South Gippsland Landcare Network's Greening Gippsland's Dams project

Case study: impacts of complete exclusion, restricted and uncontrolled access of farm dams on water security, stock management and biodiversity

This two-year project gave South Gippsland Landcare Network (SGLN) the opportunity to restrict stock access to an existing farm dam and monitor the impacts on water security, stock management and biodiversity. SGLN was able to compare the financial and environmental costs and benefits of restricted access, full exclusion and unfenced dams and consider what types of modifications achieve the best biodiversity outcomes.

This project is supported by SGLN, through funding from the Australian Government's Future Drought Fund, the Victoria Drought Resilience Adoption & Innovation Hub (Vic Hub) and Food & Fibre Gippsland as the South-East Node of the Vic Hub.

Findings

- Water security, water quality, stock management and welfare and biodiversity were significantly higher in the restricted access and full exclusion dams than the unfenced (control) dam.
- Both restricted access and full exclusion delivered water security by arresting the erosion threatening the integrity of the dam walls.
- Restricted access delivered similar stock management and biodiversity benefits to full exclusion, but was more expensive.
- Restricted access offered a more reliable stock watering solution than full exclusion which carried the risk of pump or pipe failure.
- Dams containing aquatic vegetation had higher water quality and hosted a greater number and variety of macro-invertebrates than dams without aquatic vegetation.
- Dams with shallow margins (< 30cm), and areas that dry out in summer, contained more aquatic vegetation than dams with steep margins.
- The best water quality and biodiversity outcomes will be achieved by restricting or excluding stock access and modifying the dam margins to encourage the growth of aquatic vegetation.

Restricted access dam (Drift Media)

Full exclusion dam

Unfenced (control) dam

Australian Government Department of Agriculture, Fisheries and Forestry | Future Drought Fund | Vic Hub DROUGHT & INNOVATION | Food & Fibre Gippsland | South Gippsland Landcare Network

Background

The owners run beef cattle over three 100 acre properties that are geographically close but not adjoining at Tarwin Lower. The herd increases to 100 cows and calves and up to 100 yearlings in spring and early summer. The herd is pasture-fed with some hay bought-in for winter if necessary.

The owners undertook a major subdivision of the Home Farm in 2016 to improve grazing management and protect a spring-fed dam that was suffering erosion. That dam was fenced off from stock and revegetated in 2016. It is the basis of an extensive reticulation system that feeds troughs in every paddock on the Home Farm.

Left: spring-fed dam in 2016

Above: spring-fed (full exclusion) dam in 2024

Left:: spring-fed (full exclusion) dam in 2024

The Top Block was acquired in 2018 and the ideal paddock subdivision is still being contemplated. Until this project, all dams on the Top Block were unfenced, suffered some degree of erosion and required regular cleaning. The outflow point of the dam in the paddock that is used for spring calving was at risk of collapsing and the boggy inlet made stock management difficult.

The Top Block is on an incline and this dam abuts the downside fenceline making it difficult to instal a trough and gravity-feed system. The owners were keen to explore a restricted access design for the dam and to compare it with the benefits delivered by the full exclusion dam on the Home Block.

Top: dam on Top Block showing signs of erosion.
Above and left: inspiration for restricted access dam (on property previously owned by the Trease family at Inverloch).

Greening Gippsland's Dams: case study

Ramp construction details:

4m wide watering point

25 MPa (megapascal strength)

80 slump (fluidity)

20-25% slope

Reinforced with plastic waste

Lower planks made of ironwood for water resistance

Process

The owners were guided by Chapter 2 of CSIRO's Natural Asset Farming (Enhance Farm Dams) along with advice from their fencing and earthworks contractors when modifying the dam on the Top Block. The goal was to give cattle access to water at all times of the year but prevent them from grazing the dam banks or wallowing in the dam.

The entire dam including all the boggy inflow was fenced off using the same mix of plain and electric wiring as the rest of the farm. The dam was then drained and a concrete ramp leading to the deepest point of the dam was built on the most stable section of land. The ramp was fenced using water-resistant hardwood.

1200 seedlings were planted within the fenced area around the dam. Plant selection (see plant list at end) for the banks and fenced-off areas was guided by and sourced from the Wonthaggi Seedbank & Nursery. All species are indigenous and many are specially suited for wetland areas.

The owners constructed a small floating island from a wooden pallet, shade cloth and plastic bottles to provide extra habitat for birds and fish. The island was vegetated with aquatic species from the fenced off dam.

