



refreshing
rivers
Healthy water, healthy land.

Low-Cost Solutions to Enhance Your Waterway

A guide to boost on-farm biodiversity and
waterway health using low-cost methods



The Refreshing Rivers Program is a collaboration between government, industry, research, and Community organisations, led by Local Land Services. This Program has been assisted by the New South Wales Government through its Environmental Trust.

Native vegetation near or within waterways such as creeks, rivers, wetlands and farm dams holds enormous value for farming operations and on-farm biodiversity. They serve as natural filters for pollutants, provide habitat for a diverse range of species, provide shade and shelter for livestock, connectivity to allow native animals to move through the landscape, act as buffers against soil erosion and often contain sites of aboriginal cultural significance. The health of these habitats directly impacts water quality, biodiversity on the farm and also downstream water users.

The riparian environment presents challenges for the establishment of native vegetation as the seedlings are continuously affected by grazing management, changes in water levels, stream flow and the processes of erosion and sedimentation.

Traditionally, before waterways can be revegetated they need to be fenced to restrict livestock access. But in certain situations where fencing is not an option, what are some of the possible solutions to enhance riparian native vegetation?



This guide covers a number of practical solutions and provides the key steps to help put these solutions into practice. These include:

1. Restricting Livestock Access
2. Wooden stakes
3. Individual Paddock Trees
4. Fish Hotels
5. Floating Habitats
6. Long Stem Planting
7. In Situ Cages



1. Restricting Livestock Access

Frequent or continuous grazing of waterways is highly likely to degrade the riparian zone ie the land adjacent to the waterbody. As native vegetation is quite palatable to livestock, grazing prevents native plants regenerating and the grazed short grass cover has a low habitat value for fauna. Other adverse impacts from grazing include stream bank erosion and reduced water quality.

To protect the health of your waterway, complete stock exclusion is the preferred course of action. If, however, the site is unable to be fenced conventionally there are options that could be considered such as:

- **Creating discrete riparian paddocks** - to allow longer rest periods between grazing. Fences can be installed beyond the immediate riparian area to create a riparian pasture, which can be carefully grazed as a part of a rotational grazing system.
- **Temporary electric fencing** - temporarily resting riparian areas from grazing until there is sufficient recovery to recommence grazing according to sustainable management principles.
- **Virtual fencing** - using GPS collars and wireless technology may also become a viable option in the future. Under this system, an on-animal device is used to confine or move livestock without using fixed fences.

If riparian land is to be grazed at all, it should only be when most of the vegetation is dormant and the soil moisture is low. Consider adjusting the grazing rate and frequency to graze for a very short period of time followed by a long period of rest.

It is also important to maintain a minimum of 80% ground cover at all times. These thresholds will provide adequate vegetative cover to protect your riparian land from the impacts of grazing.



Native vegetation along waterways, such as reeds and sedges are very palatable to livestock

2. Wooden Stakes

Researchers at University of Melbourne have discovered that the humble garden stake can be used in waterways to restore the natural environment and create habitat for aquatic species.

This method is useful in small to medium streams degraded by land clearance where debris is either swallowed by the sand or swept away in winter floods because of the lack of branches and logs that can hold the debris in place.

The premise is that leaves, branches, bark, twigs and other natural debris that travel downstream are caught or snagged on the stakes. It's this build-up that provides a source of food and shelter for a range of animals – like fish, insects, snails and other invertebrates.

Preparation

1. You will need 25 to 50 hard wood stakes, approximately 1.2 m high
2. Select a 30-50m long, sandy, straight section of the stream with no bends

Installation

1. Hammer stakes in pairs that are 25 cm apart
2. Hammer stakes deep enough so at least the tips of the stakes will protrude in a moderate flow
3. Stagger the remaining stakes at approximately 1-2 m perpendicular to the stream flow and 2 to 3 m apart downstream
4. Avoid placing stakes in areas where there are sharp bends
5. Over time leaf litter and small debris will be snagged on the debris creating a small biodiversity island
6. Check stakes from time to time to ensure willow and other exotic plant debris has not established.



Wooden stakes in Hughes Creek – image courtesy of Goulburn Broken CMA

3. Individual Paddock Trees

The individual paddock tree method can be used to establish native trees along the higher banks of waterways. The native trees are individually protected by a livestock proof cage. After several years the cages can be removed and re-used.

