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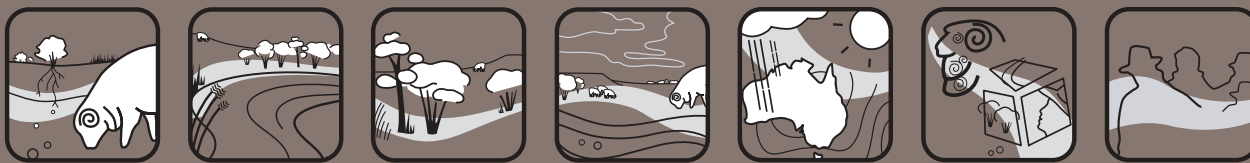
Managing creeks
and waterways in the
southern tablelands
of New South Wales:
A woolgrowers guide



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Woolgrower case study participants








- Chris and Margot Shannon, 'Talmo', Bookham
- Sam Bucknell, 'Otterbourne', Yass
- Barry Walker, 'Ledgerton', The Mullion



Introduction

This document has been prepared for woolgrowers in the southern tablelands of NSW to help them learn about, and better manage, the creeks and waterways on their farms. It is a summary of work undertaken by the Land, Water & Wool program in the Yass region, and reports back to woolgrowers and the local community on what has been achieved. Other woolgrowers in the higher rainfall (over 600 mm) and sheep/wheat zones (300–600 mm) of NSW and other parts of Australia will also find it useful.

Land, Water & Wool is a unique national research program for woolgrowers. It's a joint initiative of Australian Wool Innovation Limited and Land & Water Australia. Land, Water & Wool aims to develop production-based solutions to land management issues and is the largest collaborative natural resource management research investment for the wool industry. It has seven sub-programs with different themes:

-  Sustainable grazing on saline lands
-  Rivers and water quality
-  Native vegetation and biodiversity
-  Managing pastoral country
-  Managing climate variability
-  Future woolscapes
-  Benchmarking and evaluation

To find out more about Land, Water & Wool go to www.landwaterwool.gov.au



The NSW demonstration site for the Land, Water & Wool Rivers sub-program was established near Bookham, 42 kilometres from Yass on the Hume Highway in the uplands of the Murrumbidgee catchment. The project focussed on managing gully erosion in the NSW southern tablelands to improve water quality and maintain productive wool pastures.

Whilst the focus of projects of this kind are generally on practical outcomes such as the kilometres of fencing completed, amount of trees planted or the success of revegetation treatments, the people working on the Land, Water & Wool Rivers sub-program believe that the real success of any natural resource project is when the mind or hearts of the farmers involved have been changed, and they have a long-term commitment to their project outcomes.

A key element of this program is the recognition that landowners have a rich knowledge of their landscape and that it expresses itself as a “knowing” which has more to do with sight, sound, touch and feeling of the place. The “knowing” and the science are talking about the same issues; but separated by a different language — a bridge we need to cross together.



The people working on the Land, Water & Wool – Rivers sub-program believe that the real success of any natural resource project is when the mind or hearts of the farmers involved have been changed, and they have a long-term commitment to their project outcomes.

Through the Land, Water & Wool – Rivers & Water Quality project we have tried to develop ways to measure and remind us that every place is special, distinctive and worth appreciating. This has meant that scientists and woolgrowers have worked together to look at ways rivers and riparian areas can be managed within the farming system to meet a range of different objectives. What became clear during this work was that river and riparian areas are far more than a source of drinking water for stock, and that woolgrowers have many reasons for wanting to care for these parts of the farm. In recognition of this, the Five Ps of People, Place, Profit, Proof, and Promise were used to highlight the many different ways rivers and riparian areas are thought about, valued and managed by woolgrowers. The Five Ps are:

- **People** — investing in the people and communities is important so that their experience is recognised and valued, and people can share ideas, stories and knowledge.
- **Place** — we need to appreciate that the land where experimental or demonstration sites are located is also someone’s farm and home and therefore special to them and to their identity.

- **Profit** — the outcomes from the research into river and riparian management need to have an economic focus so that they can be incorporated readily into the farm business. Profit is also used to express the environmental and social gains that can be made from improving river and riparian management.
- **Proof** — excellent science is needed with credible researchers investigating how river and riparian areas will respond to different management approaches. Woolgrowers need good science to have confidence to act.
- **Promise** — Our promise to give something back to wool growing communities we work with so that they can benefit from the research and implement the recommended management approaches that are developed.

This publication has something from each of the Five Ps, with the research that has been undertaken presented in terms of the scientific findings, the implications these have for on-farm management, and the approaches different woolgrowers have taken to incorporating their management of streams and creeks into their day-to-day farming operation.

