Fig 1. The September 2019 fire burning through wetland vegetation in the Gwydir State Conservation Area. Credit - DPIE

Traditional Gamilaaraay Language of the Gomeroi nation used In this article

Wetland wildfire

In September 2019, a wildfire (**fire-wii**) burnt sections of the Gingham Watercourse in the Gwydir Wetlands leaving in its wake roughly 1,600 ha of black scorched earth (Fig 1). Floodplain wetlands, such as Gingham Watercourse, are extremely productive ecosystems that often contain high levels of vegetative cover which can act as fuel to increase the systems susceptibility to wildfire.

Bedded into the soil of ecosystems such as the Gwydir Wetlands (**warumbools**) are the seeds and eggs (**gawu**) of various aquatic plant and invertebrate species, these are known as seedbanks and eggbanks. The seeds and eggs comprising these banks have adaptations that allow them to remain dormant and persist in the ground until conditions are just right. When the 2019 wildfire burnt through Gingham Watercourse an opportunity arose for various plant and invertebrate species to recolonise the burnt areas via their seed and eggbanks. We were intrigued about how best to manage these wetlands post-fire so we devised an experiment to help us learn more.

The experiment

We designed a mesocosm experiment to study the effects of this wildfire on the wetland invertebrate eggbank and seedbank. To kick things off, we headed out to the Gingham Watercourse and collected tubs of soil (**dhuwan**) from within and outside of the area burnt in 2019 and brought the samples back to our lab at the University of New England (Fig 2 & Fig 3).

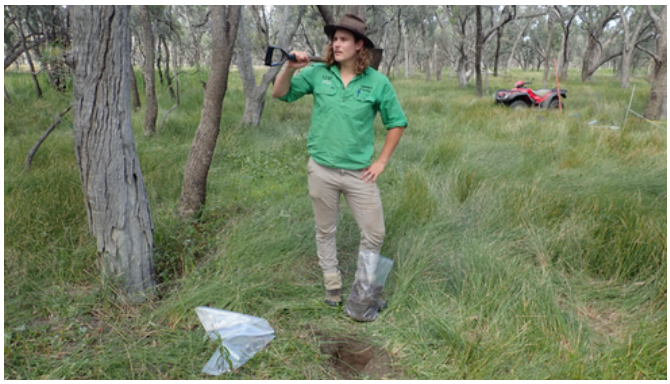

Fig 2. Soil (**dhuwan**) collection at one of our vegetation plots. Credit - UNE.

A **mesocosm** is any outdoor experimental system that examines the natural environment under controlled conditions. In this way mesocosm studies provide a link between field surveys and highly controlled laboratory experiments.

Fig 3. The left image was taken after Gingham Watercourse in the Gwydir wetlands was subjected to wildfire in 2019. The right image shows the same site 6-months post-regeneration following inundation in 2020. Credit - UNE

Method

Eggbanks

For the eggbank trials, tubs of soil were subject to 8-weeks of various inundation treatments with water nutrients levels (nitrogen, phosphorus and carbon) tested over the first 2-72 hours (Fig 4).

Seedbanks

The soil tubs for the seedbank trials were divided into three sets and each set was subject to a unique watering treatment (Fig 4). The three treatments included full inundation, moderate wetting and simulated rainfall (informed by the September-October average). The treatments continued for eight weeks to allow time for seed germination to occur.

What we found

The trials testing eggbank response to fire saw a total of 15,443 aquatic bugs from 8 taxa hatch from the samples. The most abundant and widespread taxa was the Ostracods, or seed shrimp (see information box below).

These seed shrimp presented a greater abundance and species richness in unburnt sites irrespective of the local vegetation community type.

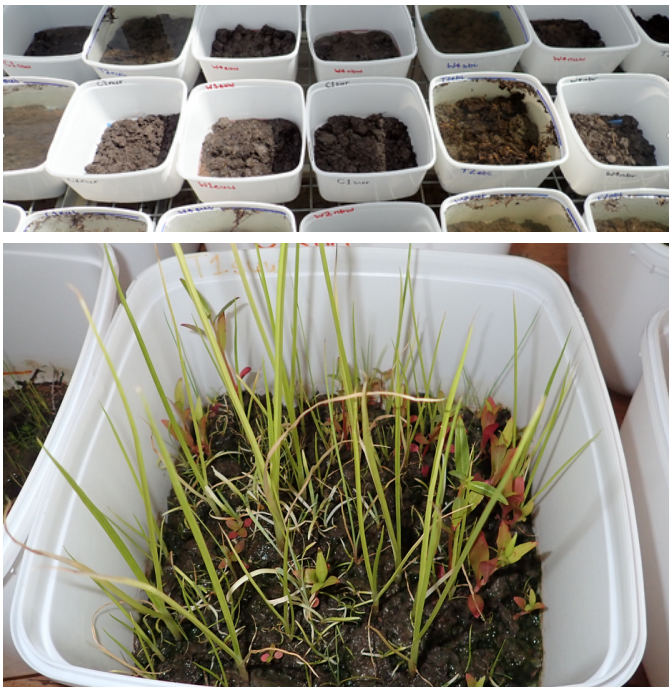

Fig 4. Labelled and inundated mesocosms in glasshouse at the beginning of eight week trial (top). An example of a wetted mesocosm from the typha vegetation community at experiment end (bottom).

