concentrations using the Los Gatos Research (LGR) Ultra-portable Greenhouse Gas Analyser (Deakin University Blue Carbon Lab)*



*Right: Dr Paul Carnell and PhD candidate Quinn Ollivier taking sediment cores in the alpine region of Victoria (Deakin University Blue Carbon Lab)*

At the same time, disturbance and loss of wetlands has a potential to release significant quantities of CO<sub>2</sub> back into the environment. Through the Murray Wetland Carbon Storage project, Deakin University's Blue Carbon Lab have found that rehabilitation of freshwater inland wetlands, through on-ground works such as fencing and revegetation, significantly improves soil carbon stocks, increasing further, the longer the wetlands have been restored. This project is being delivered through a partnership between Murray Local Land Services and the Murray Darling Wetlands Working Group Ltd.

Importantly, this study has shown that carbon stocks improve regardless of other factors that can affect carbon storage in soils (e.g. previous land-use, soil type, frequency of inundation, elevation etc.). This means that, regardless of the current state of the wetland, rehabilitation is still highly beneficial. Wetland carbon sequestration capacity can be restored in as little as five years, depending on the site and its management regime.

These projects provide promising experimental evidence of the capacity of inland wetlands to store carbon, and that restoring inland wetlands can help their carbon sequestration capacity, thereby helping to mitigate the impacts of climate change.

The Murray Wetland Carbon Storage project is funded by the Australian Government and the Victorian project was funded by the Victorian Government.

For further information on the carbon sequestration by Victorian inland wetlands project, contact:

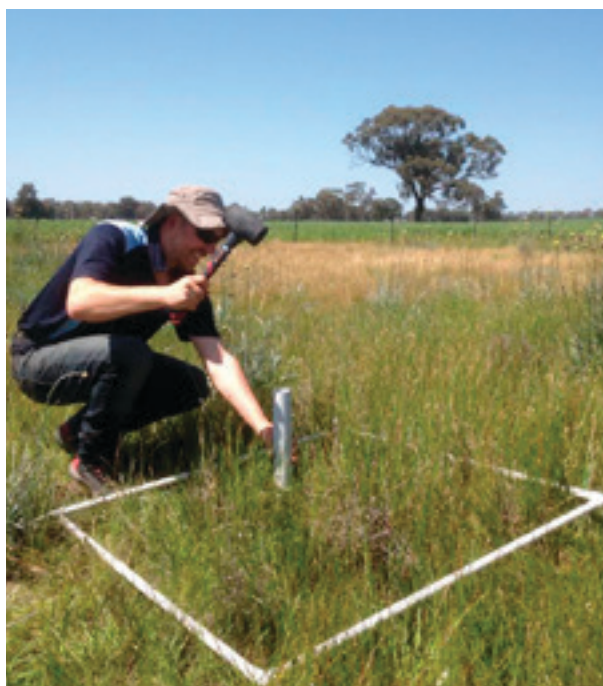
Paul Carnell (Deakin University, Blue Carbon Lab) on 0417 054 087 or at [paul.carnell@deakin.edu.au](mailto:paul.carnell@deakin.edu.au), or Kate Brunt (Goulburn Broken CMA) on 5822 7700 or at [katebr@gbcma.vic.gov.au](mailto:katebr@gbcma.vic.gov.au)

For further information on the Murray Wetland carbon storage project, contact:

Trish Bowen (Murray Local Land Services) 1300 795 299, [patricia.bowen@lls.nsw.gov.au](mailto:patricia.bowen@lls.nsw.gov.au) or visit the following websites: [www.murray.lls.nsw.gov.au](http://www.murray.lls.nsw.gov.au), [www.bluecarbonlab.org](http://www.bluecarbonlab.org) or [www.murraydarlingwetlands.com.au](http://www.murraydarlingwetlands.com.au)



*Left: Alex Pearse, PhD candidate Saras Windecker and Dr Paul Carnell identifying the different plant species present in the wetlands sampled for soil carbon (Deakin University Blue Carbon Lab)*



*Right: A total of four replicate soil cores were taken at each Murray LLS wetland site using a 50-cm long, 5-cm inner-diameter PVC pipe (Deakin University Blue Carbon Lab)*



# Constructed wetlands for drought disaster mitigation

Nadine Kilsby, Department of Environment, Water and Natural Resources

Prolonged drought, such as South Australia recently experienced, can have immediate and long-term impacts. Water restrictions result in the reduced irrigation of sporting fields and community parks, as this is seen as a non-critical use by some water managers.

As well as the social impacts a dry, brown sports field has on the local community, including player safety, amenity and community well-being, the dead grass and lack of soil moisture results in increased surface temperatures, further compounding the urban heat island effect and often high temperatures that accompany a drought. An alternative supply of water for irrigation of these community spaces could mitigate against the social impacts and heat island effects, especially during times of drought.

Stormwater is an alternative supply of water, but requires treatment to remove pollutants typical of urban runoff and storage to match winter rainfall to summer irrigation demand. A number of schemes within the Adelaide metropolitan area have addressed this issue with the construction of wetlands for stormwater treatment, and managed aquifer recharge (MAR, injecting treated water into the aquifer, to be recovered at a later date) for storage. Constructed wetlands in an urban landscape offer multiple benefits over their



*As well as treating stormwater, constructed wetlands provide biodiversity and community amenity value, such as Oaklands Park in Adelaide's south (Sam Phillips, South Australian Department of Environment, Water and Natural Resources)*



*As well as treating stormwater, constructed wetlands provide biodiversity and community amenity value, such as Oaklands Park in Adelaide's south (Sam Phillips, South Australian Department of Environment, Water and Natural Resources)*

primary purpose of stormwater treatment. These include enhanced local biodiversity, drought refugia for local flora and fauna, and importantly, often providing an opportunity for the community to interact with the wetland, connect with nature, and experience the “green” (vegetated) and “blue” (water) space it provides.

Oaklands Wetland, located within the City of Marion (southern Adelaide), is an excellent example of a wetland constructed for stormwater treatment being highly valued by the community. The wetland provides an opportunity to connect to nature and be educated on the water cycle, as well as being host to a diversity

of local wildlife (birds, aquatic biota and flying-foxes) and vegetation (including the 85,000 plants that were planted as part of wetland establishment). The wetland made use of a space that was previously a driver training facility that was covered in asphalt.

More information on the wetland can be found at [www.marion.sa.gov.au/oaklands-wetland](http://www.marion.sa.gov.au/oaklands-wetland) and [www.naturalresources.sa.gov.au/adelaidemtloftyranges/water/managing-water/stormwater/oaklands-wetland](http://www.naturalresources.sa.gov.au/adelaidemtloftyranges/water/managing-water/stormwater/oaklands-wetland).



# Our northern wetlands: science to support a sustainable future

Briena Barrett and Clare Taylor, [Northern Australia Environmental Resources Hub](#)

In the midst of the wet season, northern Australia's wetlands come alive. As the rain continues to pour, an abundance of habitats and food becomes available for thousands of plant and animal species.

This is not only a critical time for biodiversity, but also for cattle producers, fishers and tourism providers who rely on wet season flows. Indigenous communities in the north too have fundamental cultural, social and economic ties to wetlands and the traditional resources they produce which are tied to this seasonal replenishment of water.

But increasingly, these prized water resources are sparking the interest of government, community and private investors for agricultural development. With so many competing interests in our tropical wetlands, how can we ensure that users, including the environment, get the right share of available water to be sustainable in the long term?

The National Environmental Science Programme's Northern Australia Environmental Resources Hub is providing research to help inform sustainable development in the north. Hub Leader Professor Michael Douglas said our understanding of the water needs of different users still has a way to go.

"For example – how much water might we need to support the abundance of fish species in the Daly River, or how might existing environmental and cultural assets in the Fitzroy River be impacted by planned development?" Professor Douglas said.



*Top row, from left: Kowanyama floodplain (M Douglas). Researcher with net (ML Taylor)*

*Bottom: Paperbark swamp (M Douglas)*

Research under the Northern Hub will address questions like these and lay strong foundations to inform sustainable policy, planning and management of tropical wetlands.

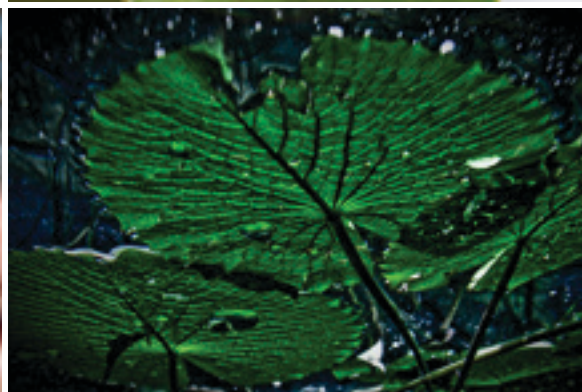
Wetland related projects under the Hub include:

1. research to improve our understanding of the flows needed to support natural assets in the [Mitchell, Daly and Fitzroy Rivers](#)
2. research to identify which rivers in the [Gulf of Carpentaria](#) region are making the most significant contribution to the health and productivity of the Gulf
3. research to improve our knowledge of Indigenous water requirements within the [Fitzroy River](#) catchment
4. research to mitigate the threats from feral animals to aquatic ecosystems in the [Archer River Basin](#)
5. research to guide improved management of [riverbank \(or riparian\) habitats across the north](#).

“Science has a critical role to play in helping to determine the water requirements for all users so that trade-offs can be understood and negotiated,” Professor Douglas said.

“This information is vital to ensure that water resources in the north are secured for all water users and that water-related development is sustainable in the long-term.”

For further information about the NAER Hub, visit: [www.nespnorthern.edu.au/nesp](http://www.nespnorthern.edu.au/nesp) or contact Knowledge Broker Clare Taylor: [clare.taylor@cdu.edu.au](mailto:clare.taylor@cdu.edu.au) or (08) 8946 7476.



Left column, from top: Barramundi (ML Taylor). Researcher taking notes (ML Taylor)

Right column, from top: Northern dwarf tree frog (*Litoria bicolor*) (M Douglas). Lilies from below (M Douglas). Centre pivot irrigation in the Fitzroy Valley (M Douglas)



# Predicting the occurrence of seasonal herbaceous wetlands in south east Australia

Phil Papas and Matt White, Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning, 123 Brown Street, Heidelberg VIC 3084

Seasonal herbaceous wetlands are listed as a critically endangered ecological community under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). They are temporary, freshwater, rainfall-fed and occur on fertile plains in south-eastern Australia. Their vegetation structure is open (woody cover is absent to sparse) and the ground layer is dominated by herbs (grasses, sedges and forbs) adapted to seasonally wet or waterlogged conditions. The community is particularly susceptible to impacts from agricultural and urban land uses because they occur on fertile plains and sometimes close to urban centres. Cropping, livestock grazing, forestry production, and urban, industrial and infrastructure development all threaten its existence and condition.

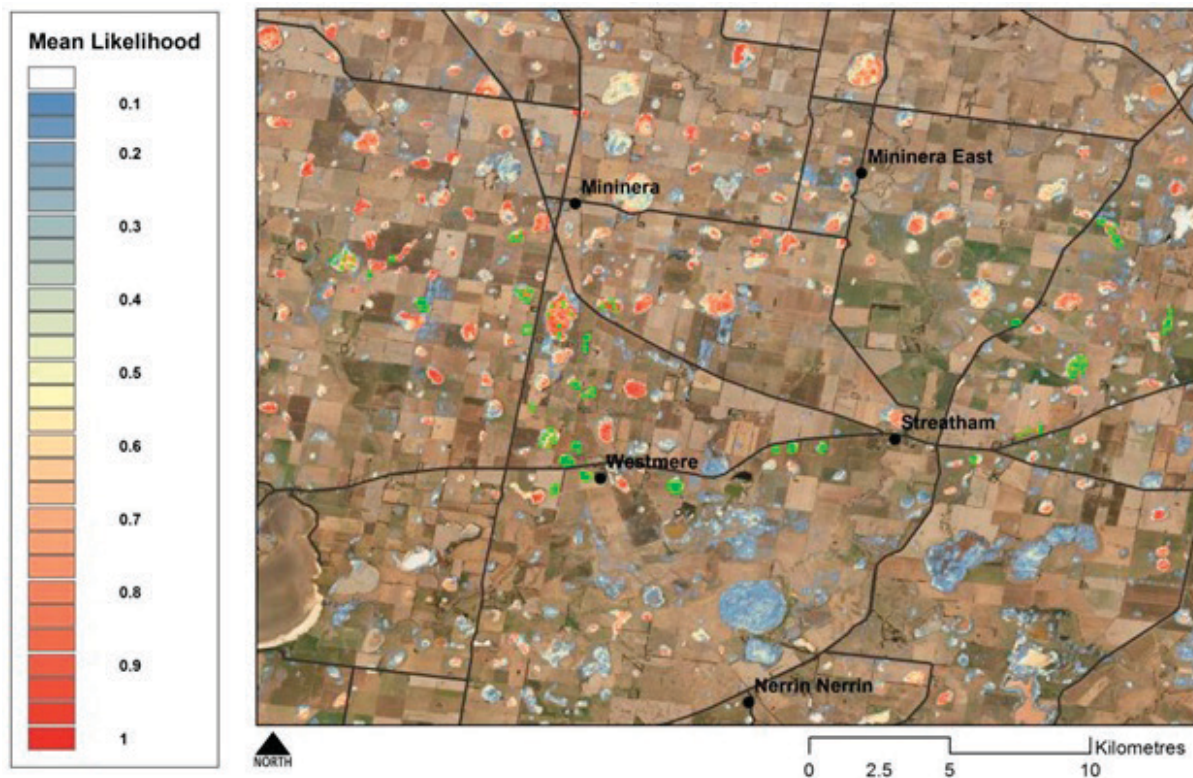
Management and prioritisation of seasonal herbaceous wetlands for conservation or rehabilitation requires good knowledge of their location. There is a high degree of confidence in the location of such wetlands in only a few, relatively small, areas in south-east Australia. The location of other potential seasonal herbaceous wetlands has been mapped but these maps were principally derived from modelled native wetland vegetation and vary in scale and accuracy and do not specifically map the defined EPBC ecological community. To address these issues, we used a new approach to modelling the likelihood of occurrence of the EPBC listed community across Victoria and adjoining areas of South Australia.

Using field observations and data derived from two satellite platforms, we modelled the spatial extent of the target ecological community at a resolution of 25 metre.

The resultant model fits the field observations well and model validation suggests that the model extrapolates successfully even when presented with novel field observations. Model outputs include the mean likelihood of seasonal herbaceous wetland occurrence at each 25 metre pixel and the uncertainty (the standard deviation derived from the set of model predictions at each 25 metre pixel). The likelihood and uncertainty values can be combined and/or thresholded depending on the decision making context.



*A seasonal herbaceous wetland in the Victorian Riverina (Diane Crowther, DELWP)*



*Spatial expression of the mean likelihood model around Streatham on the Victorian volcanic plains in south-west Victoria. Green triangular markers highlight the location of model training sites. (DELWP)*

The model outputs are available from [www.data.vic.gov.au/data/dataset/Seasonal-Herbaceous-Wetland-likelihood-model-V1-output-\(mean-and-standard-deviation\)](http://www.data.vic.gov.au/data/dataset/Seasonal-Herbaceous-Wetland-likelihood-model-V1-output-(mean-and-standard-deviation)) and a report that details the modelling approach is available at [www.delwp.vic.gov.au/ari/reports](http://www.delwp.vic.gov.au/ari/reports)

For further information, a report that details the modelling approach is available at [www.delwp.vic.gov.au/ari/reports](http://www.delwp.vic.gov.au/ari/reports)

The project was funded by the Water and Catchments Group, Department of Environment, Land, Water and Planning, Victoria.



# Models of wetland connectivity: Supporting a landscape scale approach to wetland management

Kay Morris, Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning

A range of wetland management interventions such as livestock exclusion, revegetation, environmental watering and pest animal and plant control are used to improve or maintain wetland values and condition. The resources available to implement management interventions are limited and there is a need to strategically select wetlands where management benefits are optimised.

Several factors should be taken into account when prioritising wetlands for investment. From a site perspective, these include values and threats at individual wetlands and the feasibility, cost and effectiveness of the management. Landscape factors should also be considered as these can influence the effectiveness of management, the persistence of regional wetland biodiversity, or the spread of invasive species. Landscape patterns of biological connectivity among wetlands is one such factor.

Biological connectivity represents the ability of plants and animals to move between habitat patches in the landscape. Connectivity is an important consideration in spatially prioritising management investment as connections among wetlands strongly influence the assemblage of plants and animals that occur in these habitats and their resilience to environmental change. High levels of connectivity can: (i) provide opportunities for native and introduced species to expand their range and migrate in response to local and regional changes in habitat condition, (ii) facilitate re-colonisation following local extinction events, (iii) promote gene flow among populations, increasing genetic diversity and resilience to environmental change. Low levels of connectivity can also be important in maintaining wetland values because isolated wetlands may be less exposed to diseases such as Chytrid fungus or invasive plants and animals.