People



Place



Profit



Proof



Promise



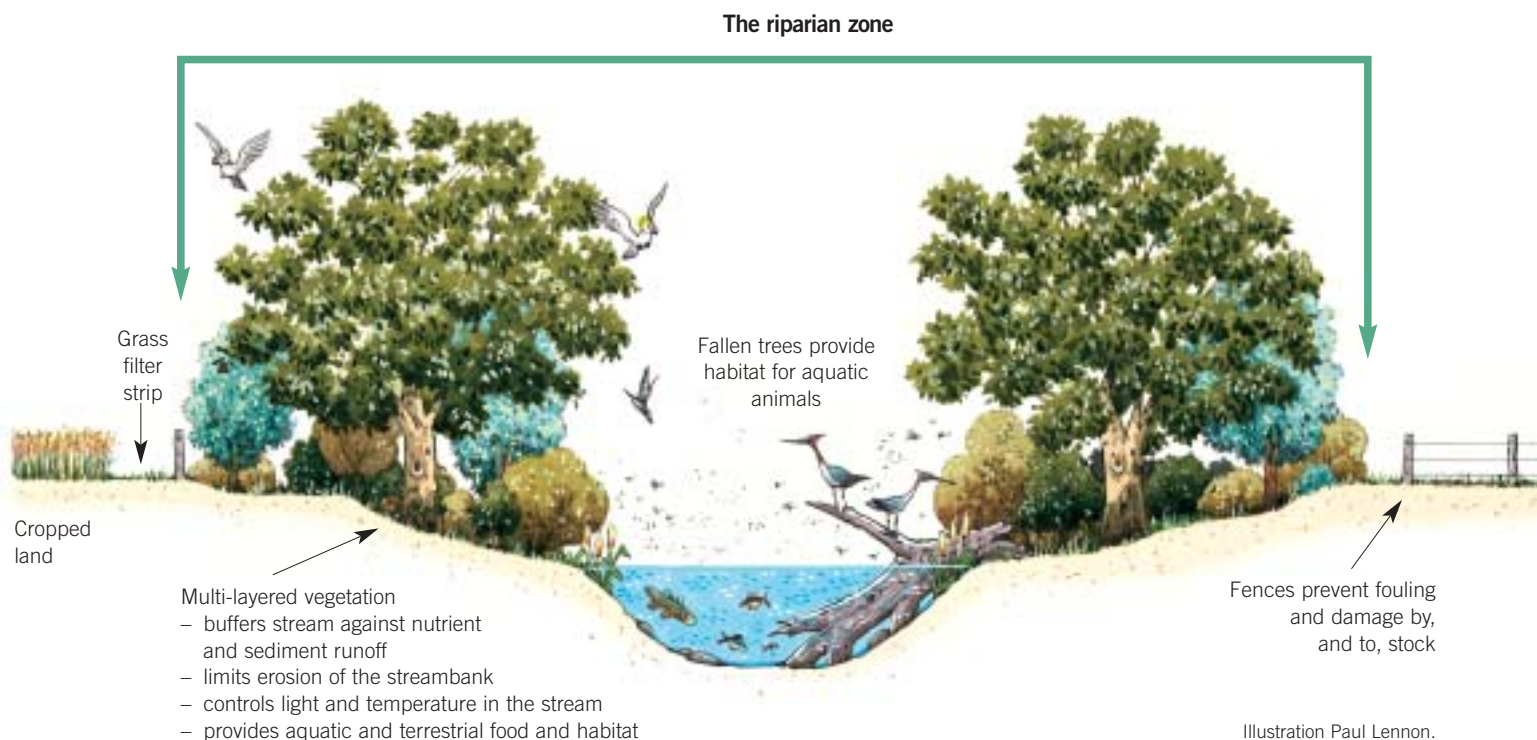
What are riparian areas and why are they important?

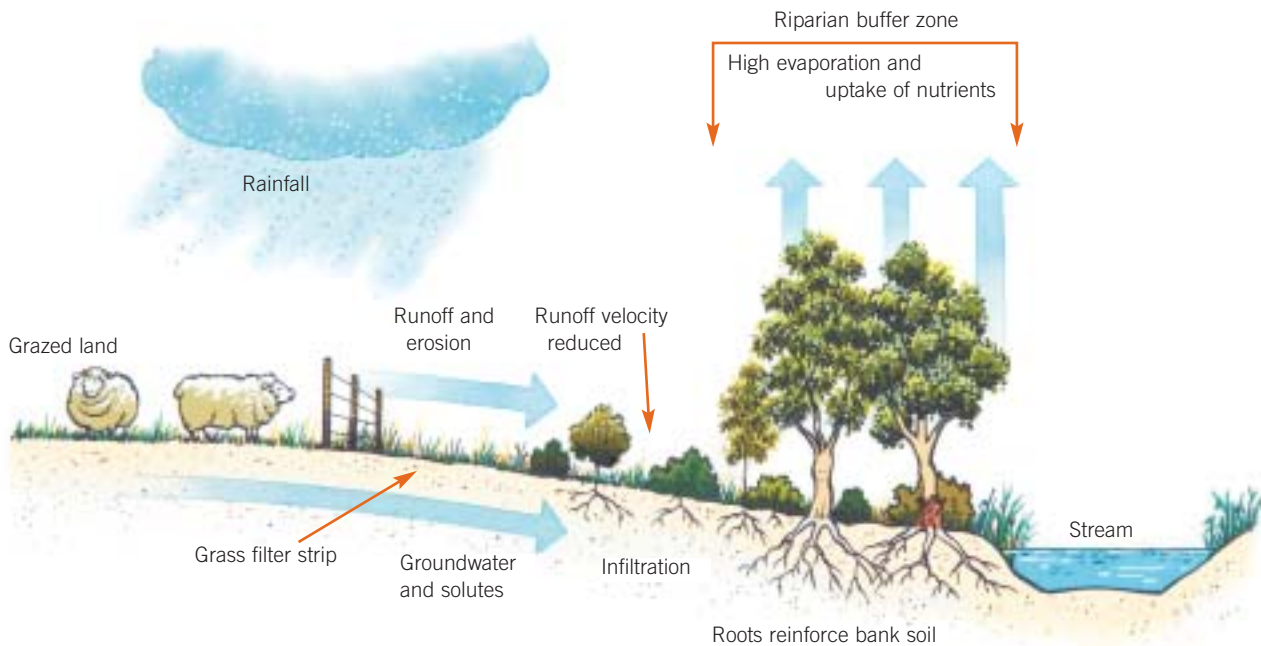
Riparian areas are at the boundary between land and water, so they are important buffers between what happens on farms and the water quality and health of local streams. Due to their position in the landscape, they are also often moister and more fertile than surrounding areas, making them important resources both for humans and native plants and animals. They are often small in area (commonly only 2–5% of the landscape), yet they are critical parts of the catchment, performing many important functions and providing many benefits to woolgrowers and the wider community.

Riparian areas and their vegetation perform many important functions within the landscape:

1. Trap and store sediment
 - Sediment from land upslope of the riparian area is prevented from entering the water.
 - Nutrients and other contaminants (including disease organisms) carried with the sediment are also trapped, improving water quality for downstream users and in-stream habitat.
 - Sediment builds soil and banks in the riparian area.

Riparian land is land connected to a waterway. For most farmers this means the area of land around the creek or stream that may flood.





Tree roots reinforce the soil and protect the bank from erosion.

Illustration Paul Lennon.

2. Stabilise banks

- The roots of native riparian plants growing on the bank surface protect it from scour by the water flowing past.
- Other roots bind and reinforce the bank soil.
- Stable banks resist erosion, preventing movement and widening of the channel.

3. Store water and energy

- Flood waters are slowed down, reducing erosion and flood damage.
- High flows over the floodplain are trapped to recharge underground aquifers.

4. Shade the stream

- Overhanging vegetation shades the water, reducing high temperatures which may kill in-stream animals and allow unwanted algae to grow.

- The lower light intensity also helps to reduce the growth of nuisance in-stream plants, even under conditions of higher nutrient level.