Seed shrimp are microcrustaceans that are very common in a range of aquatic habitats worldwide. In fact, this taxon is the most abundantly preserved of the arthropods in the fossil record, with the oldest fossil estimated to be around 485 million years old. Seed shrimp inhabit water that is fresh, salty, flowing or standing and can even withstand drying of their aquatic habitat. The ability for seed shrimp eggs to completely desiccate and remain viable many years later has contributed greatly to the taxon's success.

Seed shrimp are a key link in the wetland food chain, feeding on detritus and algae themselves and serving as prey to other aquatic invertebrates and juvenile fish. These small but important crustaceans are one of the fundamental players in the phenomenal boom and bust cycle we see in places like the Gwydir wetlands.

Seed shrimp. Credit - Wikiland

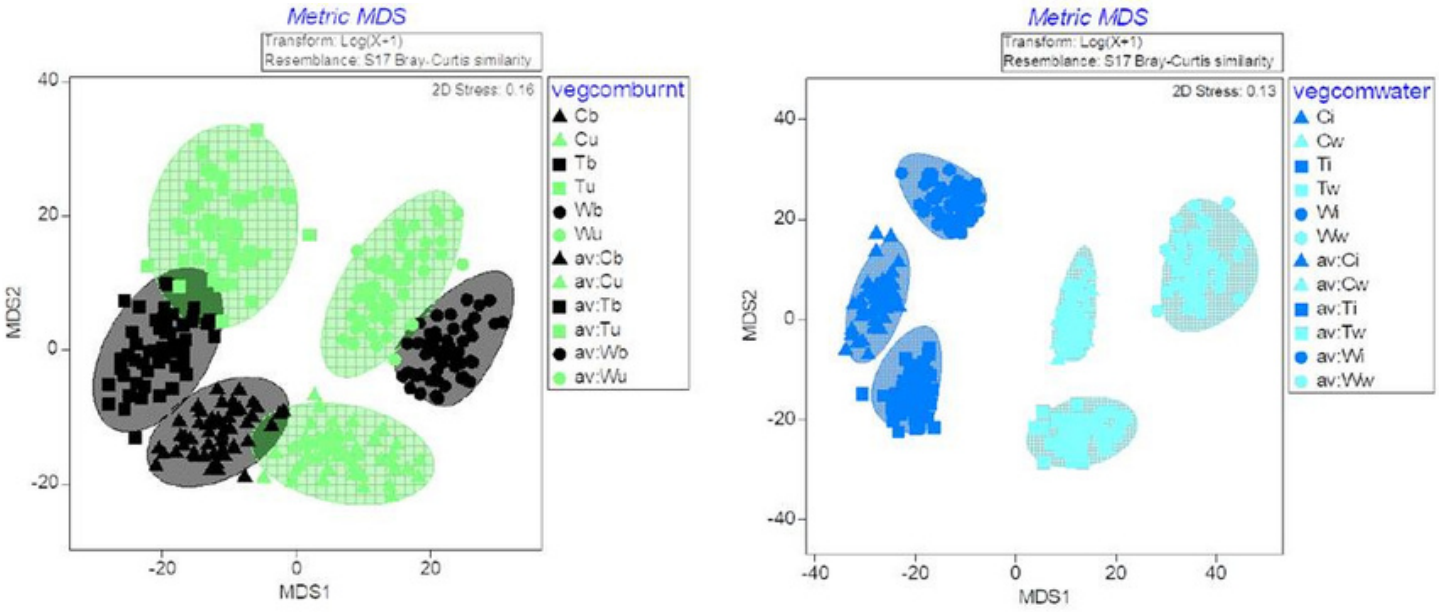

Fig 5. Vegetation community composition before and after fire (left) and in response to wetted and inundated treatments (right) in typha, water couch, and coolibah vegetation communities.

The experiment testing seedbank response to fire saw a total of 4,582 seedings germinate from 36 species. This species richness is about half of what we've observed in the Gwydir Selected Area during the LTIM and MER on-ground surveys. The most common species in our trials, occurring in 93% of the sample tubs, was the wetland sedge species dirty dora (*Cyperus difformis*).

Neither species abundance or species richness were influenced by burning or inundation treatments although the composition, or species makeup, of the communities was influenced by both burning and inundation treatment (Fig 5). This suggests that a range of inundation depths is important to maximise vegetation community diversity post fire.

Why this work matters

Floodplain wetlands are extremely productive ecosystems. Our study indicates that both fire and the inundation regime employed following fire can influence wetland vegetation community structure.

Also, providing a range of inundation conditions post fire, may enhance the wetland vegetation seedbank response following exposure to fire.

For the water bugs, although wildfire can be detrimental - reducing overall abundance and species richness, our study highlighted the resilience of Gwydir wetland waterbug eggbanks with their tolerance to wildfire, assisted by inundation.

In systems where flows can be delivered to assist in wetland recovery post fire, knowledge of the effect of fire and inundation regimes becomes important for their management.

Gamilaraay Glossary

wii ("wee") = fire
dhuwan ("done" like "drone") = dirt
gawa ("gow") = eggs
warumbools = wetlands

Traditional language sourced from dnathan.com
Frog illustration: Lakarri Pitt

Click here for more on Flow-MER

Managing water for the environment is a collective and collaborative effort, working in partnership with communities, private landholders, scientists and government agencies - these contributions are gratefully acknowledged.

We acknowledge the Traditional Owners of the land on which we live, work and play. We also pay our respects to Elders past, present and emerging.

Australian Government
Commonwealth Environmental Water Office

FLOW Monitoring Evaluation Research

2rog

une University of New England