*Seeds of typha dispersing by wind* (Kay Morris)

The Department of Environment, Land, Water and Planning has been investing in better understanding how Victoria's wetlands are biologically connected. This knowledge has underpinned the development of state-wide maps that represent modelled patterns of wetland connectivity for waterbirds, amphibians and wind-dispersed plant seed. This work has been informed by an understanding of the dispersal pathways of wetland animals and plants, the distances they can travel, the features of the landscape that restrict or enhance movement, as well as the geographical arrangement of wetlands.

The application of these spatial layers to wetland management is supported by the *Wetland Connectivity Spatial Data: User's Guide. Version 1*. The guide describes the modelling process, spatial products and how they can be used to guide the spatial prioritisation of on-ground activities that aim to protect high-value wetlands, restore degraded wetlands, and protect wetlands from the spread of weeds and/or pathogens.

For further information visit:

[www.delwp.vic.gov.au](http://www.delwp.vic.gov.au)

# Lake Eyre Basin Condition Assessment 2016

Sue Stefanoski, Communications Officer, Department of Agriculture and Water Resources

One of the biggest inland drainage systems in the world, the Lake Eyre Basin spans almost one sixth of Australia at 1.2 million square metres. From Longreach to Mount Isa, Alice Springs to Broken Hill, the Lake Eyre Basin is an area of high conservation importance and home to a variety of flora and fauna. Two Ramsar wetlands are located in the Lake Eyre Basin, Coongie Lakes in South Australia and Lake Pinaroo in New South Wales.

Every 10 years an assessment of the basin's watercourses and catchments is conducted in a joint initiative of the Australian, Queensland, South Australian and Northern Territory governments as required under the Lake Eyre Basin Intergovernmental Agreement.

The first Lake Eyre Basin Condition Assessment occurred in 2008 and was a desktop analysis of the limited data available at the time from government agencies, natural resource management boards and research reports. The 2008 condition assessment found that the rivers and catchments in the basin were in generally good condition.

The 2016 State of the Basin condition assessment reports on the current status of the hydrology, fish, water quality and waterbirds of the Lake Eyre Basin and on the current and emerging threats and pressures to the basin.

"The assessment allows everyone to consider how the Basin's environment may or may not be changing, based on scientifically-credible information. It provides a vital benchmark against which progress can be assessed in future years, and a view on the effectiveness of current management efforts", Dr Morton, Chair of the Lake Eyre Basin State of the Basin Steering Committee and Chair of the Lake Eyre Basin Scientific Advisory Panel said.

The State of the Basin report is developed in consultation with the Australian, State and Territory governments along with natural resource management bodies, research institutions, Lake Eyre Basin Community Advisory Committee members, Lake Eyre Basin Scientific Advisory Panel members, communities and landholders.

For more information visit [www.lakeeyrebasin.gov.au](http://www.lakeeyrebasin.gov.au) and subscribe or email [lebsecretariat@agriculture.gov.au](mailto:lebsecretariat@agriculture.gov.au).



*Strzelecki Corellas, Lake Eyre, South Australia (A. Emmott)*

# “Where are the wetlands in NSW?”

## A new semi-automated method for mapping wetlands

Joanne Ling, Megan Powell, Grant Hodgins, David Tierney and Michael Hughes, NSW Department of Planning and Environment, Office of Environment and Heritage

The development of semi-automated techniques for wetland mapping and assessment is a key step toward development of a state-wide inventory and a more coordinated approach to wetland management across NSW.

We know that wetlands and their ecosystem services play a crucial role in environmental risk reduction, but we don't have consistent and comprehensive maps of where these valuable wetlands are. An inventory of NSW wetlands is a fundamental tool for threat risk assessment and adaptive management. It also provides an opportunity to identify wetland recreational value for the people of NSW.

In **2015–16** we completed a pilot project to develop semi-automated techniques for rapidly generating inundation histories (a key-driver for wetlands) over large arid and semi-arid areas. This level of automation requires management of uncertainty, which can only be satisfactorily achieved with a rigorous field validation program. Regional stakeholders and the historical knowledge that they hold are also critical for accuracy assessment and management of uncertainty, because any

field validation exercise represents only a snapshot in time within a dynamic wetland landscape.

**Where to next in 2016–17?** Through lessons from the pilot project, and by field validation this year, we will finalise our wetland mapping products for the Lachlan River Catchment. To maximise their utility these products will be tailored to suit requirements of end-users engaged in environmental water planning and governance. We will also make the data publicly accessible through the environmental data portal SEED: Search Engine for Environmental Data. We will continue to engage funding bodies and potential partners to build and extend the wetland inventory across the state including exploring the use of the automated mapping methods in a coastal region such as Hunter River Catchment wetlands.



*Aerial photo of Lake Tarwong Lachlan River Catchment, 2012 (Paul Packard)*

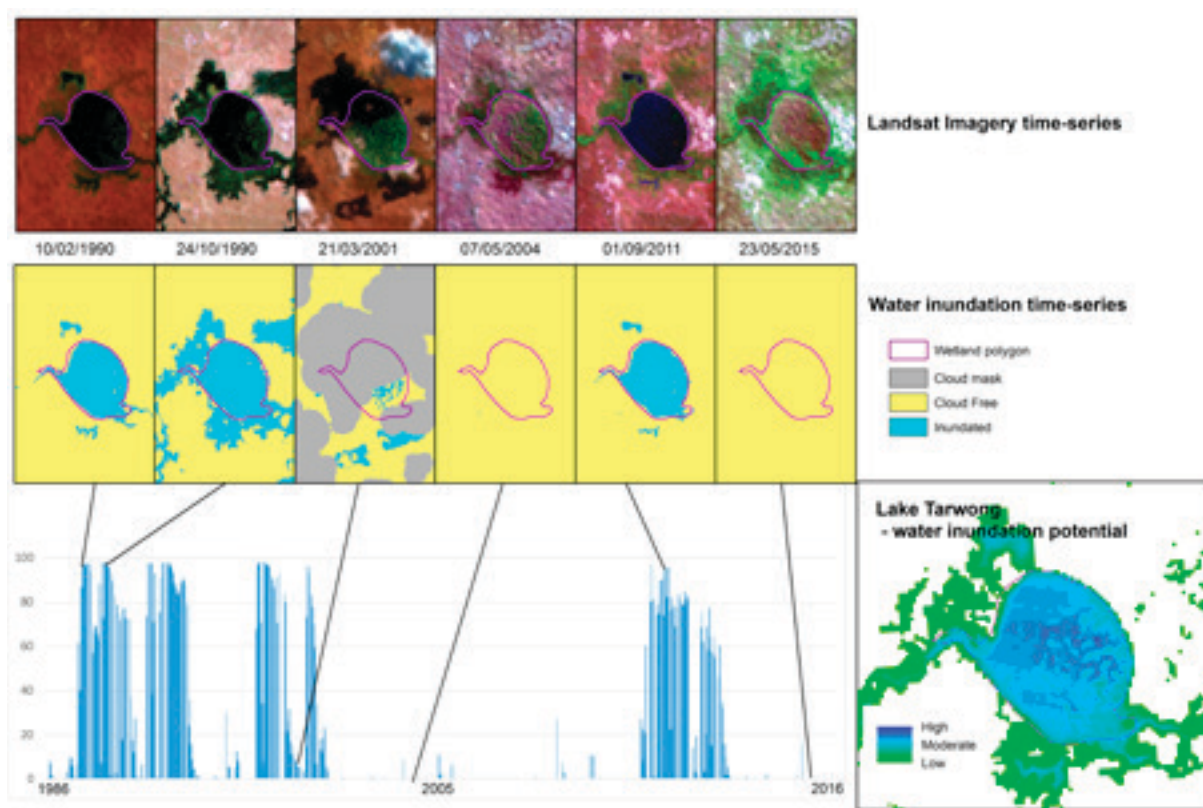


The potential uses for a NSW Wetland Inventory are extensive. Examples range from identification of environmental assets, through monitoring and evaluation of wetlands over time, to comparing similar wetland types to prioritise them for protection. State-wide management of wetlands will benefit from consistent and comprehensive mapping of wetland locations, extents and types across the state.

## How can you be involved?

Are you a potential end-user of our products? We'd like to find out how to better design the products to match your needs! Do you have data or information that could be used in the inventory?

For more information, please contact Joanne Ling, Office of Environment and Heritage at [joanne.ling@environment.nsw.gov.au](mailto:joanne.ling@environment.nsw.gov.au), or visit the OEHL Website at [www.environment.nsw.gov.au/](http://www.environment.nsw.gov.au/)



*The pilot study developed semi-automated techniques to identify wetland boundaries and applied remote sensing water-indexing techniques to generate data on percent inundated for each Landsat capture. This figure illustrates the principles behind the wetland mapping method using a time-series of remote sensing inundation observations. This example of Lake Tarwong has a graph along the bottom showing how much of the lake was inundated for each Landsat satellite images from 1986 to 2016. The series of images along the top are examples of Landsat images used in the analysis, and the second row of images shows the area of inundation or cloud obscured data respective to those images. Finally the larger image (on the right) shows the inundation potential across the wetland based on the 30 year archive of inundation observations. This inundation information can then be rapidly generated within the defined wetland boundary, and graphed to show percent inundated observations over time. The technique and data will be used to characterise wetlands and to understand the processes keeping them healthy.*

# Method for the long-term monitoring of wetlands in Victoria

Janet Holmes, Department of Environment, Land Water and Planning and Mark Stacey, Alluvium Consulting Australia

The Department of Environment, Land Water and Planning (DELWP) funded a project to identify an efficient, cost effective method to monitor wetland water regime and vegetation. This project was undertaken by Alluvium Consulting Australia in partnership with CSIRO.

Selection of the most appropriate monitoring method was undertaken by first specifying the monitoring requirements in detail. These were that the method should be affordable and rely on ongoing data supply which is frequently collected across Victoria. A review was then undertaken of potential methods applied previously in Australia and internationally. This allowed a systematic evaluation of how well each potential method would achieve the specific monitoring requirements in Victoria. Utilising optical remote sensing data, in particular Landsat Thematic Mapper (TM) imagery, was identified as the preferred method. The way that light is reflected from vegetation, water and other parts of the landscape provides valuable information. 'Reflectance values' of the landscape are recorded in 25 X 25 metre pixels at each satellite pass. These values can be analysed to determine the unique signatures of water and vegetation in each pixel. The project trialled this method for wetlands in the area near Kerang in north west Victoria.

Use of this imagery had many advantages. The imagery is proven as the basis for operational vegetation and inundation monitoring systems in Australia. It is readily available, extends back to 1988 and has a forward plan for ongoing acquisition. It is relatively cost effective. For Victoria, the cost was estimated at \$230,000 to \$400,000, depending on the intensity of the data collation and classification tasks. It provides consistent measurement of changes over time and over the landscape. The same imagery is used to monitor both inundation and vegetation cover.

There are some limitations to the method. Dense vegetation in wetlands can result in errors of omission in detecting water. The method only detects change in vegetation cover, but not between different types of vegetation. This highlights change but cannot be used to explain it.



*Three of the wetlands in north western Victoria where the method was trialled*

There are several products that can be generated by using the method. These include temporal summary inundation plots (Figure 1) and time series inundation plots (Figure 2). Wetlands can be assigned to a water regime category in Victoria's wetland classification system (permanent, seasonal, intermittent or episodic) for a particular period of time. Trends in change of wetlands from one category to another can be explored.

For vegetation, statistics, datasets and maps can be produced to indicate vegetation change at individual wetlands. This helps wetland managers to identify wetlands undergoing a change in vegetation type which can be further investigated in on-ground surveys.

For more information, contact Janet Holmes at [Janet.Holmes@delwp.vic.gov.au](mailto:Janet.Holmes@delwp.vic.gov.au) or visit [www.depi.vic.gov.au/water/rivers-estuaries-and-wetlands/wetlands](http://www.depi.vic.gov.au/water/rivers-estuaries-and-wetlands/wetlands) to read the project report

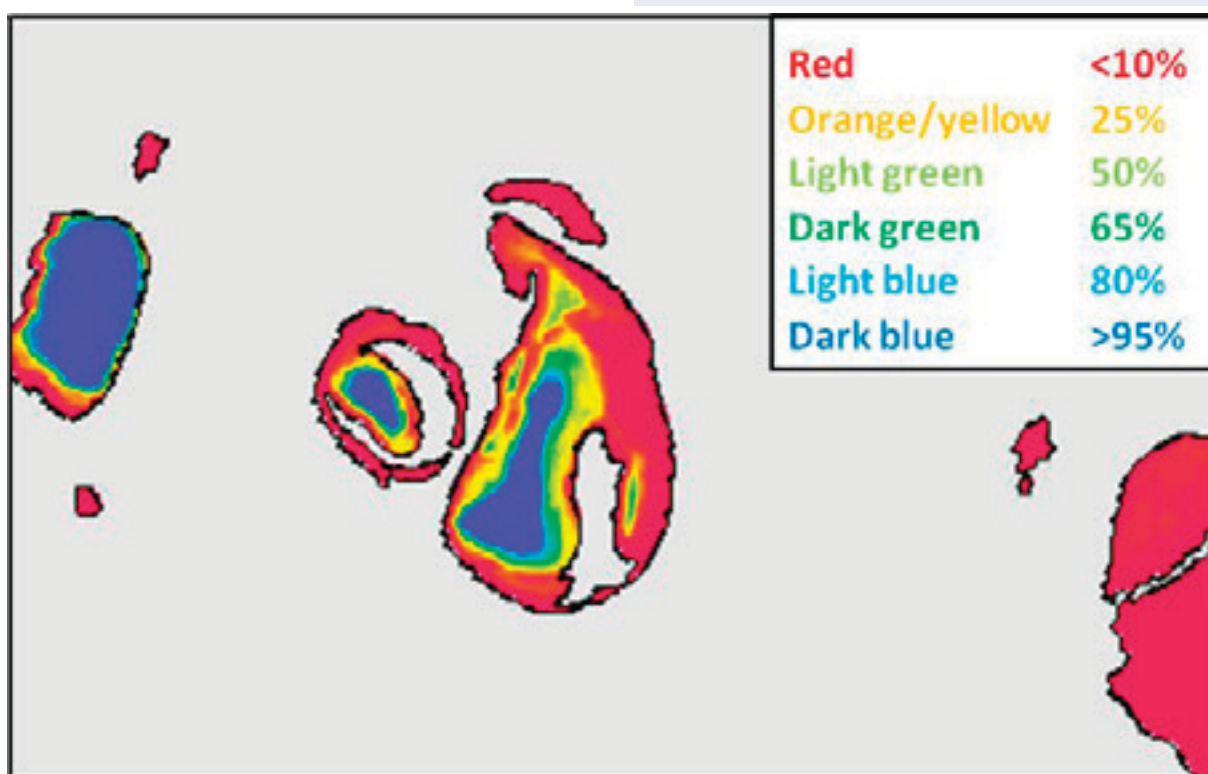


Figure 1: Temporal summary inundation plot for Lake Kelly and Little Lake Kelly near Kerang, Victoria. The colours indicate the % of wetland classified as wet over the time period of interest.

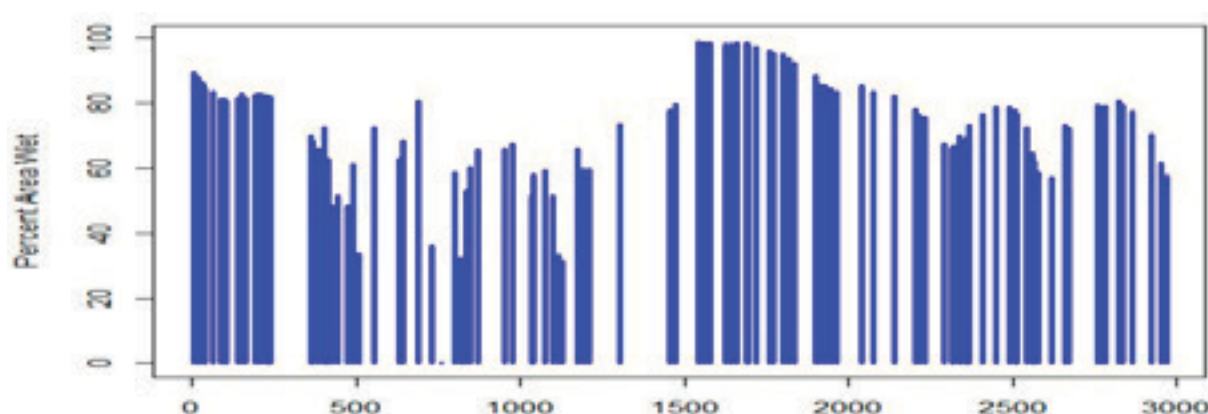


Figure 2. Time series inundation plot for Lake Tutchewop near Kerang, Victoria from January 2007 to March 2015 (116 images). Each 25 × 25m pixel in the wetland is assigned 'wet', 'dry' or 'missing' for each 16 day Landsat pass and the % of wet area in the wetland is calculated for each pass. Blue dots on X-axis indicate '100% dry', gaps on the X-axis indicate periods of missing or cloudy imagery.