5. Provide food and habitat for in-stream plants and animals

- In-stream animals rely on inputs of organic matter (leaves, twigs, fruits and insects) from the riparian vegetation for their food.
- Many animals living in the river also require large pieces of wood or litter on the bottom to hide from predators or shelter from fast-flowing water.

6. Provide habitat for riparian plants and animals

- Many plants and animals can only live in riparian areas, where there is more water, rich soils, and cooler moist conditions for much of the year.

“By fencing out my gullies and creeklines I’m trying to reduce mustering times and stress on my sheep. I’m part of an amazing experiment influencing landscape change by introducing trees, shrubs and grasses back onto the land that once had them.” Sam Bucknell, 2006, ‘Otterbourne’ Yass.

- Many other animals which aren't dependent on riparian zones year-round may use them during certain times of the year or in certain parts of their life-cycle.

7. Provide corridors for movement of animals and plants across the catchment

- Plants, via their seeds, and animals move about the landscape along riparian corridors between patches of native vegetation.
- Riparian areas also provide a refuge for plants and animals in difficult times of drought or fire.

Riparian areas and their vegetation also provide many tangible benefits to wool growing businesses, as well as to the wider community:

1. Clean water

- Cleaner, safer water for domestic use.
- Reduced costs of water treatment for human consumption.
- Sheep drink more water and grow faster when it is clean and fresh.
- Healthy aquatic ecosystems, including fish and platypus.

2. Productive riparian pastures

- Better retention of water, nutrients and sediment on riparian paddocks.
- Riparian areas retain green feed after other parts of the farm have dried off.
- Shade and shelter for increased pasture growth.

3. Stable banks

- Less erosion and loss of valuable land.
- Retention of fences, infrastructure and stock.



“One of the main benefits from rotationally grazing native pastures is the reduction in tender wool. Wool from these paddocks has the lowest break and the strongest tensile strength.” Mike Grogan, 2006, ‘Illalong’ Binalong



John Betts harvesting native grass seed to be used in replanting. Photos this page Land, Water, Wool.



4. Flood control

- Slow down and reduce “flashiness” of floods.
- Erosion problems reduced.
- Fewer losses of stock and farm infrastructure (fences, roads, buildings).

5. Healthy plant communities

- Good shade and shelter for stock, particularly off shears.
- Good stock fodder during dry times and to cover feed droughts.
- Good habitat for birds and other animals.
- Control of weeds.
- Perennial plants help stabilise banks.
- Woody pieces and leaf litter provide habitat for fish and other in-stream wildlife.
- Moderate stream temperatures.
- Potential source of timber.
- Trap carbon.
- Create corridors across the landscape for movement of plants and animals.

6. Healthy animal communities

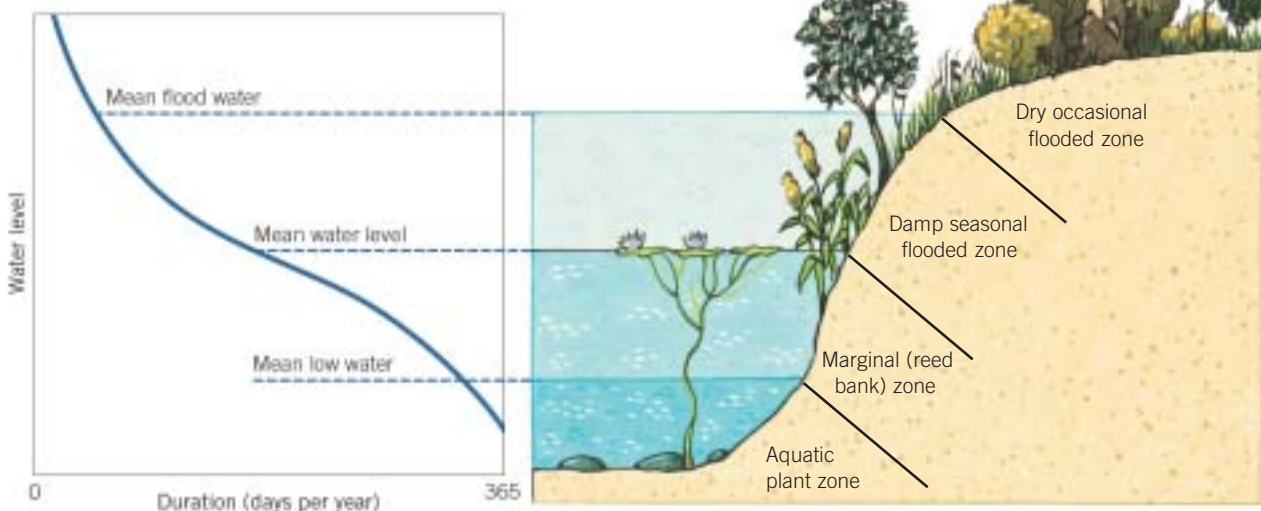
- Insects, birds and bats that require riparian areas help control pasture pests.
- Insects provide pollination of useful plants.
- Fish for recreation and tourism opportunities.
- Greater biodiversity overall improves farm productivity.
- Well-managed river frontage adds to capital value of the farm.

7. Aesthetics

- Diversity of plants and animals contribute to a unique and special environment.
- Recreation potential for the farm family and others.
- Conservation of cultural values, sense of place.

Different plants live at different levels in the riparian zone. Ideally, a mix of these plants is required to maximise the environmental and economic (e.g. bank stabilisation) benefits from protecting riparian areas on the farm.

Illustration Paul Lennon.





1. White-plumed honeyeater — often associated with red gums along waterways.
2. Rainbow bee-eater — often nests in erosion banks and it is generally thought that they mate for life. A migratory species that feeds on flying insects and bees.
3. Red-browed finch — likes long grass and shrubs along waterways.

4. Clamorous reed warbler — migratory species. This bird prefers dense vegetation alongside water, especially thick reed beds. It builds a deep cup nest with a narrow top opening, in among dense reeds. The nest is made from dry reeds and other water plants woven together and lined with fine dry grass and feathers. The adults feed on small insects near waterways. All photos Julian Robinson.

The lists on the previous pages reinforce the proposition that by changing their management of riparian areas and waterways, woolgrowers can achieve economic, environmental and social benefits.



This landholder has worked with Greening Australia to rehabilitate a part of his property that had the potential to become a large unstable gully. Photo Greening Australia ACT & SE NSW.



Are my waterways in good condition?



