Improving Biodiversity of Farm Dams

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NATIONAL PROGRAM FOR
Sustainable Irrigation

Cooperative Research Centre for
IRRIGATION FUTURES

IMPROVING BIODIVERSITY OF FARM DAMS

On-farm water storages have an immense potential to support biodiversity. Creating better habitats in farm dams is one of our best opportunities to increase biodiversity in agricultural landscapes, making farming more ecologically sustainable.

The biodiversity potential of farm dams is enormous. Drawing on studies from around the world and a growing wealth of experience here in Australia, this brochure, along with the case study brochure that accompanies it, illustrates how simple changes to farm dams can make a huge difference.

Waterplants and Water Regimes

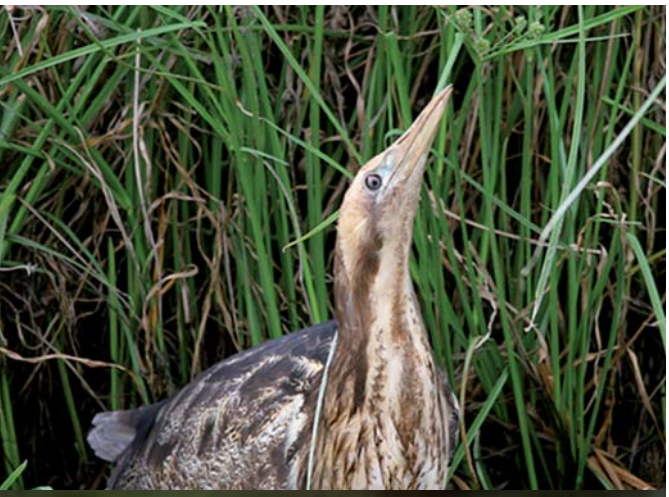
The ecology of wetlands and the biodiversity they support are strongly influenced by water regimes, such as the depth, duration, frequency and timing of flooding. The typically deep (two metres plus), largely permanent water regimes of many farm dams tend to prevent the development of diverse waterplant communities, which are so important for other forms of biodiversity.

The best way to foster a diverse and healthy waterplant community in your farm dam is to provide a range of water depths, especially variable shallows (1-100 cm) that have an ephemeral water regime. This creates a mosaic of habitats, benefiting biodiversity. High levels of phosphorus, nitrogen and other nutrients, especially without disturbance regimes like fire and the wetting/drying cycles of ephemeral water regimes, tend to favour competitive and invasive species like the Cumbungi and the Red Azolla.

As a general rule of thumb, ensuring waterplant communities are only ever at early successional stages helps to avoid the domination of certain species, maintaining diversity. Avoiding large fluctuations in water levels also helps support diverse waterplant communities and can be achieved by having various compartments within your dam.

The most commonly recognised waterplants are emergent species but there are also floating (with roots attached or unattached to the bottom, depending on the species), and submerged species. Planting aquatic vegetation can help to establish healthy waterplant communities but much of the hard work is done for us by waterbirds (see "Waterbirds - Dispersers of Life"), and many seeds, spores and other reproductive plant. parts are found in the water of channels or transported by wind. Some practitioners recommend adding mud (that contains seeds, invertebrate eggs etc.) from nearby wetlands to speed up the process of colonisation but this will only be successful if the water regimes are appropriate.

"The key principle to attracting more species to your farm dam is to increase habitat diversity."



Catering for Threatened Species

Even rare and threatened species, like the four pictured here, can respond quickly to the creation of a suitable wetland habitat in farm dams.

The Brolga prefers to breed in wetland areas that are about 30 centimetres deep with aquatic plants about 90 centimetres in height. The Australasian Bittern favours deeper water with dense but patchy reedbeds of Cumbungi or Phragmites that are two or three metres in height.

The Australian Painted Snipe avoids tall vegetation. This particular species prefers dense, low waterplant cover to hide in and needs areas with water less than about five centimetres deep, including mudflats. The Southern Bell Frog often relies on submerged aquatic plants for breeding.

Waterbirds - Dispersers of Life

Many people have speculated that aquatic plants and invertebrates arrive in isolated Australian wetlands from the faeces of waterfowl and other waterbirds. Well, it's true! Fascinating recent research on Australian waterbirds in the Macquarie Marshes, by Andy Green from the Doñana Biological Station in Spain, and his Australian colleagues, has confirmed that waterbirds can disperse viable propagules (e.g. seeds, spores, tubers, eggs) of a wide range of waterplants and aquatic invertebrates.