# Muir-Byenup Ramsar wetlands: Are they changing?

Melita Pennifold, Research Scientist, Western Australian Department of Parks and Wildlife

Many wetlands globally, including Ramsar sites, are impacted by threats (human and natural) and are currently at risk of losing their ecological character. The Muir-Byenup wetlands is one such Ramsar site where a possible change in ecological character has been reported.

The Muir-Byenup wetland system is a suite of over thirty lakes and swamps. There is a large diversity in the natural communities from permanent to seasonal lakes, freshwater wetlands to primary salt lakes and rare peat systems. Many of the wetlands are listed in the Directory of Important Wetlands in Australia and in 2001 the southern suite of wetlands were declared a Ramsar site of international importance.

Over the years, various wetlands within this system have been threatened by salinity, acid-sulfate soils, eutrophication, grazing, introduced species, pests, inappropriate fire regimes and illegal vehicle access. In more recent years, there has been the added threat of water level change, as a result of a drying climate.

Since being listed as a Ramsar site there have been a number of changes within the wetland system relating to aquatic invertebrate communities, distribution of some fish species and condition of fringing vegetation. Although these lakes are naturally highly variable, long-term monitoring (~35yrs) has indicated changes in depth, pH and salinity occurring in several lakes. One peat lake in particular, Tordit-Gurrupe Lagoon, has had record low water levels in recent years resulting in a dramatic increase in salinity and acidity. After an acidification event in 2013, the ecological value of this wetland is under threat and requires assessment.



*Tordit-Gurrupe Lagoon* (J. Higbid)



An investigation is underway to obtain a better understanding of the ecology and hydrology of the Muir-Byenup wetland system, so the status of the site can be updated and management better informed to maintain the site's ecological character. In 2014–2015 an invertebrate survey (along with water chemistry) was carried out to determine if changes have occurred in the invertebrate composition since previous surveys (1996–97 and 2003–04). Data analysis is incomplete, however preliminary findings indicate some changes in invertebrate composition and richness may have occurred in some wetlands.

While some management works can be implemented now, planning for many interventions depends on understanding the hydrological changes within the system and the chemistry of the wetland

sediments. In 2015, a three year investigation into the hydrodynamics and hydrogeochemistry of Byenup Lagoon system was initiated.

The Muir-Byenup wetlands are a complex set of unique and highly important wetland assemblages with an equally complex hydrology. An important challenge over the next decade will be to successfully model and manage the key wetlands to maintain these highly important biodiversity assets.

For future information please contact  
Melita Pennifold, Department of  
Parks and Wildlife Western Australia:  
[Melita.Pennifold@dpaw.wa.gov.au](mailto:Melita.Pennifold@dpaw.wa.gov.au)



*Peat cracking* (M. Pennifold)

# Looking below the surface of the Vasse Wonnerup wetlands

Emily Hugues dit Ciles, South West Catchments Council

The Vasse-Wonnerup wetlands system is a shallow series of lagoons that intermittently open to the sea. They are located near the town of Busselton, Western Australia. The wetlands are internationally recognised as a Ramsar site and support over 30 fish species and over 37,500 waterbirds from 90 different species.

The system is highly modified and endures extreme seasonal variations making it a highly complex system to grasp or interpret.

Management of Vasse-Wonnerup wetlands system needs to be underpinned by a sound scientific understanding of ecosystem structure and processes, but also needs to align with social and political realities and community expectations. Holistic research into the Vasse Wonnerup Ramsar wetlands is proving increasingly important to better understand and untangle the system's intricacy to assist with its management.

In collaboration with agencies, local governments and leading researchers, South West Catchments Council (SWCC) has identified key knowledge gaps and management questions for the system. Through funding from the Australian Government's National Landcare Programme, SWCC has fostered a strong partnership with Murdoch University and Edith Cowan University. In an innovative and collaborative research program a suit of projects was developed to answer key priority management questions for the wetland system.

Key questions targeted by the research include:

"Nutrients—Where do they come from? Who eats what in the Vasse Wonnerup? How does the community value the wetlands?"

Importantly, whilst focussed on a single ecosystem, the integrative nature of the program's research projects will be broadly applicable to other estuaries and wetlands.

The program will further foster a better understanding of threats, management issues and will provide key management recommendations and strategies to protect these internationally important wetlands.

For more information visit the South West Catchments Council website at [swccnrm.org.au](http://swccnrm.org.au)

This project is supported by the South West Catchments Council, through funding from the Australian Government's National Landcare Programme.



*Vasse Wonnerup Wetland System* (Monica Durncan)



# Reconnecting flows across the Budj Bim landscape

Glenelg Hopkins Catchment Management Authority

Project: Budj Bim Waterways Project

Project Sponsor: State Government Victoria under the Rivers 2040 program

## *Budj Bim landscape, ancient and valuable*

When Budj Bim (also known as Mount Eccles) erupted around 30,000 years ago it changed the landscape forever. The resulting Tyrendarra Lava Flow created a series of stony rises, rivers and wetlands between Budj Bim and the sea. This diverse landscape in the south west corner of Victoria encompasses Lake Condah, Darlots Creek and the Fitzroy River and Estuary.

Among the lava flows, local Gunditjmara people developed a large and ingenious aquaculture system designed to grow and harvest eels. The engineered channels, weirs and wetlands provided a year round supply of food. Dated at about 6,600 years old, it is one of the oldest known examples of freshwater aquaculture in the world, pre-dating the Pyramids in Egypt. This landscape is currently being considered for inclusion in Australia's World Heritage Tentative List—a list of places the Australian Government may decide to nominate for inclusion in the World Heritage List in the coming years.

## European arrival

European settlement of the area from 1830 and subsequent displacement of Aboriginal people caused a period of disconnect between traditional owners and this landscape. Gunditjmara people were excluded from practicing their cultural traditions and using and managing the resources that the Budj Bim landscape provided.

Settlement also resulted in the fragmentation of native vegetation through clearing, the introduction of livestock and planting of willows, gorse and buckthorn. Dams, drains and channels interrupted the flow of water across the landscape, severely reducing connectivity. Species such as Australasian bittern, growling grass frog, Yarra pygmy perch and Glenelg spiny crayfish, once abundant in this area, are now threatened due to habitat loss.



*Top: Lake Condah, when it flooded in 2011*  
(Glenelg Hopkins CMA)

*Bottom: The southern extent of the diverse Budj Bim landscape and Fitzroy River estuary complex*  
(Glenelg Hopkins CMA)

## Reconnecting to country

Many Gunditjmara people have maintained their connection with the Budj Bim landscape and in 1987, the Lake Condah mission lands were returned to the Gunditjmara traditional owners.

Following the restoration of Lake Condah in 2010, the local community which now includes both traditional owners and other landholders, are focusing on protecting and restoring other waterways and associated wetlands across the Budj Bim National Heritage Landscape.

## Target setting

The Victorian State Government has provided Glenelg Hopkins CMA with funding under the Rivers 2040 program to assist the local community in achieving the following outcomes:

1. supporting Aboriginal connection to waterways through the integration of traditional knowledge into waterway management
2. well-connected riverbank vegetation
3. restoring flow regimes and hydrological connectivity.

Currently in the target setting phase, the project is investigating how to align environmental and cultural objectives, such as the possibility of reinstating hydrology through wetlands which will enable cultural 'fish traps' to be reinstated for traditional practices and tourism. Traditional owners, local landholders, agencies and scientific community form the reference group undertaking the planning and implementation of works

## Taking action

Gunditjmara people including the Budj Bim Rangers will assist with on-ground works whilst training and knowledge exchange will build capacity of land managers, agencies and the Gunditjmara community. Works will consist of pest plant control, removal of fish barriers, improvement of waterway connectivity, removal of drains, control of stock access to waterways and revegetation.

## Recovery and growth to achieve 2040 targets

After an intensive implementation period of on-ground works, the project allows for a period of recovery and growth. Target outcomes will be measured against base line information gathered in the initial phase of the project.

Sources: Case Study 4—Lake Condah, Budj Bim National Heritage Landscape, Heritage Council Victoria; Budj Bim National Heritage Landscape Brochure, Australian Government

This project is a partnership between:

- Glenelg Hopkins Catchment Management Authority  
Phone: 03 5571 2526  
Website: [www.ghcma.vic.gov.au](http://www.ghcma.vic.gov.au)

and

- Gunditj Mirring Traditional Owners Aboriginal Corporation  
Phone: 03 5527 1427  
Website: [www.gunditjmirring.com](http://www.gunditjmirring.com)

For more information on the Budj Bim National Heritage Landscape: Australian Government National Heritage Places, visit [www.environment.gov.au/heritage/places/national/budj-bim](http://www.environment.gov.au/heritage/places/national/budj-bim)



*The fish channel system at Lake Condah is well visible when the landscape is dry (Glenelg Hopkins CMA)*

# Ngarrindjeri 'wise use' for protecting wetlands in crisis wins 2015 Australian Riverprize

Steve Hemming<sup>a,b</sup>, Daryle Rigney<sup>a,b</sup>, Lachlan Sutherland<sup>c</sup> and Samantha Muller<sup>b</sup>

a) Ngarrindjeri Regional Authority

b) Flinders University

c) Department of Environment, Water and Natural Resources, South Australia

Integrating Indigenous world views and knowledge into wetland management is critical to effective disaster risk aversion as Indigenous approaches ensure 'wise-use' of wetlands and prioritise environmental health.

Ngarrindjeri and Indigenous nations world-wide share an understanding that lands, waters and all living things are interconnected, refusing the Western distinction between humans and nature. For Ngarrindjeri this philosophy of interconnectivity is expressed in the concept of Ruwe/Ruwar (body, spirit, lands, waters and all living things). European colonisation of Ngarrindjeri Ruwe/Ruwar devastated the Nation and made it more vulnerable to environmental disaster. Ngarrindjeri resilience, gained through living with the degradation of their Country, and thousands of years of experience, is becoming respected for its value to improved management of their Country, including the Coorong, and Lakes Alexandrina and Albert Ramsar wetland.

Ngarrindjeri country, at the mouth of the Murray River in South Australia, is at the centre of extensive environmental management programs addressing ecological degradation caused by drought and over-allocation of water. Negotiation of a new relationship between the State government of South Australia and the Ngarrindjeri Nation utilising agreements such as the 2009 Kungun Ngarrindjeri Yunnan Agreement (KNYA—Listen to Ngarrindjeri speaking) has prepared the way for a new partnership between Indigenous people and the State in natural resource management. This partnership enabled Ngarrindjeri to work with the State to develop innovative solutions for wetland disaster risk reduction during the millennium drought.



*Ngarrindjeri Caring for Country rangers planting at Terringie wetland, Raukkan (DEWNR)*



At the peak of the Millennium Drought, Ngarrindjeri country experienced record low water levels, and significant exposure of acid sulfate soil that threatened the region's ecosystem. The KNY Agreements enabled Ngarrindjeri to negotiate with the State during the development of 'emergency response' proposals to build regulators in the Goolwa Channel to address the threat of acidification. Being opposed to interventions that further divided their Country, Ngarrindjeri negotiation ensured the responses were temporary, regulator design minimised damage to Ngarrindjeri cultural heritage, and that a panel of experts independent of government and Ngarrindjeri would advise on when the structures could be removed. Ngarrindjeri leadership produced an innovative and temporary 'emergency' solution that met both Ngarrindjeri and State needs to mitigate environmental impacts.

The Ngarrindjeri Nation and the South Australian Department of Environment, Water and Natural Resources (DEWNR) are continuing to work closely to integrate Ngarrindjeri cultural values into the management of the region. Ngarrindjeri won the 2015 Australian Riverprize in recognition for their innovations and commitment to disaster risk aversion and recovery.

For more information, contact Rick Hartman, Ngarrindjeri Regional Authority at [Rick.hartman@ngarrindjeri.org.au](mailto:Rick.hartman@ngarrindjeri.org.au), 08 8532 9000 or visit [www.ngarrindjeri.org.au](http://www.ngarrindjeri.org.au)



*Top: Currency Creek aerial photo 2009 looking towards the Murray Mouth with Goolwa Channel and Hindmarsh Island (Kumarangk) in background (DEWNR)*

*Bottom, from left: Construction of the Clayton Bay temporary flow regulator in 2009 with Hindmarsh Island (Kumarangk) in background (DEWNR). Goolwa Channel 2009 with Hindmarsh Island (Kumarangk) to right and township of Clayton in centre (DEWNR).*

# The Commonwealth Environmental Water Holder launches two new “first of their kind” partnerships

Commonwealth Environmental Water Office

## Commonwealth environmental water to be delivered by the Ngarrindjeri Regional Authority and the Renmark Irrigation Trust

This year, the Commonwealth Environmental Water Holder embarked on partnerships with Ngarrindjeri Regional Authority and Renmark Irrigation Trust to deliver Commonwealth environmental water in a way that enhances our ability to meet local environmental and cultural needs in South Australia.

The three year partnership with the Ngarrindjeri Regional Authority establishes a way to deliver environmental water which ensures environmental assets in the lower River Murray region are being cared for in accordance to the cultural protocols of the Ngarrindjeri nation. This partnership forms the start of a concerted effort by the Commonwealth to work with Indigenous people across the Basin and provides a process for the planning and delivery of environmental water in a way that supports cultural practices.

Working on-the-ground with the Ngarrindjeri means that local knowledge and cultural values are shaping the delivery of water to achieve the best outcomes for wetlands. There are many opportunities where environmental and cultural water needs intersect; for example supporting growth of native reeds used in basket weaving. The Ngarrindjeri also have a number of culturally significant species that will benefit from environmental watering, such as pelicans, turtles and river red gums.

It is anticipated that activities from this partnership will also build the capacity of the Ngarrindjeri, by creating opportunities to work on country and foster skills in ecology and water management.



*David Papps with Peter Duggin and Humphrey Howie of Renmark Irrigation Trust (Commonwealth Environmental Water Office)*

The Partnership was launched at Sugar Shack Wetlands, near Swan Reach with a Smoking Ceremony and addresses from Commonwealth Environmental Water Holder, David Papps, the South Australian Minister for Water and the River Murray, the Hon. Ian Hunter MLC, and then Chairperson of the Ngarrindjeri Regional Authority, Eunice Aston.

In another first, the Commonwealth Environmental Water Holder has formed a partnership with an irrigation water provider, Renmark Irrigation Trust.

The five year partnership enables the delivery of Commonwealth environmental water to wetland and floodplain sites in the Renmark area using the Trust's extensive irrigation infrastructure during the irrigation off-season.

Environmental watering in the Renmark area can rehabilitate areas affected by salt from rising water tables and improve the health of vegetation, including restoring areas of black box and river red gums.

This offers economic benefits as well as environmental, including making use of infrastructure when it would otherwise lay dormant and using environmental water to flush pipes. It can also foster recreational and tourism benefits by providing healthy and vibrant public places for walking, cycling and visiting.

The Partnership is a unique opportunity to use existing irrigation infrastructure to maximise the delivery of environmental water for the benefit of the environment and local community.

For further information, visit [www.rit.org.au/](http://www.rit.org.au/) and [www.ngarrindjeri.org.au/](http://www.ngarrindjeri.org.au/) or contact Local Engagement Officer, Michelle Campbell on 08 8595 2120 or at [michelle.campbell@environment.gov.au](mailto:michelle.campbell@environment.gov.au)



*Eunice Aston, Steve Hemming and Commonwealth Environmental Water Holder David Papps at the launch of the partnership agreement with Ngarrindjeri Regional Authority (Commonwealth Environmental Water Office)*



# The Snipe Project

By Lori Gould, ACT Woodlands and Wetlands Trust

A joint Japanese–Australian project is monitoring the migration to Australia of Latham's Snipe (*Gallinago hardwickii*), a bird species listed in international conservation agreements and conventions.

From wetlands in Japan across the Pacific to south-east Australia, Latham's snipe is a classic example of why we must conserve our wetland habitats. This migratory shorebird is listed under the *Environment Protection and Biodiversity Conservation Act 1999* and the [Japan-Australia Migratory Bird Agreement](#).

Latham's snipe breed in the Japanese spring then fly 9000 kilometres along the East Asian–Australasian Flyway, some as far as Tasmania. But little else is known about this pretty shorebird, which may be threatened by loss of its wetland habitat. Where do they go in Australia? Do they return to the same wetlands each year? How do fires or flooding in one area impact their movement? The answers will help governments and conservation groups manage and protect the species, which currently appears to be declining.