Cost

Restricted access (ramped) dam	
Fencing around dam (150m)	3600
Pump hire & fuel	450
Earthworks	3350
Concrete & fencing	8340
Revegetation (0.16ha)	1000
	$16740

Full exclusion dam	
Fencing around dam (180m)	3500
Solar pump & energiser	4450
Header tank	5000
Trough & float	650
Piping	3000
Revegetation (0.2ha)	1000
	$17600

The total cost of the restricted access dam was $16740, with most of the expense being construction of the concrete ramp.

The cost of fencing the full exclusion dam was $17600, with most of the expense being installation of the header tank which is located 700m uphill from the dam, and purchase of a solar submersible pump. This system provides water to most paddocks on the Home Farm, including 6 small horse paddocks. On a per paddock basis, this system is considerably cheaper than the restricted access dam.

A more straightforward comparison would have involved fully fencing a dam and gravity feeding to one trough. In this case, the fully fenced dam would have been considerably cheaper to construct than the restricted access dam.

Above: restricted access dam, less than one year after taking action to prevent the dam failing due to erosion at the outflow point (top right). Aquatic vegetation is visible in the shallow margins at the lower and right hand margins of the dam. (Drift Media)

Water security and stock management

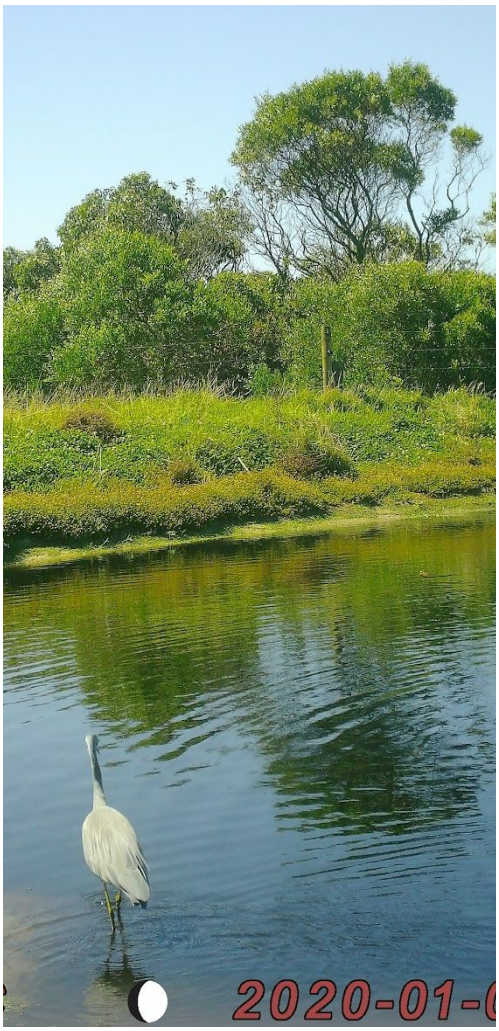
The erosion threatening water security at the outflow point of the restricted access dam ceased immediately after the area was excluded from stock. Similarly, the inflow areas have stabilised. In comparison, erosion around the unfenced dam is worsening.

The owners believe that evaporation losses from the full exclusion dam have reduced as a result of the dense revegetation and hope the same will occur at the restricted access dam. However, water cycling via evaporation and transpiration was not able to be measured as part of the project.

The owners reported they hadn't appreciated how difficult it was to move stock around the restricted access dam until the area was fenced off. The risk of newborn calves drowning in the dam has virtually been eliminated now that cows have no access to the dam banks.

There has been a lot of natural regeneration of grasses and aquatic species around the restricted access dam, particularly in the marshy areas and the margins where the water level fluctuates with the season. Revegetation losses were high (around 85%) probably due to deer and wombats, but this was expected and more planting will occur in the future. Good shade and shelter for stock (as seen around the full exclusion dam) is expected within 5-7 years.

The owners have noticed that the cattle no longer camp in the vicinity of the restricted access dam. This suggests that restricting access to the dam may have had the additional benefit of encouraging more even grazing across the entire paddock.



Some of the images captured at the restricted access dam (note the date stamp was set up incorrectly; should have been 2023).

Biodiversity monitoring

The owners borrowed field cameras from SGLN and installed them at each of the dams to detect wildlife, and downloaded and used the free FrogID app to record frog calls. The cameras were in action over several months; frog calls were recorded intermittently.

Wombats, snakes, deer, foxes, snakes and several species of birds were observed at the restricted access dam and three species of frog calls were identified (striped marsh frog, spotted marsh frog and common toadlet).