A site in excellent condition on the Upper Murrumbidgee River (RARC score = 46; this site includes continuous vegetation along the riparian zone, standing dead trees and fallen logs, native shrub understorey and regeneration of canopy trees).



A site in very poor condition on the Murrumbidgee River (RARC score = 12; note limited native overstorey, lack of understorey and no native regeneration). Both photos Greening Australia.

Woolgrowers considering work in their riparian areas should:

- assess the condition of the waterways and riparian areas on their farm,
- identify problems for production or for the waterway itself,
- then consider ways to change the existing management to overcome those problem(s).

The simple checklist at the end of this section will assist you to do this.

As part of the Land, Water & Wool – Rivers project, Fleur Flanery undertook an assessment of riparian areas in the southern tablelands. A total of 26 sites around Yass and Bookham were surveyed using the Rapid Appraisal of Riparian Condition tool (RARC) (to find out more go to the publications list on page 36) between March 2005 and March 2006.

The majority of RARC assessments were conducted on smaller creeks on farms in the Yass River sub-catchment of the Murrumbidgee catchment between March and June 2005.

One assessment was conducted at the Yass Weir, which in its current state is degraded but is undergoing intensive rehabilitation works, and another was undertaken on Crown Land. All surveys were taken along a 200 metre section of the waterway. The scores obtained at a selection of these sites are shown in the table overleaf.

Overall, the majority of the sites assessed using the RARC were in poor condition with scores ranging from 8 to 28. Many sites had some tree cover and ground cover, but the understorey of native shrubs, grasses and forbs was absent from all sites.

Several sites had little or no native riparian vegetation. Sites scoring 30 or less are generally in poor to very-poor ecological condition, 30–35 represents average condition, sites scoring 35 and above are in good condition, while 40 and above indicates excellent condition with most ecological functions intact.

**RARC scores from a range of sites surveyd within the Yass–Bookham region**

Site	RARC score (max 50)	Comments about site condition
Bango Creek	17.5	Poor condition. Some existing riparian vegetation but no natural regeneration.
Talmo Creek	21.0	Poor condition. Native riparian vegetation is present but no regeneration visible.
Yass River Weir	10.4	Very poor condition. Limited vegetation of any type and no sign of regeneration.
Eight Mile Creek	28.0	Average condition. Recreational area, ungrazed, but mown, some natural regeneration visible.
Chinamen's Creek	14.7	Poor condition. Dominated by exotic species.
Gums Lane Creek	28.0	Average condition. Dominated by native species with natural regeneration visible.
Back Creek, Yass	7.9	Very poor condition. Little or no riparian vegetation.
Cattleyard Creek, Harden	11.8	Poor condition. Good ground cover but no trees or natural regeneration visible.

This is one of the summary tables prepared by the project officer following RARC assessments of each site. The table would be more informative if details were provided about the type of land use and grazing regime being used in each of the sites, as management actions can then be linked to riparian health. This information can also provide the basis upon which new management strategies are developed to improve riparian condition.

The majority of sites on private land showed riparian areas in poor condition resulting from continual grazing which reduced the understorey along the banks and inhibited natural regeneration.

By using the woolgrower checklist on page 12 you can find out the condition of your riparian area. This will then help you to work out which of the following management strategies might enable you to protect, maintain or improve riparian condition so that economic and environmental gains can be made.



Photo Greening Australia ACT & SE NSW.

A checklist for assessing river, stream or creek health on farms

When you walk along your stream or creek bank it is often hard to know what to look at to assess whether your waterway is healthy. This quick and easy checklist will help you to work out the health of the streams or creeks running through your property by looking at six features we know affect whether a stream is healthy (in good condition).

1. Management of riparian areas
2. Bank erosion
3. Shade and shelter
4. Water quality
5. Wildlife
6. Weeds and pests

The woolgrower checklist on the following pages provides colour coded pictures that you can use to quickly assess the condition of your stream or creek against each of the six features.

The three categories of green, yellow and red have been developed to reflect the full spectrum of conditions found along many waterways. Hence they are extremes, and it is likely that your waterway's condition will fall somewhere between these categories and will vary along its course. Doing the assessment should help prompt ideas about what you want your waterway to look like, and things you can do to achieve that.

Green Stream is in good condition and management should aim to maintain it in this state.

Yellow Stream remains in moderate condition, but some changes in management needed to maintain or enhance it.

Red Stream is in poor condition and will require significant changes to current management to return it to a healthy state.

To use the checklist ...

... walk along your river, stream or creek bank and at different points assess the six different features of riparian areas. Tick the box underneath the picture and description that best matches your waterway. Once you have made your assessment, use the information provided to help think about some of the opportunities that exist to improve your stream or creek so that it can become 'healthier' and increase its value as a farm asset.

Photocopy this checklist and it can be used at different points of your river, stream or creek.




After using the checklist

Once you have made your assessment of all six features, it may be the case that your stream is in good condition for two or three of the features, but needs help to improve in other areas.




Take a look at what management options are available to maintain or improve that condition. If you need more information about how to better manage these parts of the farm, turn to the section beginning on page 36 where there is a list of free publications, websites and people who can help.



Increasing production by managing streams and riparian areas as special parts of the farm




		
Green (good condition)	Yellow (moderate condition)	Red (poor condition)
<ul style="list-style-type: none"> • Off-stream watering system provides clean, uncontaminated water on demand, water points sited to optimise feed utilisation • Grazing of riparian areas managed for optimum pasture composition, feed production and feed utilisation, and to minimise parasite loads • Riparian areas fenced to control stock access, prevent losses and make mustering easier 	<ul style="list-style-type: none"> • Stream used to water stock, but at constructed watering points only, sheep cannot wander along the banks and channel • Rotational grazing used in riparian areas, based on assessment of feed available • Riparian areas partly fenced or other means used to control timing and duration of stock access 	<ul style="list-style-type: none"> • No fencing or other means of controlling stock access to riparian areas and the stream, sheep can use all parts of the stream • Riparian areas set-stocked, or stock have full access year round, riparian areas grazed heavily • Potential for stock losses from bogging or during flood, mustering difficult from deep channels or when stock have wandered onto neighbouring properties

Bank erosion




		
Green (good condition)	Yellow (moderate condition)	Red (poor condition)
<ul style="list-style-type: none"> • No obvious areas of active erosion along the channel banks, no stock tracks adjacent to or within the channel 	<ul style="list-style-type: none"> • Majority of bank top and sides are well-vegetated, but some signs of bare and actively eroding areas (e.g. stock tracks) 	<ul style="list-style-type: none"> • Much of the banks are bare with obvious active erosion, stock tracks prominent