Thanks to an international collaboration, the world is now watching the Latham's snipe's mysterious journey. Four research and environment groups that were individually monitoring the birds—the Wild Bird Society of Japan, the Woodlands and Wetlands Trust in Canberra, South Beach Wetlands and Landcare Group in Port Fairy and Federation University Australia in Ballarat—are now sharing information, research methods and awareness raising. The project is part funded by the Australia Japan Foundation.

The Snipe Project uses a combination of animal tracking technology, field observations and systematic surveys to determine habitat preferences and movement patterns. Community involvement encourages ownership and protection of the local environment the bird relies on.



Google Earth image of Latham's Snipe movements from Japan to Australia (Google Earth)

The South Beach Wetlands and Landcare Group fitted 20 birds with geolocators in October 2015. In exciting news, the first bird was recaptured in October 2016 only 600 metres from where it left—after a return journey to Hokkaido that included a 7000 kilometre single flight.

The Wild Bird Society of Japan (WBSJ) fitted five birds with satellite trackers near Hokkaido in July 2016. The ACT Woodlands and Wetlands Trust fitted satellite trackers to another four birds in early 2017, with the ACT Government providing \$25,000 for three of the trackers. Researchers and the public can follow their journey via the [WBSJ Facebook page](#).

In early December, snipe experts from Victoria and Jerrabomberra wetland volunteers, including Young Rangers, caught, weighed, measured and tagged another six birds and took blood samples for genetic research.

The ACT Woodlands and Wetlands Trust undertakes surveys at Jerrabomberra Wetlands and other key sites across the ACT—including the remote Ginini Flats Ramsar Wetlands Complex in Namadgi National Park—in partnership with the Canberra Ornithologists Group, Friends of Jerrabomberra Wetlands, ACT Government, University of Canberra and Australian Bird and Bat Banding Scheme (ACT). Sightings are logged into a web-based platform, with the general community also encouraged to log sightings.

Threats to Latham's snipe habitat in one country have implications for species management in the other. Loss of habitat is the major threat, with documented declines in population in Japan linked to ongoing loss of wetlands. In Australia, many wetlands and other critical habitats occur on private land that is infrequently managed for conservation purposes, posing a significant management challenge. The threat is even greater in urban areas, where there are competing interests for residential and industrial development.

Conserving Latham's snipe in multi-use landscapes means identifying critical areas that support birds during different stages of their life cycle and understanding the key characteristics that define these areas. The Snipe Project is part of that journey.

More information about Latham's snipe and the Snipe Project:

For more information about Latham's snipe and the Snipe Project, visit <https://jerrabomberrawetlands.org.au/2016/12/01/first-latham-snipes-caught-at-jerrabomberra-wetlands/>  
<https://lathamssnipeproject.wordpress.com>  
[www.swift.net.au/cb\\_pages/lathams\\_snipe\\_project.php](http://www.swift.net.au/cb_pages/lathams_snipe_project.php)



*Latham's Snipe* (Geoffrey Dabb)

# Successful regeneration of coastal saltmarsh in Sydney Olympic Park

Dr Swapan Paul, Sydney Olympic Park Authority

Coastal Saltmarsh has been declared an Endangered Ecological Community in NSW under the *Threatened Species Conservation Act 1995* and a Threatened Ecological Community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. These threatened vegetation communities make important contributions to fisheries, biodiversity conservation, carbon sequestration and land protection.

It has been widely claimed that over 70 per cent of coastal saltmarsh had been lost from Homebush Bay between 1930 and 1980. Losses have also been reported elsewhere along the Parramatta River. The coastal saltmarsh community at Sydney Olympic Park on the Parramatta River catchment presently covers approximately 25 hectares—the largest coverage on the river system. This has been due to the increases of nearly 31 per cent since 2002 and nearly 40 per cent since 1998.

The increases in the total area have been attributed to a number of initiatives, which include creation of new areas and rehabilitation of degraded areas; measures for protection from human-induced damages such as litter control; staged and careful control of weeds such as spiny rush (*Juncus acutus*); and selective and authorised control of seedlings of grey mangrove (*Avicennia marina*) settling on saltmarsh areas. Many of the tools and techniques that have been trialled and applied in conserving coastal saltmarsh in the Park have been well regarded as either pioneering or at the very least, simple and effective. As a testimony, the Park was recognised as a ‘demonstration site’ for saltmarsh conservation by the former NSW Department of Environment and Climate Change.



*Poor condition of coastal saltmarsh on Haslams Flats prior to implementing a pioneering technique of regeneration*  
(Sydney Olympic Park Authority)



A scientific assessment conducted in 2014 rated the overall condition as good, however, noted that terrestrial weeds may be invading some pockets owing to their increasing losses in salinity and restricted tidal inundations. Yet other pockets have been showing signs of landward migration due to increasing levels of tidal inundations. It is a matter of utmost interest to the Park to learn the ways these two phenomena will ultimately influence coastal saltmarsh in the Park. More about the Park's coastal saltmarsh as well as management of wetlands may be learnt from the WET eBook, *Workbook for managing urban wetlands in Australia* ([www.sopa.nsw.gov.au/resource\\_centre/wet\\_ebook\\_workbook\\_for\\_managing\\_urban\\_wetlands\\_in\\_australia](http://www.sopa.nsw.gov.au/resource_centre/wet_ebook_workbook_for_managing_urban_wetlands_in_australia)).

For further information, contact Dr Swapan Paul at [Swapan.Paul@sopa.nsw.gov.au](mailto:Swapan.Paul@sopa.nsw.gov.au)



*After regeneration* (Sydney Olympic Park Authority)

# Protecting valuable swamp oak wetlands

Louise Armstrong, Department of Environment and Energy

Coastal wetlands and forests provide an important buffer between the land and sea. They can vary from tidal salt marshes and mangroves, to estuarine systems to freshwater wetlands and include the associated riparian and floodplain vegetation communities. Land clearance, soil erosion, nutrient export and other impacts from human activity and sometimes natural phenomena, such as flooding and storms, threaten many of our fragile coastal and marine ecosystems.

The coastal swamp oak (*Casuarina glauca*) forest is a highly variable coastal wetland ecosystem that plays an important role in the life of many inhabitants of Australia's eastern seaboard. From Gladstone in Queensland southwards into the South East Corner of New South Wales, coastal swamp oak forest is typically found where groundwater is saline or brackish, such as in low lying creeks and rivers, dune swales, lake margins and estuarine fringes. Coastal development and other processes are threatening this ecological community and it has been nominated for listing under the Commonwealth's national environmental law, the *Environment Protection and Biodiversity Conservation Act 1999*.

Defining what constitutes the ecological community is part of the listing assessment process. Recently, staff from the Department of Environment and Energy organised a workshop for expert scientists and natural resource managers to consider how best to describe the attributes of coastal swamp oak forest. The dominant canopy species, *Casuarina glauca*, tolerates brackish and sub-saline groundwater and inundation. Salt tolerant rushes and grasses, such as *Baumea juncea* (bare twig rush) and *Cynodon dactylon* (sand couch) cover the ground in areas closest to the coast. In more freshwater locations, lilies and ferns such *Blechnum indicum* (swamp water fern), *Dianella caerulea* (blue flax lily),



*Coastal swamp oak forest wetland area along Hogbin Drive, Coffs Harbour Airport (Louise Armstrong)*





*Staff from Australian Government, NSW and Queensland Governments and Louise Gilfedder from the TSSC discuss aspects of the CSOF (Louise Armstrong)*

*Gahnia clarkei* (saw / sword sedge) are more likely, along with creeping ground covers such as *Commelina cyanea* and *Viola banksii* (wild violets). In such areas the tree diversity increases with the inclusion of *Acmena smithii* (lilly pilly), *Alphitonia excelsa* (red ash) and *Melaleuca* spp. (paperbarks) with *Parsonsia straminea* (common silkpod) climbing into the canopy. Sometimes *Eucalyptus* spp. can be seen emerging from the canopy. Apart from its role within the landscape, habitat is

provided for a large range of other plants such as epiphytic plants and wetland fauna, including treefrogs and waterbirds, such as bitterns, snipe and curlews which love the protection that the trees and dense understory and/or leaf litter provide.

For further information, contact Louise Armstrong at [louise.armstrong@environment.gov.au](mailto:louise.armstrong@environment.gov.au)



# Bounce-back after dry times—a welcomed and strong response from the Macquarie Marshes

Tim Hosking and Dr Stephanie Suter, NSW Office of Environment and Heritage

When the rain started to fall in the Macquarie catchment in mid-June 2016 after three years of near-drought conditions, it got a lot of interest. Four months later and Burrendong Dam spilled and a series of high flows extended along the length of the river system and into the Barwon River. The rain was doubly welcome because parts of the Macquarie Marshes in Northern NSW are listed as internationally important wetlands under the Ramsar Convention, and are known as a significant site for colonial waterbird breeding.

While some people with businesses and residences on the floodplain have been impacted by crop losses, infrastructure damage and access constraints, the news was more favourable for the Macquarie Marshes wetland system. Inundation of this scale—thought to be in excess of 150,000 ha—has not been seen in the Marshes since early 2012.

Despite the best efforts of environmental water managers and land managers of the Marshes, the past three very dry years had taken a toll on the condition and resilience of the system. However, the invigorating flows have meant the majority of the flow-dependent

vegetation throughout the Marshes, including river red gum, lignum and coolabah, have had a much needed drink.

Waterbirds also profited greatly from increased inundation. Even with challenging site access conditions due to the inundation, over 130 bird species were recorded during the spring 2016 NSW Office of Environment and Heritage (OEH) ground surveys throughout the Marshes, including threatened blue-billed ducks, freckled ducks, magpie geese and the cryptic Australasian bitterns, heard booming through the reeds.



*An internet-enabled RM-Cam remote camera observing straw-necked ibis nests, Macquarie Marshes, October 2016*  
(Tim Hosking, OEH)



*Paul Keyte and Dr Stephanie Suter (NSW OEH) during installation of remote cameras in a straw-necked ibis colony, Macquarie marshes, October 2016 (Tim Hosking, OEH)*

In addition to the benefits to the resident and nomadic waterfowl, the notable 2016 flows allowed colonially-nesting waterbirds to breed in the Marshes. Initial observations indicated the presence of over 30,000 Straw-necked Ibis nests in two main colonies, plus several Egret colonies of up to 300 nests in size, which included four egret species, nankeen night herons and up to five species of cormorants.

In collaboration with CSIRO and University of NSW researchers, supported by the Commonwealth-funded Environmental Water Knowledge and Research (EWKR) program and the Commonwealth Environmental Water Office, a range of monitoring actions in the Marshes began in spring. Colony visits were scheduled to collect information for water management, with the specific aim of supporting the nesting birds through their breeding cycle to produce fledged young. Remote cameras were installed which

will allow the collection of post-event data on fledging rates, feeding, predators and other nest disturbance. Satellite tracking of a small number of adults during and after the nesting event was also undertaken.

These monitoring activities and new technologies will allow water managers and EWKR researchers to learn valuable lessons, which may assist with the success of future colonial waterbird breeding events. We'll then be in a better position to make the best of these opportunities in wet years, and to hopefully see future generations of ibis and egrets continue to thrive in the Marshes.

For further information, contact Tim Hosking at [tim.hosking@environment.nsw.gov.au](mailto:tim.hosking@environment.nsw.gov.au), or visit [www.environment.nsw.gov.au/environmentalwater/macquarie.htm](http://www.environment.nsw.gov.au/environmentalwater/macquarie.htm)

# Monitoring waterbird recruitment to inform environmental flow management: A pilot study at Reed Beds wetland, Millewa Forest, NSW

Heather McGinness and Freya Robinson, Commonwealth Scientific and Industrial Research Organisation

Wetlands within the Murray-Darling Basin provide important waterbird habitat however recent declines and abandonment of nesting colonies is concerning. Data collected on ibis and spoonbill breeding success within the Millewa Forest will inform the management of environmental flows for maximising waterbird breeding success within the Basin.

Environmental water within the Murray-Darling Basin is used to support the nesting and foraging habitats of waterbird populations. Maintaining the quality and availability of waterbird habitats is essential to maximising the recruitment of juvenile birds into the adult population. Managing environmental water flows is therefore key to maximising waterbird recruitment. Evaluating, modelling and predicting the effects of water management decisions on waterbird recruitment is however difficult as basic waterbird demographic and movement data is scarce. Little is known about waterbird survival and mortality rates (either in the nest or out of it) or about movements associated with foraging and dispersal between nesting events.

The Waterbirds Theme of the Murray-Darling Basin Environmental Water Knowledge and Research (MDB EWKR) Project is filling these knowledge gaps on the movements and demographics of colonial-nesting waterbirds in the Murray-Darling Basin.

The Waterbirds Theme is using on-ground surveys and motion-sensing and time-lapse cameras focused on nests to collect demographic data including egg and chick survival, and to assess impacts of predation, habitat characteristics and weather. It is also assessing waterbird diets during nesting and the locations and characteristics of their foraging habitats. Satellite GPS tracking devices will be deployed on adults and juveniles to track movements during and after nesting.



*Left: Motion-sensing time-lapse image of straw-necked ibis on nests with chicks. Millewa Forest NSW, 2015–16 (CSIRO)*

*Right: Royal spoonbills Platalea regia in their breeding plumage on trampled rushes during the summer 2015–2016 pilot study in Millewa Forest NSW (Heather McGinness)*



During the summer of 2015–2016, the Waterbirds Theme conducted a pilot study at Millewa Forest NSW, designed to:

1. Collect new waterbird breeding success data, taking advantage of the breeding event occurring in Barmah-Millewa Forest; and
2. Develop, test and improve survey methods and equipment for future quantification of breeding success and the impacts of associated threats and pressures, such as predation and competition for food.

The pilot study focused on one particular sub-colony of three species in Reed Beds wetland in Millewa Forest, where approximately 660 birds were observed nesting.

Australian white ibis started nesting in October 2015, adding new nests and nest clumps throughout November and December. Straw-necked ibis started nesting in mid-late November 2015 and only nested once in the study area. Royal spoonbills were courting, establishing territory and trampling rushes for several weeks before starting to nest, and most laid their eggs in late November or early December 2015.

While hatching rates were low (30–55%) because of predation on eggs, survival of chicks once hatched was very high, with chick fledging rates well above 80% for all three species. Royal spoonbill chick hatching, chick survival and chick fledging rates were higher than the two ibis species, with Australian white ibis having the lowest averages.

Using lessons learned from this pilot study, the Waterbirds Theme has modified survey methods and equipment for field research commencing in the 2016–2017 summer.

For more information about the exciting new research being undertaken by the Waterbirds Theme, visit our website:

<https://research.csiro.au/ewkrwaterbirds/>

The Murray-Darling Basin Environmental Water Knowledge and Research Project is funded by the Australian Government Commonwealth Environmental Water Office. The Waterbird theme is a collaboration between CSIRO, University of New South Wales and University of Canberra.



*Motion-sensing time-lapse image of a juvenile white-bellied sea eagle feeding on Australian white ibis eggs. Millewa Forest NSW, 2015–16 (CSIRO)*



*Motion-sensing and time-lapse cameras set up facing an Australian white ibis nest during the summer 2015–2016 pilot study in Millewa Forest NSW. (Heather McGinness)*

# Supporting important ecosystems at Toorale National Park

Adrian Clements, Local Engagement Officer, Commonwealth Environmental Water Office

Located at the junction of the Warrego and Darling Rivers, the 91,000 hectares of floodplain and seasonal wetlands of Toorale National Park and State Conservation Area in western New South Wales offer an abundance of birdlife, with ibis, pelicans, as well as iconic brolgas, a unique array of aquatic invertebrates, frogs, and fish, when the rivers are flowing. This park lies within the traditional lands of the Kurnu-Baakandji People.

The amount and nature of flows of the Warrego and Darling Rivers are influenced by upstream structures while the delivery of water to and within the Junction of the Warrego and Darling rivers is dependent on rainfall and natural flows (unregulated) rather than from specific water releases from dams.

Since its purchase in 2008 by the Commonwealth and NSW governments, Toorale, a former sheep station, has received over 100 billion litres of environmental water. This water has provided native fish species, such as Hyrtl's catfish (*Neosilurus hyrtlui*) and spangled perch (*Leiopotherapon unicolor*) with increased habitat including access to waterholes used as refuge during drought. Environmental water has also benefited the lower Warrego and Darling Rivers.

Monitoring of environmental watering, through the Commonwealth Environmental Water Holder's Long Term Intervention Monitoring program, has shown that up to 98 per cent of fish in the Warrego at Toorale were native fish species with spangled perch and Hyrtl's catfish the most common species. There was also a low abundance of european carp (*Cyprinus carpio*). In 2015–16, fish sampling in the Warrego River also showed golden perch (*Macquaria ambigua*) and bony herring (*Nematalosa erebi*) recruitment events occurred.



