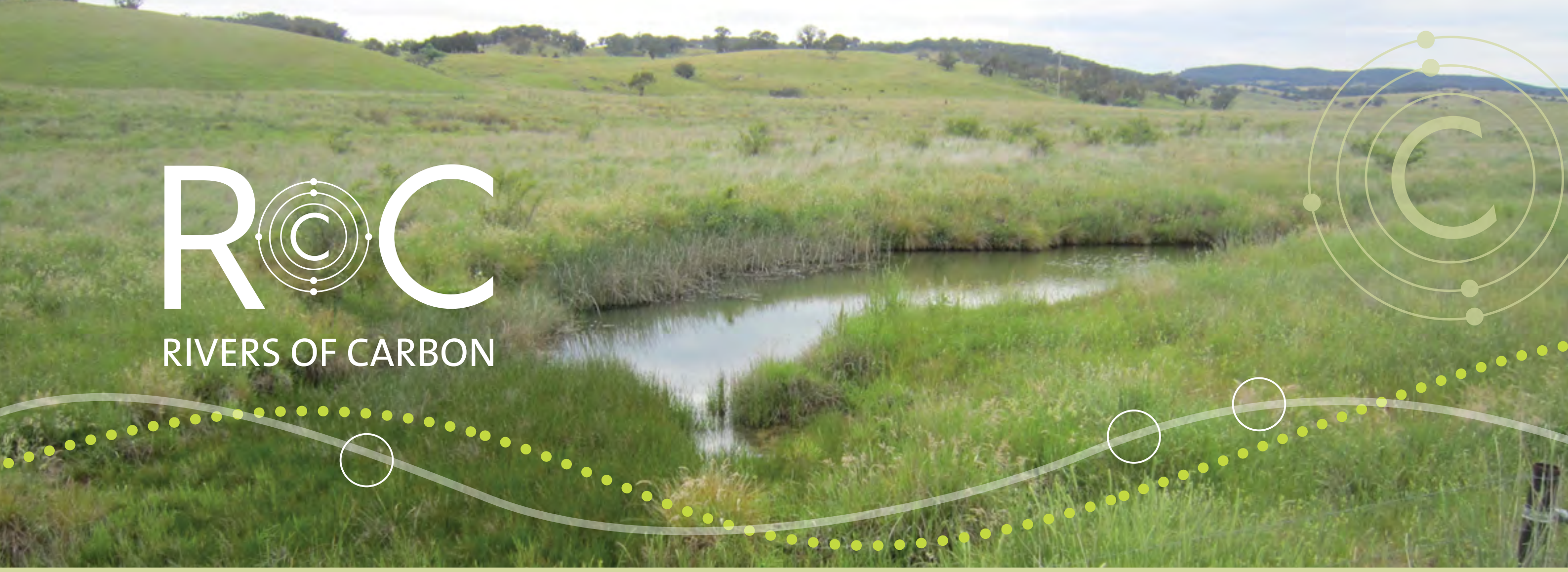


Buffers, sponges and moderators

MANAGING SWAMPY MEADOWS, WETLANDS AND CHAINS-OF-PONDS

Introduction

In the face of a changing climate, one that is expected to bring increased extremes in weather patterns, wouldn't it be nice to have a riparian system you could describe as 'buffers, sponges and moderators'. The swampy meadow does just that, and is a gem when it comes to bringing resilience to the waterways, farms and wildlife of this dry old continent.

What is a swampy meadow?

The swampy meadow is a riparian system that was very common in upland valleys of south-eastern Australia at the time of European contact. It is essentially a floodplain that doesn't have a continuous channel. As the name 'swampy' suggests, the alluvial sediments that make up the landform are regularly saturated, creating conditions that support a dense 'meadow' of moisture-loving grasses, sedges and rushes. Some, but not all, swampy meadows contain chains-of-ponds, which are irregularly spaced along the valley floor (see photo above).

Buffers, sponges and moderators

The role of swampy meadows as buffers, sponges and moderators results from a combination of the landform, the hydrology and the dense vegetation it supports.

Above: An example of a reasonably intact swampy meadow containing a chain-of-ponds. The pond provides an insight into the shallow watertable, which supports dense growth of grasses, sedges and rushes across the valley floor.