Your notes

Shade and shelter

		
Green (good condition)	Yellow (moderate condition)	Red (poor condition)
<ul style="list-style-type: none"> • Native riparian vegetation including tall trees retained, sufficiently wide (25–50 metres) for natural regeneration, and replanted where required • Paddock layout and fencing enable riparian areas to be used to provide shelter and shade for newly shorn sheep and at lambing 	<ul style="list-style-type: none"> • Some native riparian vegetation present as a narrow strip, but tree canopy and ground cover reduced (compared with an ungrazed site), little regeneration, and replanting required to fill gaps • Native riparian vegetation of limited use for shade and shelter (narrow and contains gaps) 	<ul style="list-style-type: none"> • Most native riparian vegetation cleared, lost from old age, or by damage. No tall vegetation (above 5 metres) present • Lack of regeneration of native plants due to continuous grazing pressure, no replanting, grass and weeds dominate • Sheep have no ready access to shelter or shade during extreme weather

Water quality

		
Green (good condition)	Yellow (moderate condition)	Red (poor condition)
<ul style="list-style-type: none"> • Vigorous riparian pasture acts as a filter to prevent contaminants (e.g. soil, nutrients, animal waste) from upslope reaching the stream • Good vegetation cover along the top and sides of stream banks • Stream water appears clear, no evidence of excessive in-stream algal growth • Stock cannot enter stream channel 	<ul style="list-style-type: none"> • Some bare areas in riparian pastures and risk of soil erosion • Vegetative cover along the stream bank is at least 70%, but some bare soil noticeable • Stream water may appear cloudy after rain but clears in a few days • Some in-stream algal growth and plants present • Stock can access only limited parts of the channel 	<ul style="list-style-type: none"> • Significant areas of bare soil visible within riparian pastures and along top and sides of bank • Stream water is often muddy and remains so even without rain • Obvious algal growth along stream edge as a result of excessive light and/or blocking of the channel by excessive growth of reeds • Stock can access the entire channel length putting it at risk of contamination from urine and dung



Wildlife

<p>Green (good condition)</p> <ul style="list-style-type: none"> • Riparian areas vegetated with a mix of native species including trees, shrubs and herbs/grasses, and including old trees (nesting hollows) • Native vegetation wide enough to enable natural regeneration (at least 25–50 metres) • Riparian areas connect to other blocks of native vegetation (without gaps) 	<p>Yellow (moderate condition)</p> <ul style="list-style-type: none"> • Some native vegetation along stream, but with gaps and/or a limited mix of species and vegetation ages — few old trees • Native vegetation in riparian area less than 25 metres wide in places • Riparian vegetation not directly connected to other blocks of native plants, but gaps less than 100 metres 	<p>Red (poor condition)</p> <ul style="list-style-type: none"> • Little or no native vegetation remaining, riparian areas dominated by grasses, weeds and introduced plants • Riparian areas heavily grazed and not connected to adjacent native vegetation

Weeds and pest animals

<p>Green (good condition)</p> <ul style="list-style-type: none"> • Vigorous native vegetation in riparian areas at least 25 metres wide • Stock excluded and areas not disturbed by vehicles, fire, etc • Area inspected regularly and weeds removed by hand or spot spraying • Active management applied to prevent pest animals establishing, and to reduce fire risk 	<p>Yellow (moderate condition)</p> <ul style="list-style-type: none"> • Some gaps present in native vegetation, but replanting used to reduce risk of weed invasion • Access by stock carefully managed to ensure minimal damage from grazing • Some weeds present but numbers controlled by grazing and/or targeted spraying • Active management applied to prevent pest animals establishing, and to reduce fire risk 	<p>Red (poor condition)</p> <ul style="list-style-type: none"> • Little native vegetation remains and weeds have invaded riparian areas • No control of stock access, heavy grazing and nutrients from urine and dung promote weed growth • Little or no control of weeds or of pest animals. Fire a low risk given lack of flammable vegetation

Getting started

Once you have assessed the condition of your waterway and riparian area, you will need to decide on priorities, compare costs and benefits, and consider what is feasible for the farm budget. It is also worth investigating whether there are sources of external funds that could be accessed. The need to balance economics, environmental sustainability and social benefits is important, and there are a range of benefits that can be gained from protecting, maintaining or rehabilitating riparian areas.

“Every new fence pays for itself over time either through reduced mustering times or improved pasture management. Before you start fencing you need to think about the long term, say 20 to 30 years ahead, so you can maximise the benefits.” Phil Graham, Department of Primary Industries, NSW.



Photo Land, Water & Wool.

Economic benefits may come from:

- A reduction in land and pasture lost through erosion of stream banks and gullies.
- The opportunity to change grazing management of riparian pastures following fencing, for example using riparian areas to cover feed drought on hill-slopes, resting pastures to increase annual production.
- Off-stream watering enabling sub-division of riparian paddocks to increase feed utilisation.
- Cleaner water once sheep no longer drink from the stream, leading to increased growth rates and non-transmission of diseases.
- Using native riparian vegetation to provide shade and shelter for sheep (including off shears and at lambing).
- Control of pasture and sheep pests by insects, birds and other animals that live in riparian vegetation.
- Easier mustering along river channels, no stock losses from bogging or during floods.
- Potential for additional products from riparian areas, such as poles and posts, firewood, honey, and flowers, seeds and foliage.
- Increased capital value of the property from a stable and well-managed stream frontage.



Natural regeneration of a gully that has been fenced and stock have been removed. Photo Greening Australia.

Environmental benefits may come from:

- The roots of native plants protect and reinforce stream banks and erosion is reduced.
- Reduced erosion of stream banks and gullies means less sediment to fill in pools and wreck aquatic habitat for stream animals.
- Less nutrients and other contaminants reach waterways, so water quality for downstream users and in-stream life improves.
- Native riparian plants provide shade to the stream, reducing water temperature and light levels and helping to prevent excessive growth of nuisance in-stream plants (including algae toxic to stock and humans).
- Inputs of leaves, twigs, fruit and insects from native riparian plants provide the basic food source for healthy in-stream ecosystems, while larger branches and whole trees that fall into the waterway provide essential habitat.
- Native riparian vegetation provides habitat and food for regional populations of birds, mammals and other animals.