In the first ever detailed study on this subject in Australia, propagules from 14 of 19 waterplant species found in collected bird faeces were viable and germinated back in the laboratory. Aquatic invertebrates like seed shrimp emerged from the hatching experiments when faecal samples were inundated, and live adults of some invertebrate species were also found in the faeces. Not surprisingly, the faeces of different species of waterbird contained distinct suites of aquatic plant and invertebrate species, reflecting the different diets of waterbird species and their unique roles as dispersers. Unlike creating habitat with native plants in other parts of the farm, like tree and shrub plantings, in farm dams waterbirds seem to do much of the hard work for us.

Interestingly, one of Andy´s samples was from a Pelican and contained the highest diversity of propagules, which at first might seem a little strange because Pelicans primarily feed on fish but propagules ingested by fish and dispersed indirectly by fish-eating waterbirds may be particularly important for ¨stocking¨ isolated wetlands when they fill.

Buffer Zones and Planting Trees

Avoiding continuous grazing pressure allows grasses, shrubs and trees to develop, which can support a buffer area around the farm dam. Having native vegetation beside your dam will increase the biodiversity value of the area, but planting trees around the entirety of a farm dam is not recommended because too much shade can inhibit waterplant growth and many waterbirds avoid areas with trees.

More Habitat Equals More Biodiversity

Typical farm dams don't provide the necessary habitat for most wetland dependent species. The Australian Wood Duck is a rare example of a species that has actually benefited from the proliferation of farm dams in Australia. The more habitats in your farm dam, the greater variety of species it will support; from invertebrates to frogs and bats, as well as various birds. Each has its own niche with unique requirements.

Wetland wildlife species are very responsive to new habitats. Waterbirds, in particular, are highly mobile with some migrating all the way from places like Siberia and Japan.

Overrated Islands

The construction of islands has been a common way of improving biodiversity in farm dams in Australia.

Species like the Pacific Black Duck are often recorded nesting on these islands, but in general most islands have a limited capacity to significantly improve biodiversity in farm dams; they are typically very small in area and steep-sided, lacking shallows and healthy waterplant communities. Larger, gently sloping islands are capable of supporting much more biodiversity than conventional islands. A cluster of smaller, gently sloping islands would also be capable of supporting a range of biodiversity, alongside other parts of the dam that contain ephemeral shallows and waterplants.

A Compromise?

Shallow water and waterplants, two of the key components for increasing biodiversity, need not compromise existing farm dam management principles. Large waterplants use water rapidly, but by breaking wind they help offset these losses, while small waterplants can actually reduce evaporation. Waterplants and shallows improve water quality, alongside other benefits.

Disking for Diversity

Simple changes that increase water depth variability can make a huge difference, and promote biodiversity. Disking (using agricultural machinery) to create ridges and furrows (gilgais and crab-holes), which increase topography, has the potential to achieve a range of aims. Disking improves overall farm dam health and makes agriculture more sustainable.

Diverse Design Improves Water Quality

On top of potentially supporting high biodiversity levels, farm dams can also play an important role in the cycling of nutrients and improving water quality. Fortunately, what is good for biodiversity also tends to be good for the water itself. For example, many waterplants (and the micro-organisms they support) have an amazing ability to reduce the amount of suspended sediment, increase oxygen content, and trap or remove phosphorus and nitrogen, along with heavy metals, pesticides and other contaminants. Incoming ´dirty´ water, such as irrigation drainage, should never be so polluted that it impacts negatively on existing biodiversity or the overall ecological health of the farm dam.

A recent study of nutrient retention and biodiversity in constructed wetlands by Lars-Anders Hansson of Lund University in Sweden and his colleagues has highlighted the unique functional roles of wetland features. High nitrogen retention and high biodiversity resulted from shallow water depths, large surface areas and high shoreline complexity, whilst smaller, deeper wetlands were thought to be more efficient in phosphorus retention. The key point in designing or redesigning farm dams is diversity.

Imitating Natural Wetlands

The ecology of natural wetlands can help guide our management of farm dams, providing many clues about how to enrich biodiversity. Compared to farm dams, natural wetlands tend to have larger, more complex shorelines that contain variable shallows and diverse waterplant communities.

Inland Australian wetlands, in particular, are highly variable and dynamic, with ephemeral water regimes. The 'boom and bust' cycle of ephemeral wetlands, when applied to farm dams, greatly benefits biodiversity. Within minutes of being filled, a wetland that has been dry for months, or even years, starts to spring to life. There is a hive of activity after only a few days or weeks. Waterplant seeds and spores germinate and grow rapidly, invertebrates and frogs start breeding, and waterbirds arrive in great numbers.

Increasing biodiversity in farm dams helps to make them function more like the natural wetlands that provide us with many ecological services, such as clean water.

Track the Results

Enjoy the rewards of your efforts and guide future farm dam management by monitoring biodiversity. Keeping records of birds and establishing photo points for waterplants are possible monitoring methods.