Preparation

1. Use native seedlings that have an upright growth such as Blakelys Red Gum (*Eucalyptus blakelyi*) or River She Oaks (*Casuarina cunninghamiana*)
2. Purchase pre-rolled reinforced mesh guards that are at least 1.6 m high and 1 m wide

Planting

1. Dig holes twice as deep as the plant pot. Place some of the loose soil back in the hole.
2. Pour approximately 1 litre of water into the hole and allow it to soak in.
3. Place the plant in the hole and backfill carefully using soil and water alternately to ensure that no air pockets are left.
4. Place the mesh guard over the tree.
5. Secure the mesh guard using 4 steel posts and tie wire
6. Generally no further maintenance is required.
7. The cages can be removed after 3-5 years and reused to continue the process.



4. Fish Hotels

Fish hotels are an innovatively designed wooden construction. They consist of criss-crossed wooden beams to create a complex system of habitat that sits on the riverbed. Made from natural materials, they are environmentally friendly and a perfect location for native fish to inhabit. They can also be used to protect in stream vegetation from being damaged by birds, turtles, crayfish and fish.

Note – you will need waterway approval to install these structures into waterways but not into farm dams and storm water retention basins. For further information visit: <https://www.dpi.nsw.gov.au/fishing/habitat/help/permit>

Preparation

1. Use reclaimed hardwood timber where possible.
2. Starting with the base layer, cut timber into four pieces approximately 75 to 100 cm long, depending on the size of the hotel desired.
3. Lay these 4 pieces on the ground to form a square shape.
4. Drill holes through the beams and secure using wooden dowel or natural rope.
5. Continue to add layers by stacking and criss-cross beams 6-10 layers deep.
6. Fill the hotel with additional woody material, aquatic plants (see table XX for further details) and/or sticks for extra complexity.

Installation

1. Place structure into deeper sections of the waterway
2. Weigh down the fish hotel with rocks as even heavy hotels will float away



Images courtesy of Ozfish

5. Floating Habitats

Floating islands are unattached islands that can be constructed from a wide range of materials. When planted with aquatic plants, they form rafts of water plants that produce a large root mass, useful for encouraging microbial communities which enhance water quality. They also provide habitat for fish, turtles, frogs, nesting birds and rakali (native water rats), and create shade in deeper areas of the dam or wetland.

Floating islands need to be maintained, repaired or replaced regularly. If using plastics, select tough, long-lasting plastics. Natural materials are preferable as they do not create pollutants, but they have a shorter lifespan.

Preparation

1. Construct 'raft' from materials such as a wooden pallets or lengths of PVC pipe.
2. Cover frame with shade cloth or hessian and secure using tie wire, zip ties or baling twine.
3. Add a layer of potting mix combined with straw or coconut fibre.
4. Weigh down floating island with a large rock.
5. You may need to add buoyancy such as clean drums/juice bottles secured under the raft.



Planting

1. Select semi submergent wetland plants such as rushes, reeds and sedges (see table on page 11 for further details).
2. Plant these into the island with approximately 8-10 plants/sq metre.
3. Secure plants to the floating island with wire to prevent animals pulling them out.