Social benefits may come from:

- Woolgrowers, and the wool industry, being recognised for good environmental management and their contribution to a healthy and productive catchment.
- Woolgrowers working together to tackle issues along a part of the river system.
- Sense of pride by woolgrowers in their farm and their good management achieving the results they want.
- Family, recreational and aesthetic benefits from an attractive, well-managed riparian frontage.

Neighbours working together to manage a section of their waterway. Photo Greening Australia.



Putting it into practice

— management recommendations

Once you have identified where the riparian areas are on your property and their condition, you can then work out the issues they present for management. Riparian areas can be very productive but they also require special management to optimise benefits and maintain their value for wool production. Using your whole farm plan as the basis for deciding how you can best use riparian areas will save cost, time and effort in the long run.

Ideally, the property should be sub-divided into areas of similar production capability and management requirements, with fences following the landforms. A recent aerial photograph will help to identify the different classes of land and riparian areas, and the checklist (see page 12) can then be used to assess the condition of your waterways. The farm plan can be used to map out areas of concern or with existing problems — places where special management is required to protect or make better use of that land.

Land subject to flooding, erosion, high winds, seasonal parasite load or noxious weeds are some examples. This data can then provide the basis for planning grazing management, additional fencing of riparian areas, and areas for regeneration or replanting. By doing this as part of the whole farm plan, it is easier to decide where changed management has potential to improve wool production and profit, while also improving the resource base and environmental condition.

Through the Land, Water & Wool project at Bookham, woolgrowers identified the following five issues as being the most important to deal with:

1. Grazing management and stock mustering
2. Stream bank/gully erosion
3. Water quality and off-stream water for stock
4. Flood management
5. Weeds, feral animals, and wool contamination

(Data from a survey of Bookham Agricultural Bureau members, 2004.)

Direct seeding lines near the Ponds Creek, May 2006. Photo Fleur Flanery.





Photo Rae Young.

1. Grazing management and stock mustering

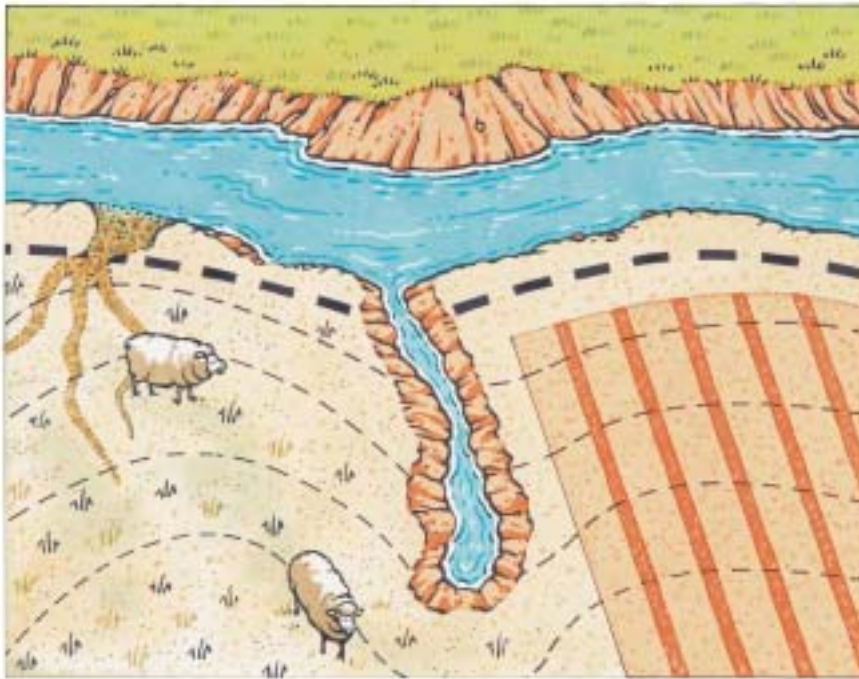
Uncontrolled stock access to waterways is considered to be the **single biggest** cause of riparian and stream degradation. Stock eat and trample understorey riparian vegetation, reducing or preventing its regeneration and leaving patches of bare ground. Their tracks are another source of erosion and the sediment and nutrients entering the stream reduce water quality for downstream users. Animal wastes (dung and urine) are another source of contamination and potential transmission of sheep diseases.

Understandably, many woolgrowers don't like the idea of fencing off their waterway as they then need to consider an alternative water source for stock. The riparian vegetation may also provide shade and shelter, and continued grazing may be a good way to control the growth or spread of weeds within the riparian zone. However, it is important to understand that fencing does not necessarily mean excluding sheep, and the stream or creek can still be used as a source of water.

Fencing allows the manager to decide which sheep can access the riparian areas, for how long and in which seasons. This means that rather than the stock making the decision, graziers can use their riparian pastures to best advantage, for example to cover feed drought or

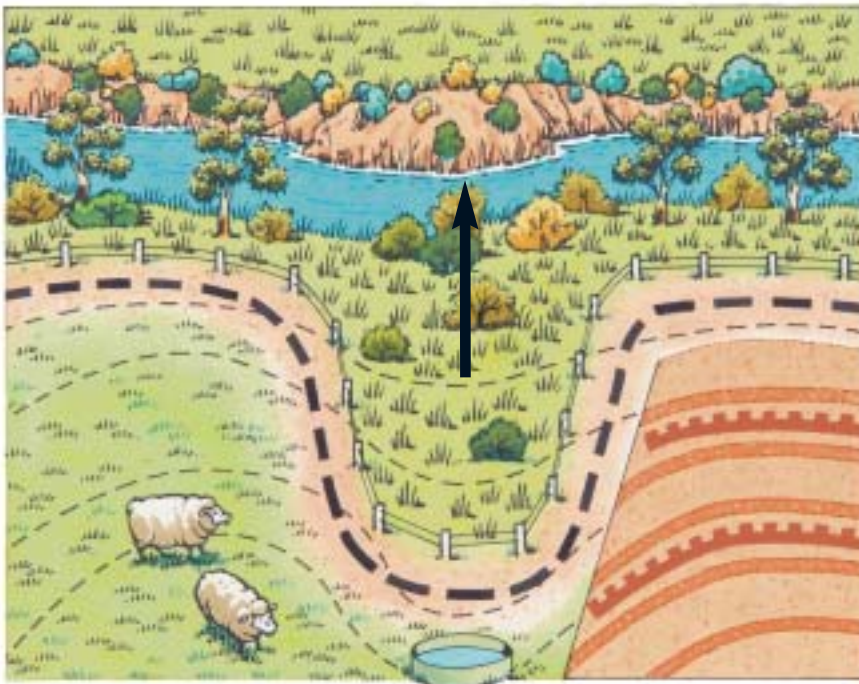
provide green pick when the higher hill-slopes have dried off, to allow seed-set and increase of preferred pasture plants, or as part of an integrated control program for internal parasites of stock. Hardened watering points can be provided for the sheep; these should be located away from potential stream erosion points (including the outer bends of meanders) and can use gravel or timber to provide a firm footing and avoid risk of animals becoming bogged. Fencing to control sheep access is also the first step in rehabilitating native riparian vegetation (whether by natural regeneration or replanting) to provide valuable shade and shelter for both stock and the stream.