Swampy meadows are **moderators** of energy. Any time that flowing water interacts with dense vegetation, the speed and energy of the flow is reduced. The 'roughness' provided by the tall tussocks, sedges and rushes that typify these settings is especially effective at moderating flow velocity, so it is important that management efforts aim to protect this vegetation and maintain good general groundcover. Dispersed flow also moderates energy, so efforts to prevent the formation of flow concentrating features such as erosion gullies, or stock and vehicle tracks are also important. Swampy meadows can also moderate the local microclimate via 'air conditioning' evapotranspiration effects.

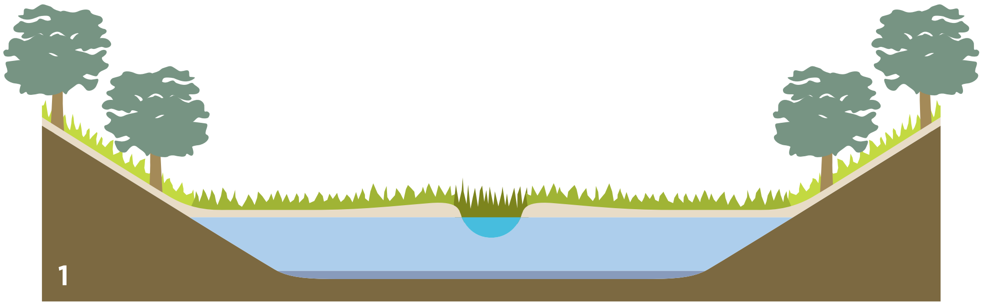
Flow moderation within swampy meadows and other similar landforms around the globe help to **buffer** peak flows as they move through the catchment, reducing the severity of downstream flooding. These systems also buffer the movement of sediment and nutrients, with the dense vegetation acting as an effective filter which can improve downstream water quality and habitat complexity while enhancing on-site productivity.

Swampy meadows also build vertically into an effective **sponge** over time, as captured sediment is combined with organic matter inputs from the highly productive vegetation. The sponge, or alluvial aquifer, fills and stores moisture during periods of flow, and then provides benefits during drier periods to both downstream users, by slowly releasing moisture as baseflow, as well as on-site flora, fauna and primary production by providing access to moisture long after the rest of the landscape has dried out.

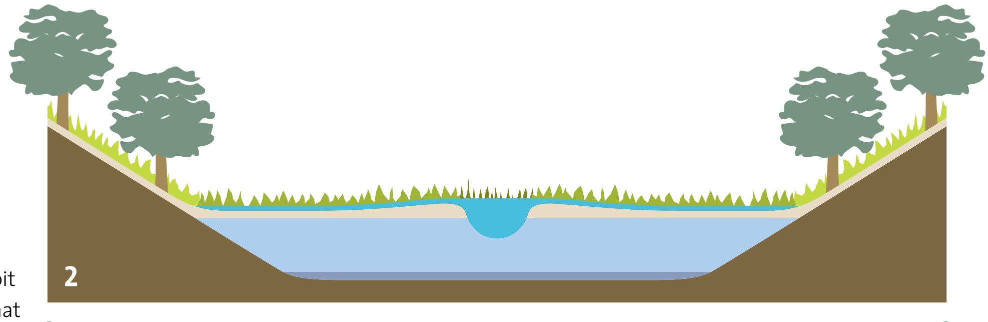
Where are they?

While swampy meadows and chains-of-ponds were quite common at the time of European contact, there are relatively few intact systems still remaining. The vast majority have had deep erosion gullies cut through, with much of the damage occurring over a century ago, often within a few decades of colonisation. The diagrams and descriptions that follow outline the degradation process in cross-section view.