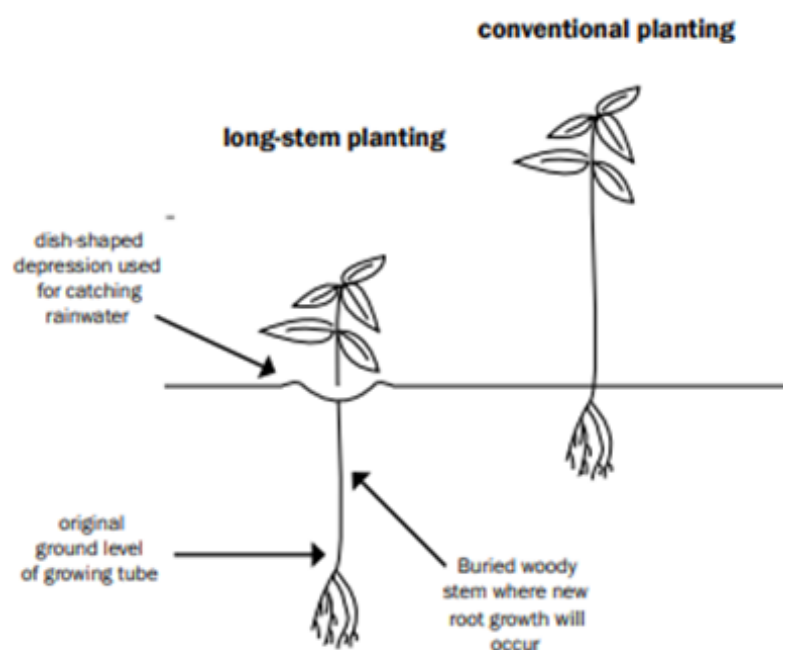
6. Long Stem Planting Method

The long-stem planting method was pioneered by Bill Hicks in the early 2000s for use on river banks in the Hunter Valley. It is an innovative way of planting that can result in higher survival and growth rates with minimal post-planting care.

Using the long-stem method, seedlings are grown in pots for 10-18 months, so that they develop long woody stems. These seedlings are then planted with about 3/4 of their length below the soil surface, approximately 1 metre deep, which results in much of the woody stem being covered with soil. The deep planting protects the roots from substantial changes in soil temperature, allows the plant access to deeper soil moisture and reduces competition from weeds.

Preparation

1. Use native seedlings that have been grown in seed-raising trays using conventional methods.
2. Apply slow-release fertilisers to allow the plant to grow to a height of approximately 1-1.5 m
3. Place the pots on 'potting racks' so that they do not have direct contact with the ground or table.



Source – Long Stem Planting Guide

Planting

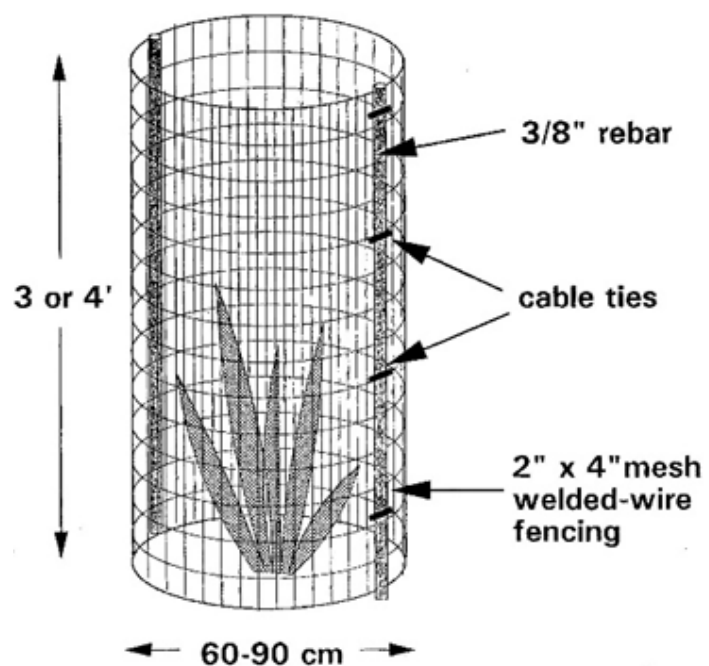
1. Dig holes deep enough to allow 3/4 of the plant to be buried. This can be done using power tools such as a soil auger, a crowbar or scissor shovel or by using a water lance.
2. Pour approximately 1 litre of water into the hole and allow it to soak in.
3. Prune side branches or large leaves from the lower portion of the stem that impede placement of the seedling in the hole when planting.
4. Place the plant in the hole and backfill carefully using soil and water alternately to ensure that no air pockets are left. This is important to prevent the roots from drying out.
5. Create a dish-shaped depression around the stem of the plant and add the remaining water. The depression will assist in catching any rain.

7. In Situ Cages

One of the challenges when reinstating aquatic vegetation is protecting the plants from being eaten and decimated by ducks, turtles, crayfish, fish, etc. Even once the plants are established, they aren't immune from hungry animals. Similar to paddock trees, guards/cages can be installed to protect newly planted aquatic vegetation.

Preparation

1. Use chicken mesh to create cylinders that are approximately 60-90cm wide and 90 to 120cm.
2. Weave two wooden stakes or rebar through the mesh. This will give the cylinder stability and help to secure it to the waterway floor.