*Brolgas with chicks on the Western Floodplain* (Lachlan Copeland)





*An inundated Western Floodplain at Toorale in 2016 (Adrian Clements)*

Inundation of the Western Floodplain with environmental water has been shown to increase biodiversity of aquatic invertebrates, frogs, waterbirds, and vegetation while also increasing persistence of drought refuge pools in dry times. 87 species of bird, including 34 waterbirds were recorded in 2015–16, including internationally listed species such as the eastern great egret (*Ardea modesta*), wood sandpiper (*Tringa glareola*) and common sandpiper (*Actitis hypoleucos*).

Environmental water from Toorale is also used to benefit ecosystems further downstream. Between February 2009 and August 2010, multiple water shepherding trials were undertaken to transfer environmental water 1300 km from Toorale, through the Menindee Lakes to the Murray River. These trials were a proven success causing overbank flows in the Darling River and contributing to successful golden perch recruitment.

Toorale is open to the public with NSW National Parks and Wildlife Service providing self drive tours and information points.

For further information, visit [www.environment.gov.au/water/cewo/catchment/northern-unregulated-rivers/monitoring](http://www.environment.gov.au/water/cewo/catchment/northern-unregulated-rivers/monitoring) or contact Local Engagement Officer, Adrian Clements on 02 5852 1206 or at [adrian.clements@environment.gov.au](mailto:adrian.clements@environment.gov.au)



*Hyrtil's Catfish caught in the Warrego River during the 2015-16 monitoring surveys (Gavin Butler)*



# Working together, to get things wetter

Commonwealth Environmental Water Office, Nature Foundation South Australia and  
Department of Environment, Water and Natural Resources

Working with local partners to deliver Commonwealth environmental water  
in wet times



*Mimicking flows to low-lying floodplain at Calperum Station by raising water levels in Lock 5 (Jaimi Smith, Department of Environment, Water and Natural Resources)*

The Commonwealth Environmental Water Holder is often asked “what is the role of environmental water when big rain events occur? The rivers flood, channels are cleansed, wetlands are inundated—Can we do more to further improve water outcomes?”

The large amount of rainfall and subsequent flows over winter and spring 2016 provided the opportunity for the Commonwealth Environmental Water Holder to work with local partners to capitalise on nature’s work to further improve environmental outcomes.

As flows in the Murray-Darling Basin are no longer natural, the health of the Basin’s rivers, wetlands and floodplains are highly dependent on intervention. Dams and weirs, along with diverting water for human uses, have reduced the size and frequency of high river flows.

That is why water holders capitalise on large flows, to help water to reach as much of the vast and thirsty floodplain as possible. This encourages growth and reproduction of floodplain plants, the many threatened black box, river red gum and lignum communities, and the animals that depend on them.

The Commonwealth Environmental Water Holder calls on locals to assist with this important task. Partnerships with state government, Indigenous and community groups in South Australia have resulted in working collaboratively to deliver water to the floodplain in conjunction with high flows.

One example is the South Australian Department of Environment, Water and Natural Resources using Commonwealth water to raise weir pool 5, near Renmark, by 45 centimetres. This resulted in over 900 hectares of additional floodplains being inundated, including Ral Ral Creek, Whirlpool Corner and Woolnook Bend at Calperum Station. Raising weir pool 5 has given native trees high on the floodplain a long needed watering and provided habitat for frogs and birds. Salt is also mobilised off the floodplain and flushed through the river channel with high river flows.



*Using pumps to flood highly elevated floodplain (Amazon and Merriti) at Calperum Station (Peter Cale, Australian Landscape Trust)*

To further extend the benefits, the Nature Foundation SA and the Australian Landscape Trust have pumped Commonwealth environmental water from the raised weir pool onto the higher Amazon, Merretti and Woolpolool floodplains. This would not have been feasible with the weir pool at normal level.

Together these two delivery partners have provided water efficiently to sites that would otherwise miss out due to the presence of dams, locks and weirs. Their work provided five year old river red gums, which germinated in the 2010–11 floods, with a vital watering to encourage further growth. In addition, black box trees that have rarely been inundated have been watered, which also benefits native bird life.

These environmental outcomes, which partners are collectively working towards, are priority objectives in the Murray-Darling Basin Plan. They are exactly the outcomes for which this Commonwealth environmental water was set aside, and have been made possible through local partnerships with the Nature Foundation SA, Australian Landscape Trust and Department of Environment and Natural Resources.

For further information, visit the 'Water for Nature' websites at [www.naturefoundation.org.au/](http://www.naturefoundation.org.au/) or contact Local Engagement Officer, Michelle Campbell on 08 8595 2120 or at [michelle.campbell@environment.gov.au](mailto:michelle.campbell@environment.gov.au)

# Collaborative partnerships on Tar-Ru Lands

Murray Darling Wetlands Working Group Ltd, Sunraysia Environmental and Commonwealth Environmental Water Office

## Working together to deliver and monitor Commonwealth environmental water on Tar-Ru Lands

Environmental watering on Tar-Ru Lands, near Wentworth in far west New South Wales, has integrated water delivery with a training program in environmental field monitoring for the Barkindji.

In April 2016 the Murray Darling Wetlands Working Group Ltd, acting as project manager, delivered Commonwealth environmental water to the Carrs, Capitts and Bunberoo Creeks system and associated wetlands on Tar-Ru Lands. The watering event aimed to improve the health of drought stressed vegetation such as river red gums and water availability for aquatic habitat for birds and frogs.

The Commonwealth Environmental Water Holder also provided funding to local environmental consultants, Sunraysia Environmental, to train Barkindji in field monitoring techniques. This helped to build capacity locally by providing the opportunity to learn methods for monitoring environmental outcomes such as water quality testing, bird surveys, weed identification and vegetation assessments on country.

New South Wales National Parks and Wildlife is facilitating the hand back of Tar-Ru lands to Traditional Owners, the Barkindji-Mauroro. The hands-on participation in environmental monitoring resulted in an inspiring exchange of knowledge as Traditional Owners imparted cultural knowledge, whilst learning environmental monitoring techniques.



*Environmental water enters Pig Swamp (Commonwealth Environmental Water Office)*



This environmental watering event was a collaborative effort involving many partners of the Commonwealth Environmental Water Holder. The Murray Darling Wetlands Working Group was the project manager. A pumping contractor was engaged to deliver metered water through siphons, taking advantage of the head difference provided by the Lock 9 weir pool. Sunraysia Environmental facilitated the training program and additional monitoring utilising sound recorders and remote cameras was provided by The Nature Conservancy Australia.

The support of New South Wales agencies including the Office of Environment and Heritage, Local Land Services Western Region and Department of Primary Industries - Water, as well as SA Water and local landholders, was greatly appreciated.

Monitoring indicates that the environmental watering triggered a marked improvement in tree canopy health for both black box and river red gum. An increase in the diversity and abundance in aquatic and shoreline plants, waterbirds and terrestrial birds was also observed.

[A short video produced by ABC Open Sunraysia about the project is available.](#)

For further information, visit [murraydarlingwetlands.com.au/](http://murraydarlingwetlands.com.au/) or contact Local Engagement Officer, Richard Mintern on 03 5051 4372 or at [richard.mintern@environment.gov.au](mailto:richard.mintern@environment.gov.au)

# Protecting Hattah Lakes during drought and beyond

The Murray–Darling Freshwater Research Centre, Latrobe University and the Mallee Catchment Management Authority

The Living Murray initiative has played an important role in protecting and improving the health of Ramsar wetlands at Hattah Lakes. Through this program, one of Australia's largest environmental works projects has been built to provide a sustainable future for Hattah Lakes. Annual condition monitoring has enabled improvements in health to be detected and has assisted the adaptive management of the system.

Located within the Hattah-Kulkyne National Park in Victoria's northwest, Hattah Lakes contains numerous freshwater lakes, 12 of which are Ramsar listed. The health of these wetlands are threatened by changes to the frequency, size and duration of overbank flows from the Murray River.

A decline in the health of river red gum trees fringing the Hattah Lakes was evident during the millennium drought (2000–2010). From 2005 to 2010, seven instances of environmental water ranging from 1700 and 17,588 megalitres was delivered with the main aim of improving the condition of fringing river red gums and providing refuge habitat for other plants and animals.

To help secure a sustainable future for the Ramsar site in the long-term, one of Australia's largest environmental works projects was built at Hattah Lakes. The \$32 million infrastructure project was designed with the intention of delivering water higher up onto the floodplain, to reach wetlands and floodplains that had been dry for more than 20 years.

In 2013 and 2014, two environmental flows of between 61,000 and 92,000 megalitres were delivered. This water inundated long dry wetlands and the surrounding floodplain. These flows achieved the goal of improving the health of black box trees higher up the floodplain and has increased the occurrence of aquatic plants and improved plant species richness over time.



*Aerial view of watering at Hattah Lakes (Mallee CMA)*

The delivery of environmental water also provided fish nursery habitats in otherwise 'dry' years. Many fish were then dispersed back into the system when water was returned to the Murray River. Some provided an important food resource for waterbirds.

The infrastructure project and the ongoing monitoring at Hattah Lakes is funded through The Living Murray program, which is a joint initiative funded by the New South Wales, Victorian, South Australian, Australian Capital Territory and Australian governments, coordinated by the Murray–Darling Basin Authority.

To find out more about The Living Murray or the iconic Hattah Lakes please visit [www.malleecma.vic.gov.au](http://www.malleecma.vic.gov.au), [www.mdfrc.org.au](http://www.mdfrc.org.au) and/or [www.mdba.gov.au/managing-water/environmental-water/delivering-environmental-water/hattah-lakes](http://www.mdba.gov.au/managing-water/environmental-water/delivering-environmental-water/hattah-lakes)



*Oateys upstream at Hattah Lakes (Mallee CMA)*



# Wetland 'treatment train' improves water quality and runoff from agricultural land: A holistic approach to water quality treatment

Matt Moore, Senior Fisheries Biologist, Catchment Solutions Pty Limited

Catchment Solutions, in collaboration with Reef Catchments NRM and Mackay sugar cane farmer Shane Cowley, joined forces in 2014 to construct a treatment train of wetlands. The project team took a holistic approach to wetland design by incorporating both water quality treatment and biodiversity outcomes.

Multiple water quality treatment chambers were constructed to capture and improve water quality flowing from adjacent sugar cane farms prior to discharging into the Bakers Creek estuary and eventually the Great Barrier Reef.

The treatment train of wetlands was constructed within a 'cane drain' immediately upstream of a degraded lowland wetland in Mackay, Central QLD. During rainfall events, water high in nutrients, herbicides and pesticides draining 500 hectares of sugar cane would enter the wetland via the drain before flowing into Bakers Creek estuary and through to the Great Barrier Reef. Previously, the wetland was used to irrigate sugar cane, and would often be pumped right down in the heat of summer. Low water levels combined with poor water quality exacerbated wetland impacts, potentially leading to fish kills.



*Nature-like rock ramp fishway connecting the wetlands with downstream receiving waters. (Matt Moore)*

## Water quality treatment

The treatment train of wetlands was designed to capture and treat the first runoff event (30–40 millimetres) leading into the annual wet season. The first runoff event usually occurs between October and December after a long dry season, and is particularly high in nutrients and herbicides. The treatment train wetland design consisted of three water quality treatment chambers: sediment basin, deep-water macrophyte zone and detention/irrigation re-use chamber alongside rehabilitation of the existing wetland. The deep (1.5 – 2 metres) sediment detention basin formed the first chamber, and was designed to drop out sediment, including particulate nitrogen and phosphorus. The second chamber consisted of a deep-water macrophyte zone (min 800 millimetres), enhancing nutrient uptake via algae, microbes and fungi that grow together on the reeds and sedges. Aquatic plants also provided habitat for fish, frogs and aquatic insects. The third chamber consisted of a deep (4 metres) irrigation re-use/detention basin, which the landholder uses to irrigate sugar cane, prior to discharging into the existing wetland. Each chamber is separated by a rock riffle or rock cross vane structure, which re-oxygenates the water, further assisting nutrient uptake while increasing dissolved oxygen levels critical for aquatic life.

## Habitat rehabilitation

Wetland habitat values were increased by planting over 3000 endemic riparian plant species, removing declared weed species including hymenachne, para grass and penny leaf, and placing large logs in the water. An often overlooked but important design feature of constructed wetlands is connectivity with downstream aquatic habitats. Connectivity issues are confounded by the construction of wetland riser outlets, which block fish passage. Wetlands provide critical nursery habitats for many fish species, including economically important fish species such as barramundi. To further increase biodiversity values of the wetland system, a 23 ridge nature-like rock-ramp fishway was constructed to provide connectivity with downstream aquatic habitats.

## Monitoring

Water quality monitoring was undertaken over two years using fixed auto-samplers located at the inlet and outlet of the wetland. Electrofishing and fishway trap monitoring were undertaken to monitor fish communities. The results have been outstanding with significant reductions in nutrients and herbicides at the outlet compared to the inlet and large increases in native fish community abundance.

For more information, visit:

[catchmentsolutions.com.au/this-train-is-a-treat/](http://catchmentsolutions.com.au/this-train-is-a-treat/)



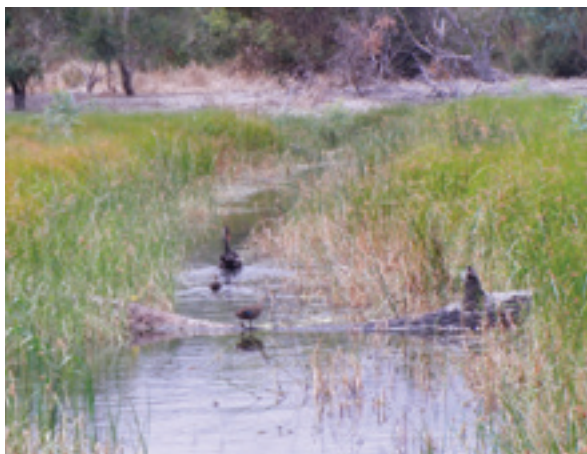
*From top: Pre and post wetland construction works. (Matt Moore)*



# Yangebup Lake solar power nutrient stripping trial

Christopher Beaton, Environment Manager, City of Cockburn

After limited success with a number of strategies to tackle an annoying midge problem, the City of Cockburn is harnessing the power of the sun and engaging the local community to make a difference.



The City of Cockburn is a peri urban local government authority on the outskirts of Perth. Yangebup Lake is part of the Beeliar chain of wetlands which lie within the City's boundary. The lake is highly nutrient rich due to past development activities and current stormwater inflow. Nutrients within the lake support algal blooms which decay and provide a food source for high numbers of nuisance midge. The midges are attracted to city lights and when present in high numbers, severely impact local residents.

Chemicals have been used in the past to address the midge problem.



To reduce the need for chemicals and address the problem of nutrients, the City has undertaken extensive revegetation around and within the lake and converted incoming drains into living streams. Community education has also been undertaken to help reduce fertiliser use. Although showing some promising results, these actions have not been sufficient to substantially improve water quality and reduce nuisance midge.

Something else needed to be done.



*Left column, from top: Habitat Creation, 1 Feb 2016 (Linda Metz). Early Growth, 7 July 2015 (Linda Metz). Basin Construction, Riffle placement, 3 June 2015 (Chris Beaton).*

*Right column: Meet the Locals, November 2015 (Linda Metz)*



The City has developed a novel trial to help address the nutrients in the wetland. A solar pump is used to withdraw nutrient rich water from the wetland. The water is then passed through a specially designed nutrient stripping basin that allows nutrients to be removed by plants (many of which were planted by local schools and community groups) prior to it flowing back into the lake. Rocks and logs have been strategically placed to establish riffles and ponds in the basin where the water is aerated and slowed. The water also gets a chance to settle, as the solar pump shuts down once the sun goes down and starts again when the sun comes up. Early results are very encouraging with plans to build a second stripping basin at another site near the lake.

Nutrient stripping basins have been shown to be very effective in treating stormwater and reducing the nutrients entering wetlands. Unfortunately many rely on rainfall to function. Using a solar power to pump water through the basins means it can function 365 days a year with minimal maintenance costs.

The added bonus is the creation of an education resource for local schools as well as much needed habitat for local wildlife as the basin was established in a previously degraded area.

For further information on the project, contact Christopher Beaton at the City of Cockburn on (08) 94113444



*Top: Aerial Photo, 23 Jan 2016 (Nearmaps)*

*Bottom: Basin Looking South, January 2016 (Paul McGovern)*

# Marrambidya Wetland—Creating an environmental resource from redundant Council assets

Tony Phelps, Environmental Coordinator, Wagga Wagga City Council

Close to Wagga Wagga's central business district some of the city's sewerage treatment ponds have been transformed into a valuable community resource.

The Marrambidya Wetland is located on the flood plains of the Murrumbidgee River in NSW, within 5 minutes' drive of Wagga Wagga's CBD. The Murrumbidgee is a regulated river. A large percentage of its winter flows are captured in storage dams and then released in summer for irrigation. The resulting high summer flows and low winter flows are opposite to the flow regime that was experienced before river regulation. The altered flow regime creates a number of environmental issues:

- thermal pollution – release of cold water from dams
- reduced occurrences of medium to large flood events
- changes to natural seasonal flow patterns
- reduced inundation of wetlands near the river channel

These changes all impact on feeding, breeding and survival of native flora and fauna.