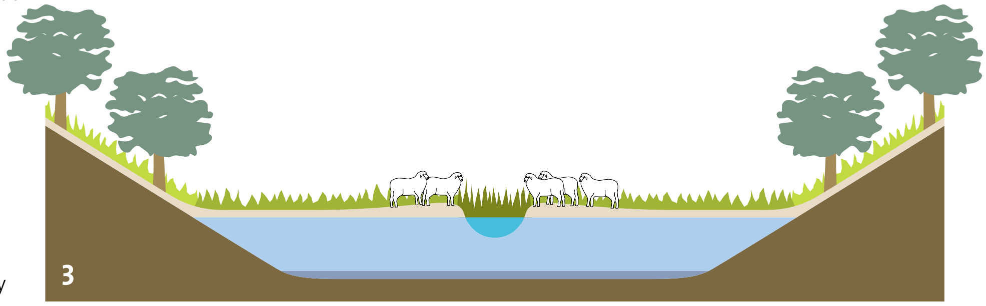
1. A cross section of a swampy meadow with a chain-of-ponds, which were common in upland valleys of south-eastern Australia pre colonisation. Groundwater is stored within the alluvial sediments, with the ponds providing an insight into the typically shallow watertable.



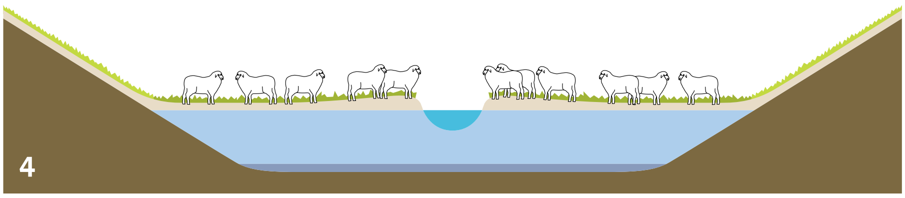
2. Dense riparian vegetation helps to buffer flows, which spread into a passive sheet across the valley floor. Sediment and organic matter accumulate, building a sponge over time.



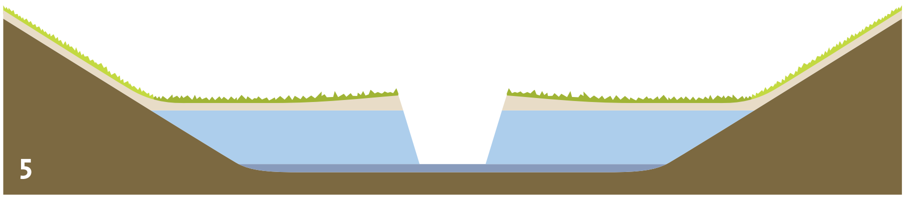
3. Chains-of-ponds offered a consistent water supply that allowed early pastoralists to exploit the extensive native grasslands that they found, which were a product of skilled and deliberate use of fire by indigenous land managers.



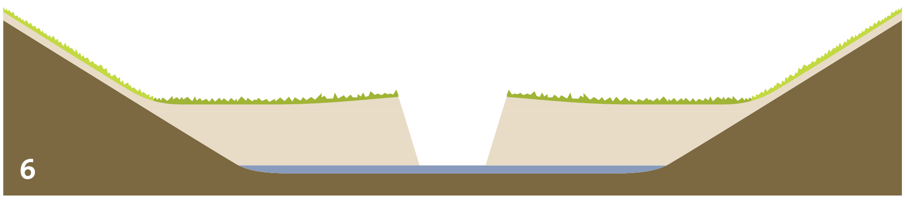
4. The imposition of a range of European land management practices severely impacted vegetation across the entire landscape within a few decades of settlement. Vegetation on valley floors was particularly impacted by the concentration of hard-hooved livestock and deliberate drainage for cropping and stock health purposes.



5. A combination of increased runoff (due to reduced perennial vegetation and severely grazed groundcover) and reduced flow resistance and soil binding root systems on the valley floors, resulted in the widespread incision of swampy meadows.



6. Newly formed gullies acted as drains for the floodplain aquifers, dropping the watertable to the channel floor. The sponge no longer functions and plants on the valley floor are now at the mercy of our erratic rainfall patterns. Within an incised system, even large flows are commonly contained within the channel, resulting in very little moisture or fertility interacting with the surrounding landscape.



An example of the gullies that dominate former swampy meadow settings to this day. While they may be well stabilised, there is minimal interaction between the channel and floodplain or alluvial aquifer.

What effect has this had?

The incision of channels within swampy meadows has removed the majority of the buffering, sponge and moderating functions mentioned previously. Streams have a more intermittent flow regime, with high energy flow concentrated within the channel during runoff events, while low flows don't last as long afterwards. Little moisture is stored within the alluvial aquifer, so plants and animals no longer have access to consistent groundwater and soil moisture, and are instead reliant on our erratic rainfall patterns.