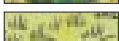
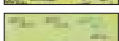







There are benefits in grazing management, animal health and growth rates from providing sheep with a supply of clean, reticulated water, and in some situations it may be possible to pump from the creek or stream. Fenced areas are also easier to muster as animals are no longer hidden within the channel, and risk of stock losses from bogging or during floods is reduced. The overall production benefits from changed management of riparian areas (better pasture growth and increased utilisation of feed, reduced stock losses, increased growth rates) help to offset the capital costs involved. There are also now many riparian fencing schemes that can assist with capital costs where the benefits from fencing extend beyond the immediate property; some of these will also provide funds for off-stream watering systems.



-  Stock tracks
-  Erosion gully
-  Cropland
-  Vehicle track
-  Contours
-  Degraded pasture

A degraded stream and riparian land. Significant sediment and nutrient is derived from degraded pasture, poor crop layout, unlimited stock access and gully erosion. Illustrations Paul Lennon.



-  Riparian vegetation
-  Grass filter strip
-  Pasture
-  Cropland
-  Vehicle track
-  Contours
-  Contour banks
-  Concentrated flow
-  Fence
-  Off-stream watering

A riparian filter strip protects water quality by trapping sediment, absorbing nutrients and providing shade over the stream to reduce water temperatures. Crop layout and a vigorous pasture with good cover reduce the potential for soil erosion.



Fencing options for revegetation areas along waterways

The type of fence needed to protect new vegetation along waterways should reflect the main threat to it. In most cases this may only require restricting access by domestic stock, but also consider the threat posed by native animals such as kangaroos and wallabies and by feral animals such as deer, goats and rabbits. Revegetation at a Land, Water & Wool – Rivers project in Tasmania was destroyed twice by possums and new fencing and tree guards had to be installed adding considerable cost to the site. Beginning on page 40 there is a list of the grasses, shrubs and trees you find in southern New South Wales tablelands riparian areas.



This fence prevents stock accessing the riparian zone.

Fence construction	Comments
4 wire electric: insulated post every 16 m, insulated dropper every 4 m.	Cheapest option. Maintenance is essential. A single failure can ruin an entire revegetation project.
5 wire: star posts every 8 m, steel dropper at 4 m centres.	Cattle and sheep proof. Lower maintenance than other options.
5 plain wire, 2 barbed*: star post every 8 m, steel dropper every 4 m.	Cattle proof, cheaper option. Option of replacing barbs* with electric wires. Can be less effective for sheep if not maintained.
6/70/30 hinged joint: secured to 3 plain wires, 2 top barbs*, 1 star post every 4 m.	Cattle and sheep proof. Pre-fabricated, quick to erect but expensive.
Rabbit proof netting: secured to 3 plain wires, 2 top barbs*, 1 star post every 4 m.	Displaces native animals. Expensive. Must be maintained properly to keep rabbits and other pest animals out of the area.
Kangaroo fence: 8 ft star posts every 8 m, steel droppers at 4 m centres, hinge joint or ring lock secured to 6 plain wires, 1 plain top wire.	Electric hotwires advisable. Reduces kangaroo pressure. Expensive, double the cost of cattle fencing. Can also use plain electric sloped fencing.

* Barbed wire is no longer considered best practice, so ideally, try and use fences with combinations of plain wire, electric or mesh. Adapted from Guide to Regeneration in the Bega Valley Shire, Blakers, Miles & Lynch, 1997.



Photos this page Jenny O'Sullivan.



Gully erosion along the Ponds Creek near Bookham, NSW. Photo Land, Water & Wool.

2. Streambank and gully erosion

Erosion rates across the NSW southern tablelands increased dramatically as a result of land clearing, road construction and grazing following European settlement. The removal of ground cover allowed the surface soil to erode, exposing the sodic, unstructured subsoils that are common throughout the region. These are very susceptible to erosion by rain impact and scour by flowing water, and as a result there was a period of rapid formation and extension of gully networks, as shown by time series of aerial photographs. Many of these gullies have since stabilised as vegetation re-established on their beds and banks, but some remain active and continue to cause problems for woolgrowers.

The roots of native riparian vegetation bind and reinforce the soil of stream banks and gully sides, making them more resistant to erosion during floods. The clearing of this vegetation, and its gradual loss and non-replacement through uncontrolled grazing, resulted in increased rates of stream erosion as well, leading to loss of valuable land and loss of water quality and aquatic habitat as excess sediment and nutrients entered the waterways.

Large quantities of soil can be lost through erosion of stream banks and gullies, particularly in the highly dispersible tableland soils. Land, Water & Wool research has shown that up to 3 millimetres of soil can be stripped from an entire 300 metre long gully in a 50 millimetre rainfall event. This resulted in the loss of 60 tonnes of sediment, 75 kilograms of nitrogen and 20 kilograms of phosphorus from just this one rainfall event in one small gully section (see diagram on page 24).

Erosion causes the water to become muddy or turbid which reduces water quality for all downstream users, including other farmers using it for stock and domestic water. Maintaining a good ground cover of vegetation in riparian areas, and in parts of paddocks at risk of gully formation, is the key to reducing erosion. Controlling stock access and promoting revegetation is also the low-cost way to rehabilitate gullies and prevent their further expansion. Read how Brendon Lunney rehabilitated the gully at his farm near Bookham on the following pages.



