Research Case Study: Cost-effective restoration of wetlands that protect the water quality of the Great Barrier Reef

The increase in terrestrial-derived pollutants is one of the causes of the deterioration of the Great Barrier Reef (GBR). While some wetlands may improve terrestrial-derived runoff, their capacity to retain and treat pollutants is poorly understood in the catchments of the GBR. This project will measure the capacity of natural wetlands to retain and treat nutrients and to provide other ecosystem services such as carbon storage. The aim of the research is to identify which wetlands should be targeted for restoration and conservation to achieve the most cost-effective at protecting water quality improvements for the GBR.

Background

The Australian and Queensland Governments have committed to reducing the amount of terrestrial pollution impacting on the GBR through the improvement of land management, and more recently, through wetland restoration initiatives. Wetlands are often constructed for industrial, agricultural and urban wastewater treatment as they have been demonstrated to efficiently clean the water that flows through them. However, the role of natural wetlands in water quality improvement is poorly understood and there is a need to determine how effective wetland maintenance and restoration activities are in reducing pollutants.

To maximise the benefits of wetland restoration, for the many values they provide and to minimise costs, it is important to identify those wetlands that are the most efficient for reducing pollution runoff. Natural wetlands can be different from constructed ones, and some wetlands are more efficient than others in removing pollutants, while others support values such as biodiversity, carbon storage and fisheries. It is necessary to measure the capacity of different types of wetlands in Queensland to retain and treat terrestrial pollution and to understand the factors which affect the delivery of this service.

Wetland Vegetation
Photo by Nick Cuff, Queensland Herbarium

Goal and Objectives

The goal of the project is to determine the most cost-effective wetlands to restore on the basis of their capacity to retain and treat terrestrially derived pollutants and provide additional ecosystem services such as carbon storage.

The objectives of the project are:

- To determine the pollution retention capacity, especially nitrogen and phosphorous, of different kinds of wetlands.
- To determine additional ecosystem services provided by different kinds of wetlands, such as carbon storage.
- To make recommendations regarding the most cost-effective wetlands to restore for the purpose of nutrient treatment.

Methodology

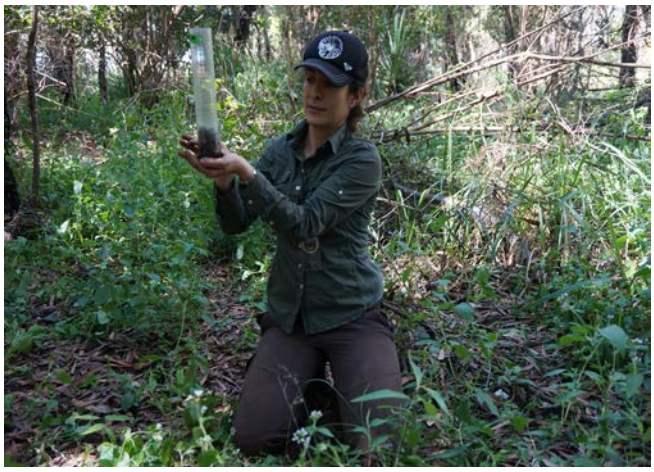
Field and laboratory experiments will be conducted on floodplain wetlands dominated by trees and those dominated by herb/sedges.

Experiments will include:

a) Nutrient transformation- denitrification rates (conversion from nitrate, NO_3, to gaseous nitrogen, N_2), and nutrient absorption.

b) Nutrient and carbon retention in sediment-sedimentation rates and nutrient and C accumulation.

Spatial analyses will be conducted using a prioritization software (MARXAN) to determine the benefits and costs of conserving and/restoring wetlands on the basis of their capacity to retain and treat nutrients and provide additional ecosystem services.



Fernanda Adame conducting research onsite
Photo by: Fernanda Adame

Outputs

The project will deliver the following outputs:

- Nutrient retention rates of floodplain wetlands through denitrification, and plant and sediment storage.
- Factors associated with nutrient retention in natural wetlands.
- A case study map showing cost-effective areas for wetland restoration on the basis of the capacity of the wetland types to retain pollutants.

Stakeholder engagement
Photo by: Fernanda Adame

Out of scope

This project does not address the following:

- The pollution retention capacity of all wetland types within the whole Great Barrier Reef catchment.
- The processes involved in nutrient retention besides the ones considered in this proposal (denitrification and plant/sediment retention).
- Experiments will be conducted in a dry and a wet season; however, results will not include inter annual variations.

Project participants and links

The project is being led by Fernanda Adame, Griffith University with funding from an Advance Queensland Fellowship, Queensland Wetlands Program and the Office of the Great Barrier Reef. The project is overseen by a Technical Advisory Group made up of officers from the Department of Environment and Heriatge Protection and the Department of Science, Information Technology and Innovation.

Map of sampling sites in the Tully and Herbert River catchment

The Queensland Wetlands Program supports projects and activities that result in long-term benefits to the sustainable management, wise use and protection of wetlands in Queensland. The tools developed by the Program help wetlands landholders, managers and decision makers in government and industry. The Queensland Wetlands Program is currently funded by the Queensland Government.

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QWP/2017/07