Several species of birds were observed at the full exclusion dam and three species of frogs were recorded (eastern banjo frog, common toadlet and brown tree frog). No mammals or reptiles were observed.

Wallabies and kangaroos were observed at the control dam. Eastern banjo frog tadpoles were found at the control dam but no frog calls were recorded.

Above left: Jasper Davis & Balin Branch-Spence at the restricted access dam.

Above right: Ty Matthews at the full exclusion dam
(photo: Food & Fibre Gippsland)

Link between aquatic vegetation, water quality and biodiversity

SGLNworked with Deakin University senior lecturer Ty Matthews and two third year environmental science students Jasper Davis and Balin Branch-Spence (Deakin University is a partner in the Victoria Drought Resilience Adoption & Innovation Hub). They took water samples from the full exclusion, restricted access and unfenced dams immediately after construction of the ramp at the restricted access dam.

At Ty Matthews' suggestion, the owners released two species of endangered native fish (silver pygmy perch and dwarf galaxis) in the full exclusion, restricted access and another dam that was excluded from stock (causeway dam), as a conservation strategy. The causeway dam was also monitored for water quality and biodiversity.

The water quality indicators (turbidity, pH & dissolved oxygen) were highly variable depending on the season and, in the case of the restricted access and control dams, the timing of grazing. Not surprisingly, turbidity increased after stock were present in both dams while the full exclusion dam remained clear.

The number and diversity of macroinvertebrates at the restricted access dam was initially very low but increased dramatically within a few months of the works being completed. Notably, mayflies which are highly sensitive to water quality, were detected at the restricted access dam. Macroinvertebrate diversity was very high at the full exclusion dam, moderate at the causeway dam and very low at the control dam.

Dissolved oxygen was consistently lowest in the control and causeway dams. Both Ty and ecologist David Carew concluded this to the lack aquatic vegetation in both dams. In the control dam, aquatic vegetation is unable to establish itself because of stock trampling. In the causeway dam, the edges are too steep to allow aquatic plants to root, and do not dry out sufficiently to promote germination.

In contrast, aquatic vegetation is thriving in the full exclusion dam and established itself very quickly in the restricted access dam in the shallow margins and outflow point. Some species were planted by the owners but many regenerated naturally as soon as stock were excluded from the dam banks.

Our conclusion is that the presence of aquatic vegetation is critical to water quality and biodiversity.

Conclusion

The restricted access dam has met the owners' requirements regarding water security, water quality and stock management. Biodiversity in and around the restricted access dam is greater than the unfenced control dam and is expected to increase as the aquatic and terrestrial vegetation becomes more established. Shade and shelter will increase correspondingly.

The results of the project have inspired the owners to modify other dams on the Top Block to arrest erosion and improve water quality, grazing management and biodiversity. They are more likely to fully exclude rather than restrict stock due to the cost and topography of those dams (it will be possible to gravity feed to a trough installed below each of the dams).

Importantly, the owners will ensure that each dam includes shallow margins, approximately 30cm below the high water level and areas that will dry out seasonally, to encourage aquatic plants to become established.

For more information about this project, including a video, go to www.sgln.net.au

Greening Gippsland's Dams: plant list

Rushes, sedges, grasses

Ficonia nodosa (Knobby club-sedge)

Juncus amablis (hollow rush)

Juncus sarophorus (broom rush)

Rytidosperma setaceum (bristly wallaby grass

Machaerina rubiginosa (twig grass)

Understory plants

Lythrum salicaria (purple loosestrife) (aquatic)

Ordnuffia reniformis (running marsh flower) (aquatic)

Goodenia ovata prostrate (hop Goodenia)

Goodenia radicans (shiny swamp-mat)

Leucopogon parviflorus (coastal beard heath)

Leptospermum continentale prostrata (prickly tea tree)

Shrubs/midstory plants

Acacia suaveolens (sweet wattle)

Acacia verticillata (prickly Moses)

Bursaria spinosa (sweet Bursaria)

Correa alba (white Correa)

Goodenia ovata (hop Goodenia)

Leptospermum continentale (prickly tea tree)

Pultenaea daphinodes (large-leaf bush pea)

Rytidosperma setaceum (bristly wallaby grass

Machaerina rubiginosa (twig grass)

Hakea nodosa (yellow Hakea)

Hakea ulicina (furze Hakea)

Trees

Allocasuarina paludosa (scrub/swamp sheoak)

Banksia Integrifolia (coast banksia)

Banksia marginata (silver banksia)

Eucalyptus viminalis (coast manna gum) (for koalas!)

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