

Management of temporary aquatic habitats in an agricultural landscape

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I live on a farm in Western Victoria near Lake Bolac, in a landscape with a Mediterranean climate and seasonal [playa wetlandsⁱ](#). Twenty years ago, I started looking at our local swamps (including their [charophytesⁱⁱ](#)) and how best to manage them.

The wetlands are important repositories of biodiversity. These freshwater swamps have a high diversity of plants, algae and blue-green algae. These are consumed by a range of herbivores, and they in turn are consumed by birds, snakes, frogs and so on. And the whole system is driven by the input of water, sunlight and nutrients. Flooding drives all of the processes in these wetlands.

There are many important processes associated with these wetlands. They provide a diverse habitat that teem with life when they are wet. They have a role in control of pests that live in wetlands. They are important in carbon cycling. They act as a fire retardant in one of the most fire prone landscapes in the world. They are important for ground water recharge. And they have huge cultural values.

In 1835 the district was settled by Europeans resulting in big changes to the landscape. Many marsupials have gone extinct while other native and exotic mammals have increased. The soil conditions have changed from the friable soils and large numbers of swamps reported by Major Mitchell to severe compaction. Soil nutrient levels are higher particularly since superphosphate was introduced. Topsoil has been lost through wind erosion. And rising groundwater due to clearing of perennial vegetation has increased salinity in some areas.

Modelling of the rainfall cycles shows that these swamps were reasonably seasonal. They filled about six to seven times each decade and they only remained dry for a year to year and a half. Until recently, the longest dry period was about two or three years. Now they are wet less often, dry out faster and stay dry for longer. They also sometimes fill in summer which is different from the past.

So, are wetlands capable of returning to their original state when wet or have we put them into a completely different state requiring a lot of energy to return them to where they were before?

Management studies of wetlands

Many streams through Western Victoria come off the mountains and spread out across the landscape and into large swamps, then drain through steeper ground closer to the coast. Under Indigenous use, they were grazed by kangaroos and emus, and were burnt. Broad acre set-stock grazing by sheep and cattle began in about 1840. Removal of habitat and sowing of pasture has increased in the swamps because they dry more often. And, more recently, people have started growing crops in swamps. I have been involved in four studies to assess the effects of management on these swamps.

Study on the effects of cropping on seed banks in wetlands: Cropping affects the quality of the seed bank and results in a reduced diversity and density of plants. But plants in swamps do have the capacity to put up with disturbance and retain some resilience to the effects of cropping.

Study of the effects of land use on the Wannon wetlands: Nineteen study sites had different management, and differences in their position in the catchment, water flows, substrate and channel characteristics, salinity and surrounding land use. But overall, the vegetation communities at sites that were continually grazed throughout the study were distinctly different from sites that were ungrazed, and vegetation at lightly grazed and heavily grazed sites were also different. Land use does affect what occurs on the river floodplain.

Study of seedbanks at different sites along the river and in the channel, at the top of the bank and on the floodplain showed there was connectivity between the sites along the river and across the floodplain. This indicates that this particular system has a reasonably healthy flooding regime.

Study of dry-season grazing on the Wannon River: Sites that had been grazed since the 1830s still had a functional wetland seed bank. But reduction and restriction of grazing pressure improved habitat values in both the floodplain and the top of bank areas (but not the in-channel area). Grazing is a natural event that plants are adapted to, but it generally changes the plant community structure.

Study on the incidence of cropping in wetlands: Recent satellite images showed that about 45% of all the wetlands were cropped or had some incidence of cropping at least around the edges. And that's compared with the data collected in 2011 when just one swamp was cropped. Tracking the changes in specific wetlands using temporal sequences of maps also show significant changes to the amount of cropping even since 2012. So there are significant changes in land use.

Swamps are most vulnerable to cropping is where there's a lot of cropping in the surrounding landscape. Temporary, intermittent or seasonal swamps are more likely to be cropped than more permanent wetlands. People don't crop saline swamps and large swamps are less likely to be cropped. Swamps are equally likely to be cropped or not cropped whether the swamp has been drained or not. High quality vegetation is not recognised as being a hindrance to cropping but a swamp is less likely to be cropped if the farmer has a conservation ethic.

The impact of cropping and the resilience of wetlands

To obtain a successful mono-culture like a crop, you need to apply herbicide, remove impediments, sow seed, undertake cultivation and application of soil ameliorants. This causes the death of targeted and non-targeted species, destruction of habitat and changed soil conditions. With cropping, autotrophs (the primary producers) are removed and detritivores increase. This is particularly apparent in swamps that are cropped and then flood.

But swamps are resilient. Because they're adapted to intermittently wet and dry conditions and other disturbances, seeds are resistant to being killed and will still germinate after cropping. And there's a huge diversity of species; if one species doesn't get established, another one will undertake the same role in the environment. Grazing has an impact on individual plants, but will reduce the dominance of more abundant species and help to maintain the diversity of the community. And, in a landscape with lots of swamps, the connectivity between swamps encourages migration of species. But if you take some of those swamps out, you lose some of that connectivity.

Recommendations

To retain connectivity and biodiversity values in swamps: retain the water regime where possible and reinstate it if possible; conserve the seed bank by just not wrecking it; and control exotic species. Possibly the best management of wetlands in western Victorian is grazing. [The Wetland Intervention Monitoring Program](#) is currently assessing the consequences of different grazing regimes on the biodiversity values of swamps?

ⁱ Playa wetlands are seasonally and temporarily flooded wetlands at the low point in a catchment, often dominated by emergent plant species. http://forestandranger.org/new_wetlands/playa_wetlands.htm

ⁱⁱ Charophytes are six distinct groups of mostly freshwater green algae that are related to modern land plants. <https://www.sciencedirect.com/science/article/pii/S016953470400285X>