In 2010 Wagga Wagga City Council developed a conceptual plan to rehabilitate redundant tertiary sewerage treatment ponds into constructed wetland ponds. Ponds were reshaped, pond walls removed and large and small cobbles and clay were placed at different depths within the ponds and on the banks to create a wide diversity of niche aquatic and riparian habitats.

Water is supplied to the Marrambidya Wetland as treated effluent from the adjacent sewerage treatment facility. Its quality more than meets the threshold parameters required by the Environment Protection Authority. The 22,000 riparian and aquatic plants that have been planted in the wetland provide an additional bio-remediation process to the treated water.



*Construction works reshaping ponds and installing woody debris (Tony Phelps)*





*Ducks on emergent timber at wetlands* (Tony Phelps)

As the source water into the wetland is from the Council owned treatment facility, Council officers have the ability to manage the water levels within the wetland independently of river levels and rainfall events. This makes the constructed wetland almost drought proof, as the supply of treated water into the wetland ensures that even in extended drought periods the ponds will have a typical wetting and drying cycle. The wetland is now a valuable resource for wetland fauna and flora in a climate of uncertain weather patterns.

In addition to being a valuable resource within the natural environment Council's vision is that the wetland will be used for:

- environmental education
- promoting Indigenous culture
- tourism and passive recreation
- show-casing best practice in water management and site rehabilitation
- breeding habitat for endangered native fish.

For further information, contact Tony Phelps at [phelps.tony@wagga.nsw.gov.au](mailto:phelps.tony@wagga.nsw.gov.au) or visit [www.wagga.nsw.gov.au/city-of-wagga-wagga/environment/marrambidya-wetland](http://www.wagga.nsw.gov.au/city-of-wagga-wagga/environment/marrambidya-wetland)



# Revegetation of the Griffin Environmental Reserve

Moreton Bay Regional Council

Moreton Bay Regional Council and Unitywater are working in partnership with the local community to revegetate the Griffin Environmental Reserve, on the Pine River, south east Queensland. The suburb of Griffin is rapidly developing and the reserve plays an important role in increasing natural wildlife habitats and buffering the Pine River system and Moreton Bay from the negative impacts of stormwater flows and urban development.

The lower parts of the Pine River lie within the internationally recognised Moreton Bay Ramsar wetland, and are part of a declared Hays Inlet Fish Habitat Area. The Pine River provides habitat for numerous resident and migratory shorebird species. Adjacent to the Pine River and next door to the Griffin Environmental Reserve, Moreton Bay Regional Council operates the Osprey House Environmental Education Centre which helps to educate the community, especially school groups and young children, about the important values and ecosystem services that the Pine River wetlands provides.

In 2013, Moreton Bay Regional Council partnered with Unitywater as part of their *Creekside Greening Program* to engage the local community in a staged revegetation of the Griffin Environmental Reserve. Over a four-year period, volunteers have planted some 6000 seedlings at the 24 hectare reserve, helping reduce sediment loads and nutrients entering the Pine River being transported to Moreton Bay.



*Top: New revegetation at the Griffin Environmental Reserve, 2016 (Jessica Mowat)*

*Bottom: Established revegetation at the Griffin Environmental Reserve, 2014 (Jessica Mowat)*

Annual planting days have been conducted over consecutive years and returning volunteers can observe the progress of the previous year's revegetation work. The staged revegetation approach ensures that each planting is at a scale that can be managed and maintained to a high standard. The cumulative benefits of several plantings at the reserve is evident. The plantings are enhancing wildlife habitat for multiple species including koalas, birds and reptiles, creating a habitat movement corridor and increasing the vegetation buffer along the Pine River. The project is empowering local residents and community groups and providing lasting benefits to the wider community.

The plantings are part of a long term Master Plan for the reserve, developed by Moreton Bay Regional Council, which will see the area fully regenerated with opportunities for nature-based recreation.

For further information, contact Jessica Mowat, Moreton Bay Regional Council, on 3205 0555 or at [jessica.mowat@moretonbay.qld.gov.au](mailto:jessica.mowat@moretonbay.qld.gov.au).



*Aerial Map showing staged revegetation at Griffin Environmental Reserve, 2013 (Morton Bay Regional Council)*



# Sydney's 'Hawkesbury Environment Network' prepares for urban expansion with conservation and community

Justin Pepito and Robin Woods

The Hawkesbury-Nepean riverine area of greater Sydney is a uniquely dynamic place where rural lifestyles meet metro-suburban amenities in ways that challenge community, culture, and conservation. While some of the region's property developers and primary producers in market gardens and turf have cleared vital wetland buffer zones and even some wetlands themselves, several community members are spearheading efforts to make lowland wetland damage more clear and meaningful to the expanding urbanised community.

The Hawkesbury Environment Network (HEN)— the primary grassroots environmental organisation in the region— believes it can foster a connection between Sydneysiders and neighbouring landowners in order to build an appreciation for wetland conservation. Robin Woods, a HEN committee member, believes that in order for better interest in conservation and restoration management to unfold into the future, community stakeholders must take action to inspire, educate and engage *with* each other in ways that may seem intuitively contradictory.

Sydney Polo Club, which recently won a bid to host the 2017 World Polo Championship, is one of these stakeholders whose property borders lagoons. The club's mown lawns currently extend to the lagoon rim with no fringing zone of vegetation to protect the banks from slumping and to filter effluent from the nearby horse stables. HEN is currently partnering with the club's land management staff to establish appropriate buffer zones to protect the lagoon. The club is also planning some positive community engagement activities in the lead up to their high profile events. These include University and TAFE ecosystems field classes and carp fishing classes for pest management.



*Carp are a huge problem throughout the Hawkesbury wetlands. (Hawkesbury Environmental Network)*



HEN has also teamed up with the Green Army to mobilise “Wetland Warriors.” The warriors, many of whom are western Sydney locals aged between 17 and 25, feel the advancing pressure of urbanisation in their communities, and believe that the best management involves getting community members to act as one. The group was recently dispatched to Sydney Polo

Club to revamp its lagoon banks with native species. Robin and HEN believe that Wetland Warriors venture will, in the face of Sydney’s future expansion, sustain HEN’s work into the future.

For further information, contact Robin Woods at [robin@hen.org.au](mailto:robin@hen.org.au) or visit [www.hen.org.au/](http://www.hen.org.au/)



*Currently the polo club mows to the water’s edge. Green Army Wetland Warriors will revegetate this area to create a riparian buffer. (Hawkesbury Environmental Network)*

# Recycled hardwood logs for riverbank stabilisation

David Keast, Catchment Management Officer, City of Gold Coast

The City of Gold Coast (City) has trialled an innovative technique using recycled large hardwood logs with intact rootballs to protect the riverbank of Tallebudgera Creek.

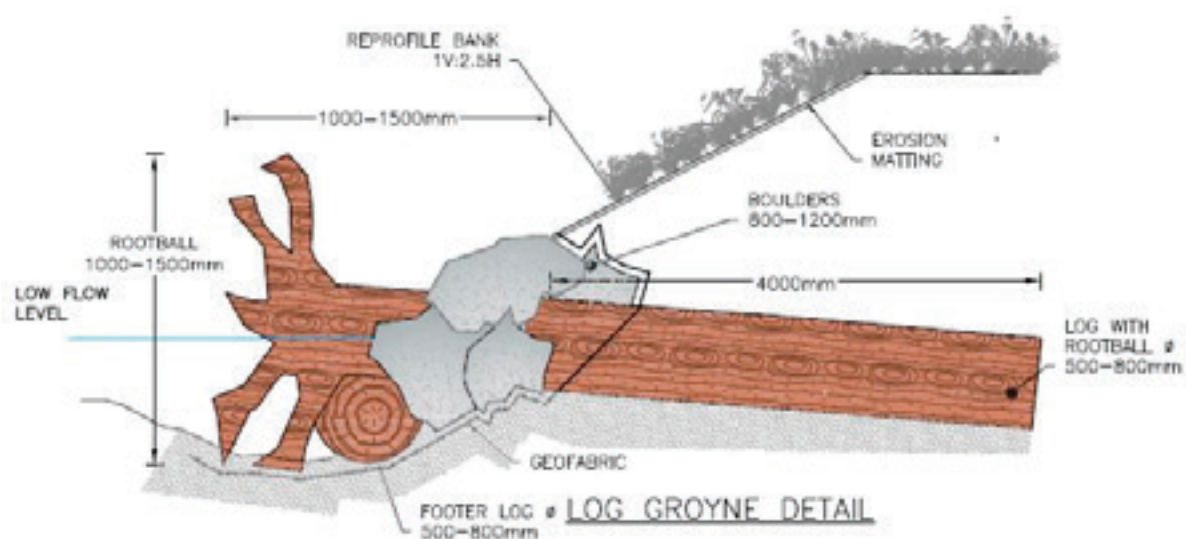
Smales Park is a community recreational reserve on Tallebudgera Creek which had been experiencing severe erosion along a 70 metre stretch of riverbank.

Tallebudgera Creek has undergone significant changes since European settlement. The removal of riparian vegetation and in-stream large wood and the construction of a dam in the 1950's has resulted in geomorphic degradation of the river channel.

At Smales Park, Tallebudgera Creek is partially confined by the valley margins, with the discontinuous floodplains consisting primarily of highly erodible fine sands and silts. The altered hydrology of the creek in conjunction with limited riparian vegetation had resulted in scouring and failure of the riverbank at Smales Park. The channel width had increased from 10 metres in 2009 to 15 metres in 2014, and an estimated 1200 cubic metres of sediment was exported downstream.

The City engaged Alluvium Consulting to design and implement riverbank stabilisation works using large hardwood logs. As well as protecting the reserve, the project was an opportunity to demonstrate alternate riverbank stabilisation techniques to rock rip rap, which is currently the predominant riverbank protection method.

Hardwood footer logs were laid along the excavated toe (lowest part) of the riverbank to protect it from scour. Additional logs were placed on the footer logs at a 45° angle, with the root ball extending upstream around one metre into the channel. The logs were secured with large boulders and the backfilled spoil, and the riverbank was battered and replanted to reflect the remnant riparian vegetation on the opposite bank.



*Typical detail of the log structure used to stabilise the riverbank and create aquatic habitat at Smales Park.*

The protruding root ball is designed to reduce flow velocity near the river bank and maximise aquatic habitat within the creek by creating changes in the physical form of the channel such as scour holes and deposition zones. A particularly pleasing aspect of the project was that the hardwood logs were recycled from a development site, and would have otherwise been converted to woodchips.

Monitoring of the site in the two years since construction has demonstrated the effectiveness of the technique in halting riverbank erosion. The logs have also created variability in the physical form of the river, providing additional aquatic habitat, and the vegetation is now well on its way to replicating natural systems.

For further information, contact David Keast at the Catchment Management Unit, City of Gold Coast on 07 5581 7399 or visit [www.cityofgoldcoast.com.au/catchments](http://www.cityofgoldcoast.com.au/catchments)



*Looking downstream at the completed large wood riverbank stabilisation and revegetation works at Smales Park.*  
(Catchment management Unit, City of Gold Coast)



# Reducing acidic discharge into Bungawalbyn Creek, NSW

Department of Primary Industries NSW

A drained coastal wetland at Bungawalbyn Creek has been partly re-flooded to minimise the discharge of extremely acidic water into the downstream waterways.

The property at Boggy Creek, Bungawalbyn is 10 kilometers west of Woodburn on the Richmond River, NSW. It is a former natural back-swamp that was first drained in the 1920s, the drainage network later being expanded for tea tree production.

Unfortunately, this work also exposed the underlying acid sulfate soils to oxidation; which generated toxic quantities of sulfuric acid. Chronic discharges of acidic water severely affected aquatic life including Australian bass, eel-tailed catfish and freshwater shrimp. On-farm effects were also noticed with vegetation scalding and cattle suffering from debilitating scour.

In the early 2000s NSW Agriculture were approached for some technical advice. They established a monitoring program to examine the nature and scale of the problem, while identifying potential solutions. pH levels of 3 to 4 were commonplace (classed as extremely acidic). The research recommended raising the water table, however this reduced the ability to grow tea tree in the lowest parts of the wetland and the trial was abandoned.



*Newly installed weir with wetland flows discharging downstream (Simon Walsh)*



*Water now covers a previously scalded area (Simon Walsh)*

After several years, the property owner recognised that tea tree production at the lowest elevations would always be compromised by the area's tendency to become inundated when wet and scalded when dry. The project concept was re-visited in 2015–16, this time by NSW Department of Primary Industries (Fisheries) with our project partners WetlandCare Australia (now Conservation Volunteers Australia) and North Coast Local Land Services. Discussions highlighted that raising water levels in the lowest parts of the wetland would simultaneously raise groundwater in the slightly higher tea tree paddocks and increase their productivity.

In June 2016, a low-level weir was fabricated and installed in the drainage system. The weir was designed to retain maximum water in the wetland without infringing on the surrounding tea tree crops or other farm infrastructure. The property is located in the upper estuary of the Richmond River, where although influenced by the tide, the water is of low salinity. The weir was built with two flap gates to allow

high tides to 'recharge' the wetland with freshwater, but then stop it from leaving again. In this way the wetland is prevented from drying out completely (and re-oxidising the sulfidic sediments) as it did during previous droughts.

DPI (Fisheries) is continuing to work with the landholder and project partners on the site. A 12 month monitoring program has now commenced to gauge the effects of the weir on water levels and changes to the wetland vegetation communities. Two field days have also been held on site to showcase the benefits for neighbouring farmers who wish to improve their on-farm productivity, while also enhancing natural wetland values.

For further information on this project, please contact Simon Walsh at [simon.walsh@dpi.nsw.gov.au](mailto:simon.walsh@dpi.nsw.gov.au)

# Incredible community support secures Mt Burr Swamp for restoration

Mark Bachmann, Nature Glenelg Trust

Every once in a while, an opportunity to investigate a site with standout wetland restoration potential comes along. This was the case way back in February 2012, only a few weeks after Nature Glenelg Trust began, when we were alerted to a drained wetland called Mt Burr Swamp, situated only half an hour from Mt Gambier in the lower south east of South Australia.

The concept immediately looked like a great idea. After all, the property was located next door to one of the region's premier wetland reserves, The Marshes (a nationally recognised wetland complex), and would enable the overall conservation area to be expanded by 50 per cent.

The property contains dozens of drained wetlands with excellent restoration potential. The largest wetland, Mt Burr Swamp, is a large, former deep freshwater marsh that forms something of a natural centrepiece for the site. Plus, fortunately for us, and unlike a lot of the South East where water resources are under pressure, water security in this area has not been compromised—meaning that the ingredients for a successful restoration project were in place.



*The restoration of Mt Burr Swamp—September 2016 (Lachlan Farrington)*



There was just one problem. Because the property has been developed as a farm, a significant amount of funding would be required to get the purchase off the ground.

And so began a long and arduous four year journey, working behind the scenes in an attempt to find partners interested in helping us make this vision a reality.

Fast forward to today and what seemed unlikely, if not impossible, has actually eventuated, with Nature Glenelg Trust settling the purchase of the 300 hectare Mt Burr Swamp property on the 30th of September 2016.

We did so by successfully establishing a unique blend of partnerships with government (the South Australian Native Vegetation Council), private business (OneFortyOne Plantations) and the wider community (individuals, groups and businesses who donated to our fundraising appeal) to reach this significant milestone.

The purchase was celebrated with an art exhibition and on-site open day in early October, while the ecological restoration of Mt Burr Swamp is also already underway. A trial structure installed in August to lift water levels has resulted in the immediate reinstatement of over 50 hectares of wetland habitat, which early surveys have now confirmed already support recovering populations of two nationally threatened aquatic species—the growling grass frog and little galaxias. More significant species are expected to return to the site over the years ahead.

While the full restoration of the property is a long term work in progress, thanks to fantastic broad-based community support, this project is clearly off to a flying start.

Nature Glenelg Trust will keep you up to date on the progress of its wetland restoration projects through the NGT website: [natureglenelg.org.au](http://natureglenelg.org.au) and future editions of *Wetlands Australia* magazine.



*The restoration trial structure at Mt Burr Swamp—  
from August to September 2016 (Mark Bachmann)*

# Look how far we have come—celebrating Panboola's 20<sup>th</sup> birthday!

Michelle Richmond, Project Coordinator, Pambula Wetlands and Heritage Project

In 2017 Panboola will celebrate 20 years of existence! On the Pambula River floodplain on the Far South Coast of NSW, Panboola is a wonderful example of the power of committed individuals coming together to protect and restore a significant environmental and community asset.