Source: Propagation and Establishment of Aquatic Plants: A Handbook for Ecosystem Restoration Projects

What Methods Should I Use?

Method	Wooden Stakes	Paddock Trees	Fish Hotels	Floating island	Long stem	In situ Cages
Difficulty	Low	Low	Medium	Medium	Low	Low
Longevity	Low	High	Medium	Low	High	Medium
Suitable Location	Small to medium waterways with a sandy bed	Wetlands, farm dams & waterways	Wetlands, farm dams & storm water retention basins	Wetlands, farm dams & storm water retention basins	Wetlands, farm dams & waterways	Wetlands, farm dams & storm water retention basins
Maintenance	Low	Low	Medium	Medium	Low	low
Best Time of Year	Spring/early summer	Autumn through to early spring	Summer	Anytime	Autumn through to early spring	Spring/early summer
Approvals needed	No	No	Approvals required for waterways	Approvals required for waterways	No	No



Plant List

Fringing Woodlands	Common Name	Scientific Name
<i>These tree/shrubs grow on land but can withstand temporary inundation</i>	River Red Gum	<i>Eucalyptus camaldulensis</i>
	River She Oak	<i>Casuarina cunninghamiana</i>
	River Tea Tree	<i>Leptospermum obovatum</i>
	River Bottlebrush	<i>Callistemon peludos</i>
Fringing Plants	Common Name	Scientific Name
<i>These plants grow on land but can withstand temporary inundation</i>	Tall sedge	<i>Carex appressa</i>
	Plains sedge	<i>Carex bichenoviana</i>
	Austral rush	<i>Juncus australis</i>
	Spiny-headed mat-rush, basket grass	<i>Lomandra longifolia</i>
	Tussock grass, river tussock grass	<i>Poa labillardierei</i>
Emergent Plants	Common Name	Scientific Name
<i>These plants grow in water and in damp soil at the margins of the water.</i>	Common Reed	<i>Phragmites australis</i>
	Common Spikerush	<i>Eleocharis acuta</i>
	Stream club rush	<i>Bolboschoenus fluviatilis</i>
	Slender knotweed	<i>Persicaria decipiens</i>
	River club sedge	<i>Schoenoplectus tabernaemontani</i>
	Sedges	<i>Carex sp.</i>
	Rushes	<i>Juncus sp.</i>
Submergent/Floating Plants	Common Name	Scientific Name
<i>These plants can grow in fully submerged water</i>	Water Ribbons	<i>Triglochin microtuberosum</i>
	Water Milfoil	<i>Myriophyllum crispatum</i>
	Nardoo	<i>Marsilea drummondii</i>
	Pondweed	<i>Potamogeton sp.</i>
	Wavy marshwort	<i>Nymphoides crenata</i>
	Swamp Lily	<i>Ottelia ovalifolia</i>
	Common duckweed	<i>Lemna disperma (minor)</i>



Further reading:

1. Livestock Grazing

- Best management practices for riparian biodiversity: Current advice and actual practice
Microsoft Word - Milestone-Final-Doc.doc
- www.stockandwaterways.com.au

2. Wooden stakes:

- High stakes for native fish in Hughes Creek - GB CMA - Goulburn Broken CMA
- Re-diversifying our waterways, a garden stake at a time | Pursuit by the University of Melbourne

3. Paddock Trees

- Protect and restore paddock trees – ANU Sustainable Farms

4. Fish Hotels

- What are fish hotels? | OzFish Unlimited

5. Floating Islands

- How to build a wildlife island on your farm dam – ANU Sustainable Farms
- How to make a floating wetland | How to make a floating wetland | Redland City Council

6. Long Stem Planting

- Longstemguide.pdf

7. In situ cages

- Propagation and Establishment of Aquatic Plants: A Handbook for Ecosystem Restoration Projects DTIC ADA369779: Propagation and Establishment of Aquatic Plants: A Handbook for Ecosystem Restoration Projects : Defense Technical Information Center : Free Download, Borrow, and Streaming : Internet Archive

Acknowledgements

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Need more help? Get in touch with one of our Refreshing Rivers Project Officers:

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<https://www.refreshingrivers.org.au>