While few targeted ecological studies have been completed, Hazell et al. (2003) found that the channelisation and drainage of these systems is likely to have had negative impacts on a number of frog species. It is reasonable to presume that the near complete removal of such a vast network of moist landforms within our generally dry landscape has had a range of other ecological consequences.

Yuin elder Uncle Max Dulumunmun Harrison points to the cultural significance of swampy meadows to his people, with the 'Gadu Dreaming' of the Yuin tribe beginning in the headwaters of the Shoalhaven River (Harrison & McConchie, 2009), and some large swampy meadows acting as important regional meeting places due to the abundance of tucker.

How can we manage the remnants?

One of the most important management actions to preserve intact swampy meadows and chains-of-ponds is fencing to control stock access. While these settings can provide valuable green feed to landholders during dry times, it is important that the timing of access is based on soil moisture.

During wet periods, soils on the valley floor are more prone to damage via compaction, pugging and track formation. It pays to keep stock out during wetter periods, which generally coincides with decent feed being available elsewhere. Once the rest of the land has hayed off, the green feed that persists within swampy meadows can provide the most value, with soil moisture having dried off somewhat. Targeted use during drier periods can also help to reduce the negative impacts of liver fluke that can be commonly associated with swampy sites.

Another continuing threat to intact swampy meadows is channel formation, which occurs as a result of headwall erosion migrating from downstream. Advice can be sought from local natural resource management agencies and other associated organisations on appropriate avenues for assistance in armouring and halting the active erosion face.

Can we fix them?

The channels within many incised swampy meadows have now stabilised and commenced a natural infilling process. In-stream wetlands are characterised by the establishment of extensive stands of macrophytes (reeds) such as Typha and Phragmites, which are able to trap and bind even fine sediment, raising the channel floor over time. Fencing and stock management to protect vegetation can help to facilitate this process.

An in-stream wetland of dense Typha has established within an incised channel in a former swampy meadow. The reeds are able to capture and bind sediment, slowly raising the floor of the channel over time.

A platypus enjoying a midday swim in one of the ponds within a swampy meadow in the Orroral River, Namadgi National Park.

While the in-stream wetlands described earlier will cause the system to eventually aggrade (infill), this could take centuries or even millennia depending on the rate of sediment movement within the catchment.

There are some instances in which we may be able to speed up the repair process and reinstate a range of the positive functions carried out by intact swampy meadows and chains-of-ponds. By understanding the historical surface and groundwater pathways within these settings, strategic interventions may be u sed to reinstate some of these processes. There can be considerable risks and regulatory requirements associated with attempting such work, so professional advice should be sought.

The strategic placement of structures within an incised swampy meadow has helped to reinstate sheetflow on the floodplain of Rod Hoare's property *Cadfor*, buffering high flow conditions. Photo R. Hoare.

SWAMPY MEADOW MANAGEMENT SUMMARY

1. Fence swampy meadows to control stock access.
2. Avoid grazing and vehicle access when soils are wet to protect soil structure and groundcover (generally coincides with feed being available elsewhere).
3. Protect pond surrounds, if they are present, with portable fencing, particularly vegetation on the main flow entry and exit locations.
4. Providing stock with access to high ground to camp can help to transfer captured fertility from floor to ridge.
5. Valuable feed is often found between less palatable tussocks. Monitor grazing pressure and duration to ensure that good groundcover is retained.
6. Avoid unnecessary disturbance of tussocks as these play an important role in moderating flow.
7. Inspect for headwall erosion and seek advice if channels threaten to migrate upstream through the system.
8. Strategic tree and shrub plantings around the margin of the swampy meadow can provide complementary habitat while also protecting soil moisture.

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Harrison, M.D. & McConchie, P., 2009. *My People's Dreaming: An Aboriginal Elder speaks on life, land, spirit and forgiveness*. Sydney: Finch Publishing.

Hazell, D., Osborne, W. & Lindenmayer, D., 2003. Impact of post-European stream change on frog habitat: southeastern Australia. *Biodiversity and Conservation*, 12, pp. 301–20.

THIS TECHNICAL NOTE WAS WRITTEN BY CAMPBELL WILSON OF EARTH INTEGRAL.

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