Panboola is a diverse estuarine and freshwater wetland comprising billabongs, saline areas, a tidal channel, tidal mudflats, mangroves and saltmarsh. Remnant stands of forest red gums also exist along with vast areas of past grazing land undergoing revegetation. The area is bordered by Ben Boyd National Park, NSW State significant wetlands (SEPP 14), the Pambula River, the Princes Highway and the southern fringe of Pambula village.

The area is being rehabilitated as a wetland for the purpose of nature conservation, protection and restoration of habitat for birds and other indigenous flora and fauna and for community education and passive enjoyment. The story of Panboola began in 1997 when a block of land on the floodplain was put on the market. A local conservationist purchased the land to protect this six hectare area from development. It is

now known as the Waterbird Sanctuary. This land has since become the subject of a Voluntary Conservation Agreement and has been formally gifted to the community.

At around this time the nearby Pambula Racecourse was decommissioned and this Crown land is now managed as part of Panboola along with additional lands that have been purchased and donated. Today the site spans 82 hectares.

Over the years, tens of thousands of grasses, shrubs and trees have been planted on this formerly cleared farmland, numerous formal biodiversity surveys have been conducted and community events are held regularly. Walking and cycling tracks extend across the area. Panboola is almost entirely managed by volunteers with over 2,500 hours given annually toward maintenance and development.



*Panboola is teeming with birds* (Michelle Richmond)



Panboola has:

- four Endangered Ecological Communities,
- five species of bat listed as protected or threatened,
- five species of flora noted as being regionally uncommon,
- over 160 different bird species, including 14 species listed as threatened on schedules of NSW and Commonwealth legislation,
- over 50,000 visitors each year.

The initial vision for Panboola to be a beautiful refuge for waterbirds and all other native animals as well as a place where the local community and other humans can be inspired, educated and rested, has certainly been achieved.

For further information, contact Michelle Richmond at [panboola@gmail.com](mailto:panboola@gmail.com) or visit [www.panboola.com](http://www.panboola.com)



*Salt marsh and pond now cover the old Pambula Racecourse (Robyn Kesby)*



*The waterbird sanctuary today (Michelle Richmond)*



# Habitat restoration in Dee Why Lagoon Wildlife Refuge

Jillian Macintyre, Northern Beaches Council

The Dee Why Lagoon Habitat Restoration project involves many stakeholders in a whole-of-lagoon system approach. It is focusing on removing and reducing environmental impacts, restoring ecosystems and engaging the community to encourage community ownership.

Dee Why Lagoon Wildlife Refuge (DWLWR) provides important habitat to a range of animals. The lagoon has a maximum surface area of 30 hectares and is located within a 571 hectare catchment. It supports three Sydney Basin endangered ecological communities (EECs)—Sydney coastal estuary swamp forest complex, Sydney freshwater wetlands and coastal saltmarsh, listed under the *Threatened Species Conservation Act 1995* (NSW).

Land uses in the catchment have a significant impact on the health of the lagoon. The DWLWR catchment is regarded as extensively developed with 75.5 per cent classified as urban, 13.5 per cent light industrial and 11 per cent native vegetation and open space.

Threats to the lagoon system and biodiversity values in the reserve include an increase in invasive plants and animals, domestic pets, rubbish and stormwater impacts. These threats reduce ecosystem service capacity and resilience while increasing vulnerability to climate change.

The habitat restoration project recognises that wetland habitat in the lagoon is likely to be affected by climate change in the foreseeable future. Threats to DWLWR may increase over time and place further stress upon local habitat and exacerbate the risk of local plant and animal extinctions. The project has assisted in building habitat resilience in the face of a differing climatic regime.



*Dee Why Lagoon Salt Marsh* (Northern Beaches Council)

Northern Beaches Council has restored natural areas impacted by invasive plants and animals. The focus has been on the removal of weeds, restoration of EECs and vertebrate pest animal control. Fauna surveys have also been established with the aim of identifying the presence/absence of critical species including the threatened eastern pygmy possum.

Bush regeneration works to date have seen high priority weed species removed from over 10 hectares. This has resulted in natural regeneration beginning to recover, providing critical habitat for native animals.

A native seed bank has been created with over 3000 tube stock established by Council's Community Nursery volunteers. The Friends of Dee Why Lagoon bushcare group continue to remove weeds, restore ecosystems and promote DWLWR.

Community awareness-raising events such as planting days, a fauna fair and bird survey workshop have increased the local community's understanding and appreciation of DWLWR. A newly established volunteer bird survey group is assisting in local bird surveys, including the annual swift parrot and regent honeyeater surveys.

DWLWR provides a valuable ecological function for various mammals, birds and aquatic species. Continued monitoring will be essential in determining the success of restoration efforts and enabling alternative solutions to be found to support critical ecosystem services into the future.

For further information, contact  
Jillian Macintyre, Northern Beaches Council,  
E: [council@northernbeaches.nsw.gov.au](mailto:council@northernbeaches.nsw.gov.au),  
P: 02 9942 2111



*Aerial view of Dee Why Lagoon Wildlife Refuge (Northern Beaches Council)*

# NGOs combine forces to support wetland resilience

Conservation Volunteers Australia

Two Australian non-government organisations with a mission to conserve nature and connect with people have joined forces to expand their wetland programs. WetlandCare Australia merged with Conservation Volunteers in July 2016. Our two organisations are now fully integrated, combining our expertise and resources and expanding our reach to 35 offices in Australia and New Zealand. Our goal is to increase ecosystem resilience through the protection, maintenance and restoration of the environment by engaging volunteers in practical conservation projects.

We have launched two conservation programs with a focus on wetland conservation: *One Reef*, and *Wetlands Catchments Coasts*. Both programs integrate a range of activities including site assessments and restoration planning, volunteer engagement, training, citizen science and on-ground work.

*One Reef* harnesses the strength of partners, communities and volunteers to repair priority wetlands and catchments of the Great Barrier Reef. One Reef is all about mobilising the community to make a practical

and tangible on-ground difference. The program addresses the fact that declining marine water quality, influenced by land-based run-off, is one of the most significant threats to the long-term health and resilience of the Reef. The Great Barrier Reef receives run-off from 35 river basins which drain 424,000 square kilometres of coastal Queensland. River discharges are the single biggest source of nutrients to the inshore areas of the Great Barrier Reef World Heritage Area.



*Merv Pyott, Senior Project officer for the Delivering Biodiversity Dividends to the Barratta Creek Catchment project at Horseshoe Lagoon in the Barratta Creek Catchment (Conservation Volunteers Australia)*



One of the first initiatives under the One Reef program is a partnership between Conservation Volunteers Australia, Greening Australia and Birdlife Australia to restore 200 hectares of riparian habitat and coastal wetlands. The project aims to protect the reef from water pollution and sediment.

The *Wetlands Catchments Coasts* program aims to conserve healthy and resilient wetlands, catchments and coasts for nature and people. *Revive Our Wetlands* is a key initiative of the program. *Revive Our Wetlands* recognises that wetland losses are estimated at 50 per cent in Australia. Projects are being undertaken to protect and restore wetlands for nature conservation, water security, climate change resilience and wellbeing. Maintaining habitat values at shorebird flyway sites is also a focus.

A partnership between Conservation Volunteers and Belmont Wetlands State Park Trust is a good example of a *Revive Our Wetlands* project funded by the NSW Environmental Trust. Conservation Volunteers is working with community Trustees, educating park neighbours to appreciate and protect wetland values and get involved through volunteering.

The *One Reef* and *Wetlands Catchments Coasts* programs provide frameworks to inspire and empower communities to make a positive contribution to conservation, through practical nature based experiences and skill development.

For more information, visit [www.conservationvolunteers.com.au](http://www.conservationvolunteers.com.au) or contact Ian Walker, Director, Conservation Volunteers, T: 1800 032 501, E: [iwalker@conservationvolunteers.com.au](mailto:iwalker@conservationvolunteers.com.au).

# NGO Networks for wetland conservation

Conservation Volunteers Australia

The World Wetland Network (WWN) is a global network of over 2000 non-government organisations (NGOs) initiated at the Ramsar Conference of the Parties (COP) in South Korea, 2008. It arose from the need for NGOs to arrive at Ramsar meetings well prepared, and participate effectively. The network also supports members in their broader wetland conservation activities, making a positive contribution to delivery of the Ramsar Convention.

Australian Louise Duff was recently appointed Chair of the World Wetland Network. Louise is the Program Manager – Wetlands Catchments Coasts with Conservation Volunteers, and administers the Australian Wetland Network. She has been the Oceania representative to WWN for five years, working with the WWN management committee consisting of eight regional representatives from Europe, Asia, Africa, America and the Neo-tropics. Ms Duff attended Ramsar COP 11 in Romania and COP 12 in Uruguay, working with WWN to give smaller NGOs a voice in the proceedings.

In the lead-up to Ramsar COP 12, WWN conducted a survey of its members and the broader wetland conservation community. The survey overwhelmingly showed that NGOs are committed to Ramsar and want to do more. The creation and continued existence of WWN is testament to this. According to Ms. Duff, *“WWN and the broader NGO community understand that human and financial resources for wetland conservation are scarce and that collaboration between the government, non-government and business sectors is critical to wetland conservation.”*

Developing a greater understanding of the role, the commitment and the potential of wetland NGOs is an important first step, said Ms. Duff.

Conservation Volunteers (CVA) endorsed Ms Duff to take up the chair, noting the close alignment between WWN's commitment to support community-based wetland conservation with CVA's partnership approach and practical achievements engaging up to 7000 volunteers a year in nature conservation. CVA's new Wetlands Catchments Coasts program managed by Ms Duff aims to conserve healthy and resilient wetlands, catchments and coasts for nature and people.



*World wetland Network Chair, Louise Duff* (Conservation Volunteers Australia)

With the recent merger between WetlandCare Australia and Conservation Volunteers, CVA became host for the Secretariat of the Australian Wetland Network (AWN), also administered by Ms. Duff. AWN was formed in 1994 to facilitate input by Australian Non-Government Organisations (NGOs) to the Ramsar Conference of Parties held in Brisbane in 1996. Since then its members have supported an ongoing role in wetland conservation, strategic planning, national reporting and policy. It is informally affiliated with the World Wetland Network.

AWN has 39 member organisations representing all states and is guided by a Reference Group with six members. It is supported by the NSW Government with funding through its Environmental Trust. New members for both the network itself and the Reference Group are welcome.

For more information, visit [www.worldwetnet.org](http://www.worldwetnet.org), [www.wetlandcare.com.au](http://www.wetlandcare.com.au), or contact:

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# Local government facilitating cross-agency collaboration to achieve positive outcomes for Tasmania's largest wetland

Glamorgan Spring Bay Council

On the east coast of Tasmania, Glamorgan Spring Bay Council is playing a key role in facilitating the collaborations and partnerships critical to achieving positive outcomes for Moulting Lagoon Ramsar wetland. Moulting Lagoon at the northern end of Great Oyster Bay on Tasmania's east coast is the largest and most significant wetland area in Tasmania. This wetland of international significance supports an array of rare, vulnerable and endangered species of plants and animals. Many businesses and land holders depend upon the health of this wetland to sustain their livelihood.

For many years Glamorgan Spring Bay Council and the Glamorgan Spring Bay Natural Resource Management Committee (a Special Committee of the Glamorgan Spring Bay Council) have been working with stakeholders including public and private land managers to raise awareness of this unique wetland. Two Weeds of National Significance, gorse and African boxthorn pose a threat to Moulting Lagoon. Council has been working in partnership with the Tasmanian Parks & Wildlife Service and private land managers to source funding to undertake weed control works around the perimeter of the wetland to aid in regeneration of native vegetation. Thirteen threatened plant species are found around the Lagoon.

Moulting Lagoon is home to about 80 per cent of Tasmania's black swans. The Lagoon was named after the piles of swan feathers that can be seen along the shoreline when the swans undergo their annual moult. At different times of the year the Lagoon is also home to many other birds such as ducks, herons and egrets, plovers, grebes, cormorants, oystercatchers, gulls and terns, waders and birds of prey.

In partnership with the Parks & Wildlife Service, Glamorgan Spring Bay Council will continue to seek funding to build on and maintain weed control works undertaken in the past and to engage the local community via awareness raising activities such as World Wetlands Day celebrations.



*Moulting Lagoon, Tasmania's largest and most significant wetland area, is home to 80% of the State's black swans (Eric Woehler, Birdlife Tasmania)*



The success to date of the weed control works and awareness raising would not be possible without the support of the Parks & Wildlife Service, Crown Land Services, the Department of Primary Industries, Parks, Water and Environment, the Australian Government, Wildcare, Friends of Freycinet, BirdLife Tasmania, NRM South, Landcare Tasmania, the Tasmanian Land Conservancy, private land managers and the local community.

For more information, contact: Mel Kelly,  
Manager, Natural Resources, Glamorgan  
Spring Bay Council, 03 62564777,  
[mel@freycinet.tas.gov.au](mailto:mel@freycinet.tas.gov.au)

# System repair: Key partnerships help repair wetlands and bring back fish

NQ Dry Tropics

Coordinated local action is helping to restore the ecosystem function of the shallow coastal freshwater wetlands that flow into the Ramsar-listed wetlands at Bowling Green Bay National Park, and into the Great Barrier Reef lagoon.

Under the Australian Government-funded System Repair project, NQ Dry Tropics has brought together Burdekin Shire Council (BSC), Lower Burdekin Water (LBW), Burdekin Fish Restocking Association (BFRA) and local landowners to remove weeds, construct fishways, and revegetate wetland riparian areas.

NQ Dry Tropics Senior Project Officer Scott Fry said many fish species migrate between fresh, estuarine and saltwater environments:

*“Fishing is one of the Burdekin region’s most popular recreational activities, but healthy fish stocks need healthy wetlands. Nearly 70 per cent of Queensland’s fish species rely on freshwater wetlands to complete their lifecycles. They need clean, oxygenated water, and connectivity between inland waterways and the sea.*

*“Species such as Barramundi need to move between freshwater and estuarine areas to spawn. Without continuous passage linking fresh and saltwater, they can’t successfully breed, which impacts stocks,” he explained.*

Human development has altered the natural landscape of the region, undermining the connectivity of its wetlands and waterways. Obstructions include dams, weirs, roads and railway crossings, irrigation water control gates and weed chokes.

Lack of connectivity affects species’ populations, health and distribution, and helps pests such as tilapia flourish. Waterbirds also suffer from decreased habitat and less fish to eat. Many years of riparian tree clearing has also been bad news for fish. Tree roots provide valuable habitat, and trees provide shade—reducing water temperature, helping to keep water oxygenated and preventing fish kills.



Fishway (NQ Dry Tropics)

Scott says: *“We work with BSC on a major weed removal programme, which we fund jointly, with help from local landowners. “We are co-investing with LBW to better control how irrigation water is delivered, to improve efficiency and minimise losses. We are also working closely with them to construct fishways in their current and future infrastructure. The BFRA monitors and replenishes fish stocks, and helps revegetate riparian areas.”*

Recent results following a major tree planting at Sheepstation Creek in Brandon indicate the project is benefiting fish stocks. Electro-fishing surveys indicate increased fish diversity, with 15 species found, compared with only three species 10 years ago. Alan Griggs of the BFRA says: *“Massive amounts of small fish have come back to the habitat. Everyone involved with the project is ecstatic – nobody can believe the results.”*

For more information, contact  
Scott Fry, Senior Project Officer—Waterways,  
Wetlands and Coasts Programme

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[www.nqdrytropics.com.au](http://www.nqdrytropics.com.au)



# Hunters—Australia's most surprising conservationists

David McNabb, Field and Game Australia

Field & Game Australia has a long history with wetland conservation, forming in 1958 in response to news that due to habitat loss, the pacific black duck could be extinct in 10 years. The private/public partnership created in response, joined conservationist-hunters and government through a game licensing system to fund the acquisition of threatened wetlands.

Nearly 50 years later, state game reserves created under the licensing systems in Victoria and South Australia together provide around 100,000 hectares of critical breeding sanctuary for waterbirds. These include 200 wetlands (75,000 hectares) in Victoria and 10 wetlands (25,000 hectares) in South Australia. The game reserves provide an offset for habitat lost by drainage for agricultural and other purposes and also facilitate legal hunting during the prescribed season, a purpose often overlooked.

FGA has responded to some of the environmental challenges caused by widespread landscape modification, seeking commitment to improving wetland habitat for waterbirds and a greater focus on monitoring and gathering accurate data for long-term decisions. To support these aspirations, FGA established the WET Trust (Wetlands Environmental Taskforce) in 2002 and is proud of this achievement. The WET Trust funds research and wetland acquisition, protection and restoration.

Some highlights of FGAs wetlands protection work are highlighted below.

The Heart Morass restoration project, near Sale in Victoria, has transformed depleted, saline grazing land to a thriving wetland with healthy biodiversity and improved water quality. Importantly, it demonstrates a new model of private partnerships to acquire and rehabilitate wetlands, underpinned by dedicated, local volunteers, providing students with opportunities linking wetland ecology and art.

