

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

Find out more about Reef Aid on the Greening Australia website 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:

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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:

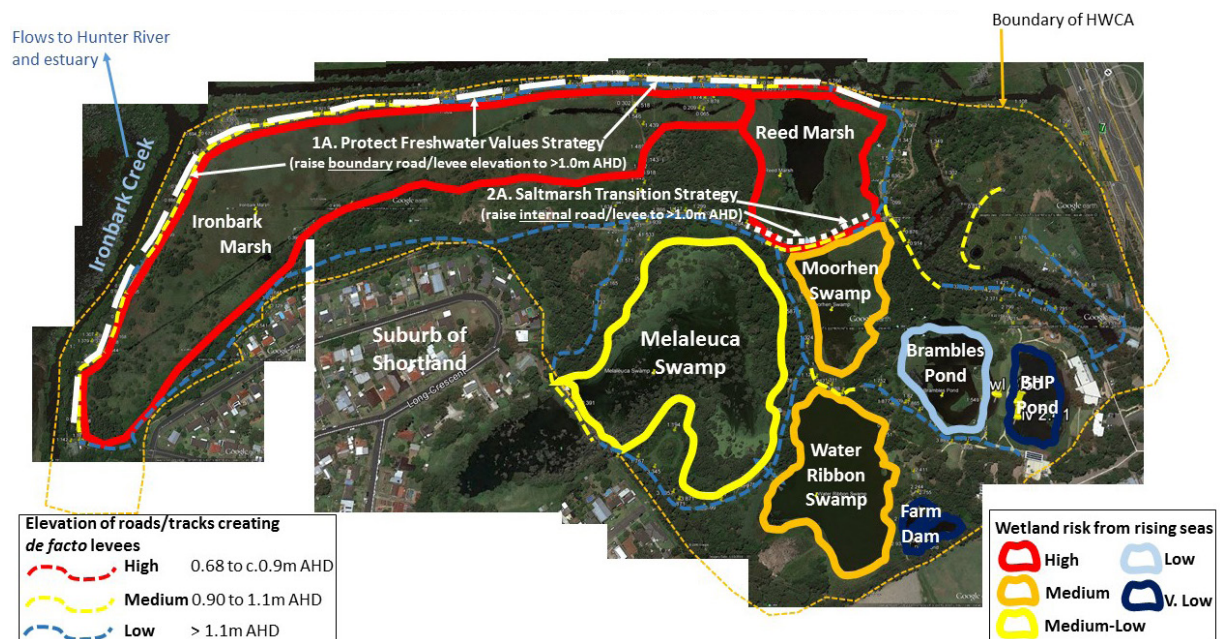
1A. Protect Freshwater Values Strategy: raising the height of low sections of the boundary road to <1.0 meters above sea level with relatively inexpensive road base to maintain freshwater values. This should work for at least a few decades

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.

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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. 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)

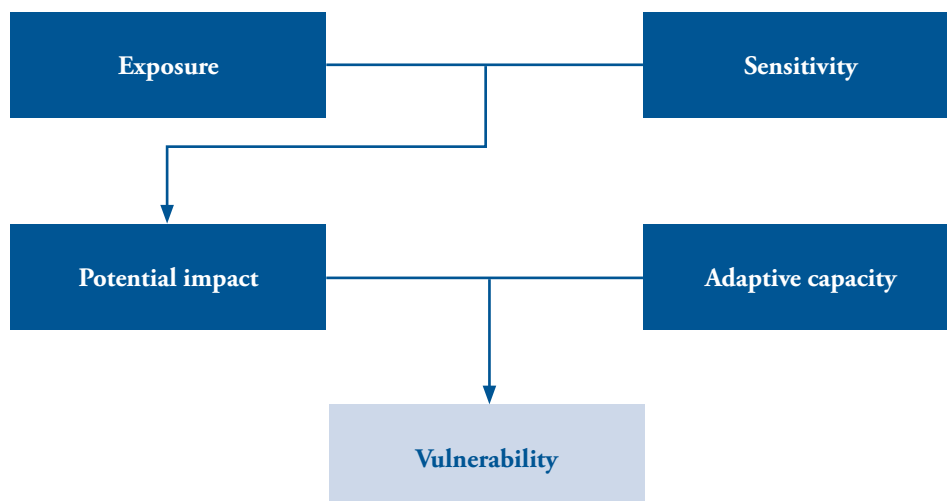


Figure 1. Vulnerability assessment approach for coastal wetlands.

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 or visit 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.

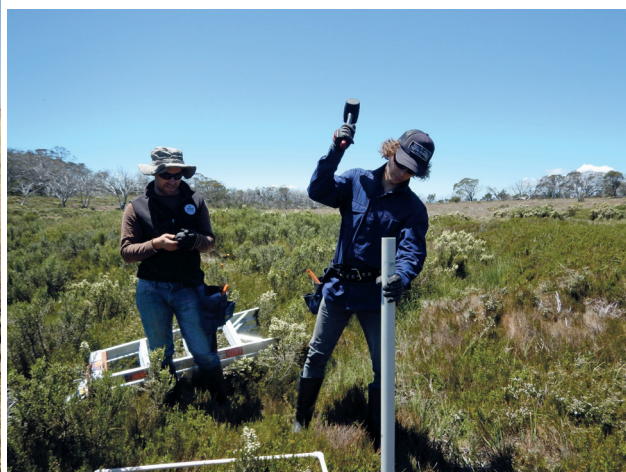
As the impacts of climate change are becoming increasingly realised, wetlands are drawing more and more attention for their vast potential to capture atmospheric carbon. Until recently investigations of the carbon sequestration capacity of wetlands have concentrated on coastal or 'blue carbon' wetlands. 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 CO₂ equivalents per year, equivalent to the CO₂ 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 CO₂ 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:

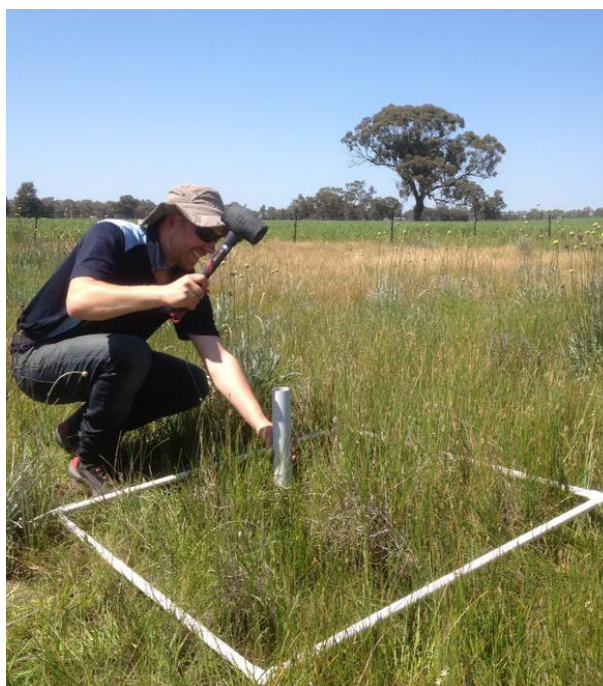
Paul Carnell (Deakin University, Blue Carbon Lab) on 0417 054 087 or at paul.carnell@deakin.edu.au, or Kate Brunt (Goulburn Broken CMA) on 5822 7700 or at katebr@gbcma.vic.gov.au

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 or visit the following websites: www.murray.lls.nsw.gov.au, www.bluecarbonlab.org or 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)



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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 and www.naturalresources.sa.gov.au/adelaidemtloftyranges/water/managing-water/stormwater/oaklands-wetland.