Management of Cumbungi and Phragmites

Cumbungi, also known as Bulrush, includes two species; Typha orientalis and Typha domingensis. Phragmites are also known as Common Reed. Cumbungi and Phragmites can grow to four metres tall and form dense stands. They are common to irrigation landscapes, often benefiting from water depths of up to two metres, especially over summer when they thrive.

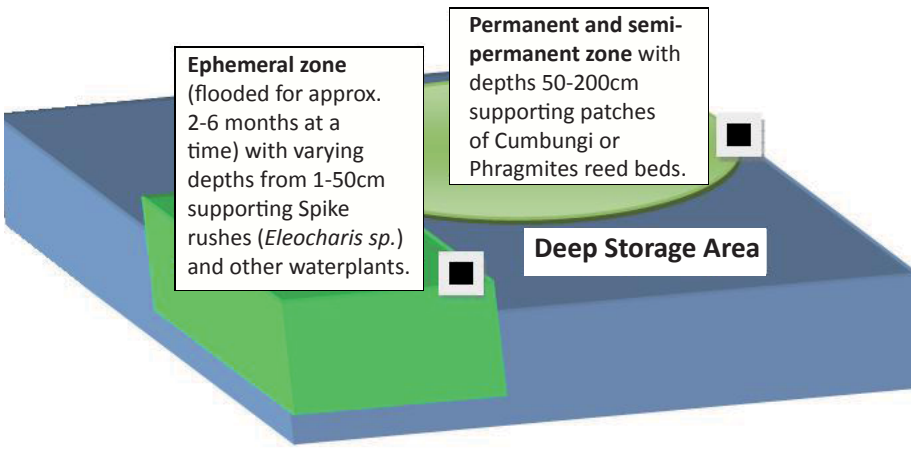
Stands of Cumbungi and Phragmites provide important habitats for many native wildlife species, but when they dominate a wetland the overall biodiversity plummets. Altering the water regime, especially the depth and duration of flooding, is the simplest method to limit growth. Other control methods can also help achieve a balance of patchy, young stands.

In North America and Europe, Cumbungi and Phragmites are often cut, or managed to maintain floristic diversity, and a balanced habitat structure. Around the world, Phragmites reeds are also harvested commercially to produce roof thatch. Recent research in France by Brigitte Poulin has shown reed harvesting and a summer drawdown can actually enhance the habitat of the threatened Eurasian Bittern by creating open water areas that increase the amount of reed bed edge where bitterns tend to feed.

Other studies have shown invertebrates and small birds are disadvantaged by continual reed management. Elena Valkama from Finland recently reviewed reed management in Europe and concluded a rotating one to two year cycle should be implemented. More research is needed into what the period of rest between rotations should be but the idea is to manage reed structure so the often competing needs of birds, invertebrates and plants can all be met at any given time by providing a mosaic of habitats.

Landscaping for Biodiversity

Earthworks to create shallows that have variable water depths (including mudflats), ephemeral water regimes, and healthy waterplant communities will attract a wide range of new species, substantially increasing biodiversity. Avoiding constant grazing pressure from stock will enable shallows and waterplants to flourish, resulting in even more species utilising your farm dam. The basic conceptual diagram illustrates how a dam could be designed or modified to include compartments with different functions, where water levels are managed independently (black squares represent regulators). Additional habitats can be created by adding logs, straw and other materials that increase diversity in farm dams.



Avoid Grazing...

As a general rule for improving biodiversity, it is best not to graze farm dams, especially when they contain water or mud. Sometimes grazing can be used to maintain habitat diversity and manage vegetation structure (e.g. crash-grazing stands of Cumbungi or Phragmites to prevent domination), or help control exotic weeds and other undesirable, invasive plants. It is worth remembering though that grazing is just one of many methods available to achieve such aims (see article titled "Management of Cumbungi and Phragmites").

Stock, especially cattle, can have a detrimental effect on the biodiversity values of farm dams through trampling and eating wetland plants, disturbing sediment and muddying the water, compacting the soil, increasing nutrient levels and promoting weeds, as well as disturbing waterbirds and other wildlife. Grazing patterns tend to be concentrated around watering points like farm dams and the typical denuded, barren farm dam is often a product of a heavy and continuous grazing regime.

Fencing to exclude stock or at least managing grazing regimes so that the area can be rested for long periods, especially when wet, can make an enormous difference to biodiversity. To ensure stock still have access to water, it can be pumped to a stock tank using a simple system like a ball and float valve. Stock exclusion has the added benefit of reducing the risk of Liver Fluke, Johnes disease and other threats to stock health associated with self-contaminated water.

more information

For more information on the National Program for Sustainable Irrigation's research programs and projects, visit NPSI's website at **www.npsi.gov.au**.

For more information on the CRC for Irrigation Futures' research programs and projects, visit the CRC's website at **www.irrigationfutures.org.au**.

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