Our volunteers are motivated by the value they place in the continuation of their hunting culture and traditions and the ability to utilise these project wetlands for research, education, or other recreation. This provides the funding necessary for wetland restoration and management.



*Top: Johnson Swamp State Game Reserve (Field and Game Australia)*

*Bottom: Heart Morass restoration project (Field and Game Australia)*

The Connewarre Wetlands Centre near Geelong in Victoria, is another exciting project. The project includes a building designed for community and educational use, a feature wetland, and access to the adjoining Lake Connewarre Complex of State Game Reserves—part of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site.

Metropolitan Field & Game celebrate the worlds wetlands each year, linking people from all walks of life through their nest box program. Supported by Latrobe University Lifeskills Program, Parks Victoria and the City of Whittlesea, this program highlights the value of volunteer effort for protection of precious remnant wetlands.

These successful projects demonstrate the value of private conservation models with pools of volunteer resources delivering great conservation outcomes. The challenge is greater than ever with our increasingly urbanised society, largely removed from the practical realities of habitat and wildlife management.

FGA is a hunter organisation but we are heavily invested in conservation—always have been! We want science and public policy that supports better habitat for wildlife and for us—the people in the equation, to utilise.

For further information, contact David McNabb at [david.mcnabb@fga.net.au](mailto:david.mcnabb@fga.net.au)



*Top: Johnson Swamp State Game Reserve (Field and Game Australia)*

*Bottom: Heart-Morass restoration project (Field and Game Australia)*

# Inspirational wetland restoration on private land

Steve Clarke, Wetland Conservation Ecologist, Natural Resources South East, Department of Environment, Water and Natural Resources

The Department of Environment, Water, and Natural Resources South Australia (DEWNR) has been working with private property owners to achieve an exciting large scale restoration project in the south east of South Australia. Steve and Kaleen Harris, graziers, from Iluka Estate, near Beachport have recently placed 130 hectares of their property underwater in a conservation measure to restore the landscape to that of pre-drainage and clearance.

Originally part of a vast near-coastal wetland system that spanned over 100 square kilometres, the Iluka tract of wetland abuts the Crown land wetland of Mullins Swamp effectively creating a 375 hectare, 5 kilometre long wetland.

Recent on-ground works designed to hold water for longer periods on Iluka have included reinstating a 500 metre levee/causeway, a spillway, fish passageway and fencing. The engineering has enabled the surface water to remain within the required area to a depth of up to 60 centimetres. On a brief survey over 50 indigenous flora species have been identified

including tall saw sedge (*Gahnia clarkei*), river buttercup (*Ranunculus inundatus*) and bottlebrush tea-tree (*Melaleuca squarrosa*), which are all rare, state listed species. Fauna records so far are equally impressive and include the EPBC listed southern bell frog (*Litoria raniformis*), dwarf galaxias (*Galaxiella pusilla*) and the Australian mudfish (*Neochanna cleaveri*), which was recently thought to be extinct in SA. So far five species of fish, seven species of frogs, and over 20 species of water fowl have been recorded. Transects and quadrats have been set up and surveys undertaken to better understand the vegetative changes that will occur over the next few years.



Top: 2 kilometres of open water (Steve Clarke)

Bottom: Tea tree and sedge (Steve Clarke)





*Top: Steve Harris inspecting a spillway and fish passageway (Steve Clarke)*

*Bottom: Survey at Illuka (Steve Clarke)*

The Harris', though very excited about the possibility of restoring a wetland to such extent, debated for some time about placing such a large part of their property under conservation. Eventually, after much deliberation, they settled on the option of grazing parts of the wetland that totally dried over summer, alleviating some of their concerns. Selectively grazing was the ideal method to manage the introduced pasture grasses therefore reducing fire fuel loads and allowing an economic return at the same time. Grazing management would be undertaken using hot wire ribbon (a type of electric fence) and exclude stock from high conservation areas and revegetation sites.

DEWNR works with many private landowners to conserve their wetlands but only rarely do landowners return such large areas to wetland. All landholders that conserve must be highly commended for their contribution to the natural environment.

Restoration work at Illuka Wetland has been funded by the South Australian and Australian Governments. Contact Wetland Conservation Ecologist Steve Clarke for more information ([steve.clarke@sa.gov.au](mailto:steve.clarke@sa.gov.au))

# Wetland thrives alongside food production

Garry Baker

There's a unique habitat for a plethora of wildlife, birdlife and reptiles near Deniliquin, in southern New South Wales. It's called Lake Geraldine and provides food in abundance and a fertile breeding ground for birds including ibis, brolgas, Australasian bitterns, ducks and pelicans...the list goes on.

If you stand on the lake's edge you will discover it is also home to numerous species of croaking frogs, lizards and other reptiles, including the snakes which slither around the wetland and its surrounds. It also provides the environment for a myriad of plant species.

But this is a wetland with a difference.

It's not in a national park or even a public adjunct to a river or tributary system. Lake Geraldine is in the middle of a productive irrigated mixed farming enterprise, sharing its surrounds with crops of rice, cereals and pasture, as well as sheep and cattle.

It is a great example of reconciliation ecology, where biodiversity lives in harmony with a human ecosystem, and highlights how agriculture and ecological outcomes can coexist.

The owners, like most farmers, appreciate they are custodians of their land and take pride in the benefits this wetland habitat provides to the profusion of wildlife that calls Lake Geraldine home, or simply drops in for a cursory or extended visit.



*Birdlife abounds on Lake Geraldine, unaware of the beef-producing cattle in the background (Garry Baker)*





*The Lake Geraldine wetland on a mixed farming property east of Deniliquin, in the NSW Murray region (Garry Baker)*

The lake is a natural low spot on the property, and as such rainfall drains into the area. Lake Geraldine highlights the need to ensure the focus of environmental water is extended to private land. Nature does not care about ownership, and therefore public land should not be the sole focus of assessing environmental outcomes for water reform. Maybe we should ask the question: Do the thousands of birds, reptiles and invertebrates who inhabit the wetland care who owns it? We suspect not.

If wetlands on farms are recognised as important pieces in the ecological puzzle, we will take positive steps to reduce the impact which extremes in the Australian climate can have on non-human life that shares our environment.

Finding ways to maintain healthy private wetlands will ensure they always provide effective breeding grounds, even in times of drought.

For further information, contact Louise Burge  
on 0428 984 570



# Native fish responses to increased connectivity and flows in a restored freshwater wetland

Lauren Veale, Nature Glenelg Trust

Long Swamp, proposed to be Victoria's next Ramsar site, is a large freshwater wetland in south western Victoria, supporting a suite of nationally threatened species, including the Yarra pygmy perch (*Nannoperca obscura*) and little galaxias (*Galaxiella toourtkoourt*). With a complex range of factors at play (catchment land use change, climatic trends and artificial drainage), the wetland system has experienced a long-term drying trend, reducing habitat for these and other key species.

Over the last three years, Nature Glenelg Trust has successfully worked with the community and agency partners to reduce the impact of artificial drainage on the system and restore natural flows towards the Glenelg River. With funding from the Department of Environment, Land, Water and Planning (DELWP), a trial structure was completed in April 2015 and successfully closed the last remaining artificial outlet at Nobles Rocks (Figure 1). This resulted in the recovery of approximately 200 hectares of aquatic habitat upstream of the weir.

Following this year's above average rainfall for the region, water levels upstream of the Nobles Rocks weir rose to a level that saw our ultimate goal achieved: the redirection of flows downstream towards the Glenelg River. For the first time, this spring we recorded continuous hydrological connectivity throughout Long Swamp and prolonged freshwater flows. The restoration of this natural flow path has been essential in facilitating species colonisation and assisting the movement of migratory species.



Figure 1—from top: The trial structure at Nobles Rocks built of over 7000 sand bags and recreated aquatic habitat upstream of the weir. (Lauren Veale)



*Figure 2—from top: the threatened Yarra pygmy perch and little galaxias, and juvenile short-finned eel and common galaxias recorded during monitoring in spring 2016.*  
(Lauren Veale)

Ecological monitoring (funded by DELWP and Glenelg Hopkins Catchment Management Authority) conducted throughout the restoration process has been pivotal in detecting the native fish responses to restoration. During monitoring in spring 2016, an increased number of juvenile common galaxias and a single juvenile short-finned eel were detected in central Long Swamp (Figure 2). This confirmed restored connectivity and the ability of fish that migrate between fresh and salt water to utilise the reinstated original flow path to the ocean. Providing further evidence of increased connectivity, was the exciting discovery of Yarra pygmy perch in the newly inundated habitat upstream of Nobles Rocks weir. Furthermore, this restored habitat is providing critical refuge for another nationally threatened fish species, the little galaxias.

While other areas of Long Swamp (which may receive less groundwater influence) will remain susceptible to drying during periods of low rainfall, the Nobles Rocks weir should result in permanent aquatic habitat. This restored habitat will provide important refuge for fish and other fauna, and greatly contribute to their overall persistence in an ever changing landscape.

For more information, contact  
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# Taking a whole of catchment approach to Ramsar conservation

Conservation Volunteers Australia

Two major projects are yielding conservation outcomes for Ramsar sites by taking a whole-of-catchment approach. One is focussed on urban waterways in the upstream catchment of the Hunter Estuary Wetlands Ramsar site in Newcastle, NSW. The second is rehabilitating Barratta Creek, the catchment for Bowling Green Bay Ramsar site in Queensland.

The two projects are separated by 2000 kilometres of coastline, and face different issues from urban degradation to agricultural impacts. But both are successfully employing similar strategies to improve conservation values downstream: working with Indigenous Australians, engaging local communities and undertaking on-ground rehabilitation in partnership with land managers.

The four-year projects were initiated by WetlandCare Australia and funded by the Australian Government. They are now in their final year. Since WetlandCare Australia merged with Conservation Volunteers in July 2015, the project teams have been retained and Conservation Volunteers is now the lead agency through its *One Reef* program in Queensland and *Wetlands Catchments Coasts* program in New South Wales.



*Expert scientific staff assess wetland health in a wide variety of environments* (Conservation Volunteers Australia)

## Results by numbers

Newcastle Wetland Connections is improving the condition, function, resilience & biodiversity of urban waterways from the top of Ironbark Creek catchment via state-listed freshwater wetlands to the Hunter Wetlands Centre.

The project has regenerated 11 hectares of riparian bushland at 14 sites improving 10 kilometres of creek line. Revegetation projects have focussed on improving biodiversity and creating buffers to reduce pollutants entering the waterways. In all, 48,898 local natives have been planted covering 6.4 hectares. Rock riffles, check dams, armouring and bio-swales have been introduced into the system to slow water movement, reduce sediment and create habitat.

157 Indigenous Australians participated in cultural events around the project. Fifteen were employed on the project, with two achieving accredited qualifications. 1,723 members of the community participated in projects activities.

The Barratta Creek project is protecting and enhancing a major artery of the Bowling Green Bay wetlands, the only Ramsar site in North Queensland. The project is also improving in-shore waters to protect the Great Barrier Reef.



Revegetation with over 30,000 local natives has improved the connectivity of wildlife corridors, increased diversity of species, and protected stream-banks from erosion. The project has also treated 35 hectares of invasive aquatic weeds to improve water quality and re-establish fish habitat. Feral animal control targeted sensitive wetlands being degraded by feral pig colonies. Community events have attracted 316 volunteers, and 70 Aboriginal people have participated in a range of training and on-ground activities. Community education has seen a significant reduction in environmentally destructive wildfires.

A Youtube video by TropWater, one of the Barratta Creek project partners, on cane farmers restoring Burdekin wetlands can be viewed here: [https://www.youtube.com/watch?v=ydPuXKE7\\_jE](https://www.youtube.com/watch?v=ydPuXKE7_jE)

For more information, visit [www.conservationvolunteers.com.au](http://www.conservationvolunteers.com.au) or contact Ian Walker, Director, Conservation Volunteers, T: 1800 032 501, E: [iwalker@conservationvolunteers.com.au](mailto:iwalker@conservationvolunteers.com.au).

# ExxonMobil and Conservation Volunteers Australia support vital wetland systems

Conservation Volunteers Australia

ExxonMobil Australia has partnered with Conservation Volunteers Australia (CVA) to deliver the Victorian Wetland Care Program. Through on-ground conservation actions, community and school education programs and support, ExxonMobil and CVA aim to improve the habitat value of two wetland systems listed under the Ramsar Convention. The Victorian Wetland Care program is made up of three key elements.

## Sale Common Nature Conservation Reserve

The Sale Common Nature Conservation Reserve covers 300 hectares and is managed by Parks Victoria. More than 70 per cent of the reserve consists of freshwater marsh, and the remaining area supports river red gum woodlands and grassland. The site is part of the Gippsland Lakes Ramsar listed wetlands and is home to a diverse range of waterbirds, kookaburras, wrens, brushtail and ringtail possums.

In 2015–16, key community conservation activities at the site included the removal of invasive weed species, site maintenance and the removal of more than 120 kilograms of debris. Fencing to protect sensitive areas and litter collection is essential to maintain water quality at this important wetland site.

## Paisley Challis Wetlands

Paisley Challis Wetlands adjoins Cheetham Wetlands, which are part of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site of international significance. The wetlands contain native grasslands, salt marsh and mangrove vegetation and function as valuable habitat for a diverse range of fauna and flora, as well as recreational spaces for local community members. Over 200 species of birds and local native plants, and the endangered Altona skipper butterfly inhabit these wetlands. Key community conservation activities at the wetlands over the past year have included weeding, planting trees, grasses and reeds and mulching to protect sensitive areas.



*Little Pied Cormorant at Sale Common (Conservation Volunteers Australia)*

## Schools Outreach program

ExxonMobil, through their partnership with CVA have also supported a Schools Outreach program. This included the production of a Victorian Year 4 Science curriculum educational resource for students and teachers. This resource highlights the diversity in Victorian wetlands and assists Year 4 students to learn about ecosystems such as wetlands and the interrelations of plants and animals within the environment.

The Victorian Wetland Care program between ExxonMobil and CVA has delivered school education outcomes, along with community conservation actions to assist the restoration of vital wetland systems of international significance in the Gippsland and Altona regions.

For more information, visit [www.conservationvolunteers.com.au](http://www.conservationvolunteers.com.au) or contact:  
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# Protecting and enhancing Esperance Ramsar wetlands

Claudia Magana, Project Officer, South Coast Natural Resource Management, Esperance

The Esperance region of Western Australia is lucky to have not one but two wetlands of international significance, Lake Warden and Lake Gore. Lake Warden is located 5 kilometres north of the Esperance town site while Lake Gore is 35 kilometres west. Each year both wetlands are crowded with thousands of winged visitors from all over the world coming to rest and feed in the mudflats of the wetlands.

As well as supporting one per cent of the global population of hooded plover (*Thinornis rubricollis*) and the chestnut teal (*Anas castanea*), the Esperance region is recognised as the most important region for shorebirds along the south coast of WA because it has consistently supported more than 4000 shorebirds and has shown an increase as reported in the recent report on '*Shorebirds on WA's South Coast—2015*' by Peter Taylor and Green Skills.

South Coast NRM and partners including a number of local land managers, community groups and government agencies, have been working together for over 10 years to address threats to the Ramsar wetlands and surrounding catchments to ensure that that these wetlands, the species they support and the wider community have a future.



*Lake Gore* (Claudia Magana)



*Lake Warden* (Claudia Magana)

With funding from the Australian Government's National Landcare Programme, South Coast NRM and partners are half way through a three year program to support the Esperance community to deliver targeted rehabilitation works in priority areas within both catchments. These works include:

1. 30 hectares of biodiversity plantings to restore and provide suitable habitats for significant flora and fauna; 15 hectares of control of invasive weeds that impact the wetland values
2. 12 kilometres of fencing to protect shorebird habitat
3. Three bird surveys
4. Six Indigenous participation opportunities to enhance cultural engagement in protecting Ramsar wetlands
5. 20 communication events to extend project activities to the community
6. Six technical advisory groups meetings to guide on ground works programs and future project activities.

The results and benefits of these activities can be seen across both catchments through the happy stories told by land managers as they see their landscapes recover from inundation, wind erosion and weeds. In addition, Esperance has had the highest species count and highest count for both resident and migratory shorebirds throughout the South Coast regions as reported in '*Shorebirds on WA's South Coast—2015*'.

South Coast NRM looks forward to continuing to support the community and land managers to rehabilitate and protect the wetland environments and Ramsar values of the Esperance wetlands and lakes.

To find out more on this exciting project please visit the South Coast NRM website [www.southcoastnrm.com.au](http://www.southcoastnrm.com.au) or contact Claudia Magaña the South Coast NRM Esperance project officer: [claudiam@southcoastnrm.com.au](mailto:claudiam@southcoastnrm.com.au), (08) 90762206.



*Hooded Plovers on White Lakes* (Caitlin Jackson)