LAND, WATER & WOOL – RIVERS IN THE YASS REGION

Dealing with gully erosion at Bogolara

A Land, Water & Wool demonstration site is located on 'Bogolara' near Bookham, about 42 kilometres from Yass in NSW. This site focuses on ways to prevent, manage and rehabilitate gully erosion which is a significant environmental issue that impacts on farm productivity and catchment health. Gully erosion is one of the highest priority issues in the Murrumbidgee Catchment and considerable attention is being given to restoration works in order to reduce the amount of sediment entering the Murrumbidgee River. For further information go to the website located at the website www.murrumbidgee.cma.nsw.gov.au. (If you are in the Lachlan Catchment go to www.lachlan.cma.nsw.gov.au or call 1800 885 747.)

The gullies you can see in paddocks and along waterways in the Yass region have formed in the last 180 years, with the main effects occurring after the big land clearing phase in the 1850s. Many of these gullies have since stabilised, but some remain active; even some that appear stable are in fact active, but erosion is only apparent

after large rain events that may occur once every 10 years or so. Aerial maps can also be used to show change over time, in some cases records can cover a 50 year period.

This Land, Water & Wool project aimed to understand more about the cause, impacts and treatments for gullying by:

- determining the key causes of gully formation and extension,
- analysing and collating data on movement of water, sediment and nutrients from a monitored section of the gully,
- testing and comparing the effectiveness and costs of different treatments to stabilise the gully,
- comparing the results from Bogolara with other gully erosion monitoring sites in the Murrumbidgee which are part of the CSIRO — Open Air Laboratory project (OAL).

Brendon Lunney and his son Jim own 'Bogolara' and a full time manager and his family who live on the farm run the day-to-day operations. They along with former manager Kevin Schofield readily showed their interest in participating in the Land, Water & Wool research program.



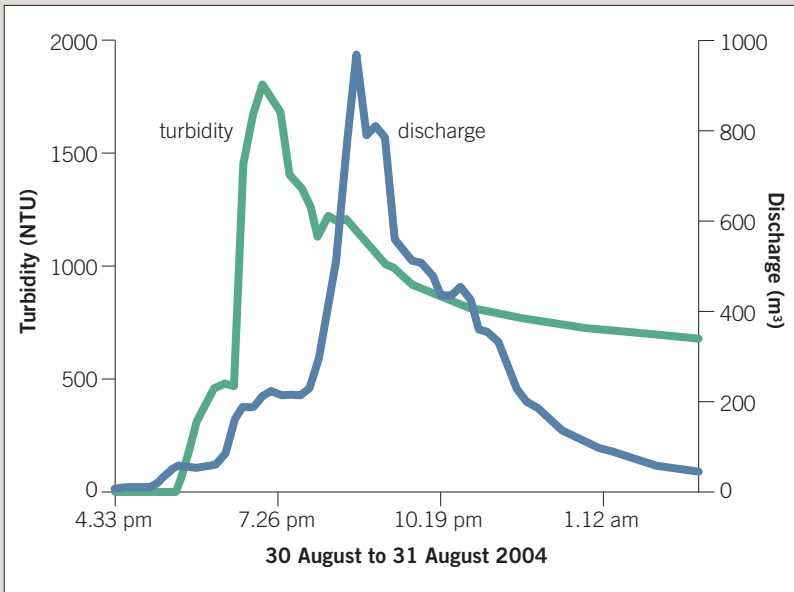


“It was clear to us that a large erosion gully is lowering water quality in the creeks that serve our property and continually destroying land that could otherwise be used for productive grazing. We were also concerned for the wider catchment as all the water running off our place finishes in the Murrumbidgee and affects the water quality, flora, fauna and human uses further down the river.

We believe that wool users around the world are increasingly concerned about wool farming methods. The international environmental concerns are likely to impact on the way Australian woolgrowers manage their properties. If the person who wears wool is concerned about the environmental impact of growing wool then we have to take those concerns on board and find sensible solutions to these issues.

It’s important we come up with a process that demonstrates a cost-effective and cost-beneficial outcome. There’s no point in conducting a series of experiments and carrying out works that are going to be unaffordable. What we’re trying to do on ‘Bogolara’ is use the improvement of water quality processes to enhance the management of all the surrounding grazing area. We are working to improve water quality and increase productivity.

If we increase productivity, and funds flow from the work, then it’s a reasonably clear picture for landholders to see not only an improved landscape with environmental benefits but also that it make good business sense as well. It’s got to work and be cost-effective.”
Brendon Lunney, 2004



The blue line on the graph shows discharge through the gully during the flow event. It was quite a short event, starting at 4.30 pm, peaking at around 8.00 pm and then tailing off around midnight. What is interesting is the green line that shows the concentration of sediment, or the turbidity measurements, peaked before the peak of the flood. This is because when the event starts the rain immediately washes off the loose surface soil from the gully sides and bottom; once this has been washed away the turbidity falls to a lower level.

Research at Bogolará has shown up to 60 tonnes of suspended sediment was discharged from the gully in a 50 millimetre rainfall event. This one event was equivalent to eroding 3–4 millimetres of soil from along the 300 metre long gully, and putting 75 kilograms of nitrogen and 20 kilograms of phosphorus into the water. This rate of erosion has been replicated in a number of gullies involved in the wider OAL research project.

To reduce this erosion, stabilise the gully and improve the quality of water leaving it, a large 13 megalitre, deep-water dam has been constructed at the head of the gully, contour banks now protect the side gullies by diverting overland flow from their walls, the gully has been fenced off to limit stock

access, and the area has been revegetated. The dam will not only flood out the eroding gully head, it will provide a valuable new source of water on the farm and enable improved use of highly productive riparian pasture. The area temporarily ‘lost’ to grazing while revegetation takes hold is minor, and movement of sheep in the paddock will be much easier with no risk of stock being lost through accident on the steep gully walls or from floods.

With some help for capital costs reflecting the wider community benefits of this work, Brendon expects in the long-term to see an increase in profit as well as an improved landscape and the ‘fixing’ of a problem area that did not meet his high standard of land management.

A new dam at Bogolará created in the former deep gully, May 2006. Photo Fleur Flanery.



The CSIRO's Open Air Laboratory

The Land, Water & Wool project has worked alongside CSIRO's Open Air Laboratory (OAL) project which has been studying the complex relationships between land use and large rivers within the Murrumbidgee and its sub-catchments. It has established monitoring sites on six farms from Bookham to Harden in southern NSW to determine river system processes like erosion, and sediment and nutrient transport and how they are influenced by land use and management. Specifically it has been:

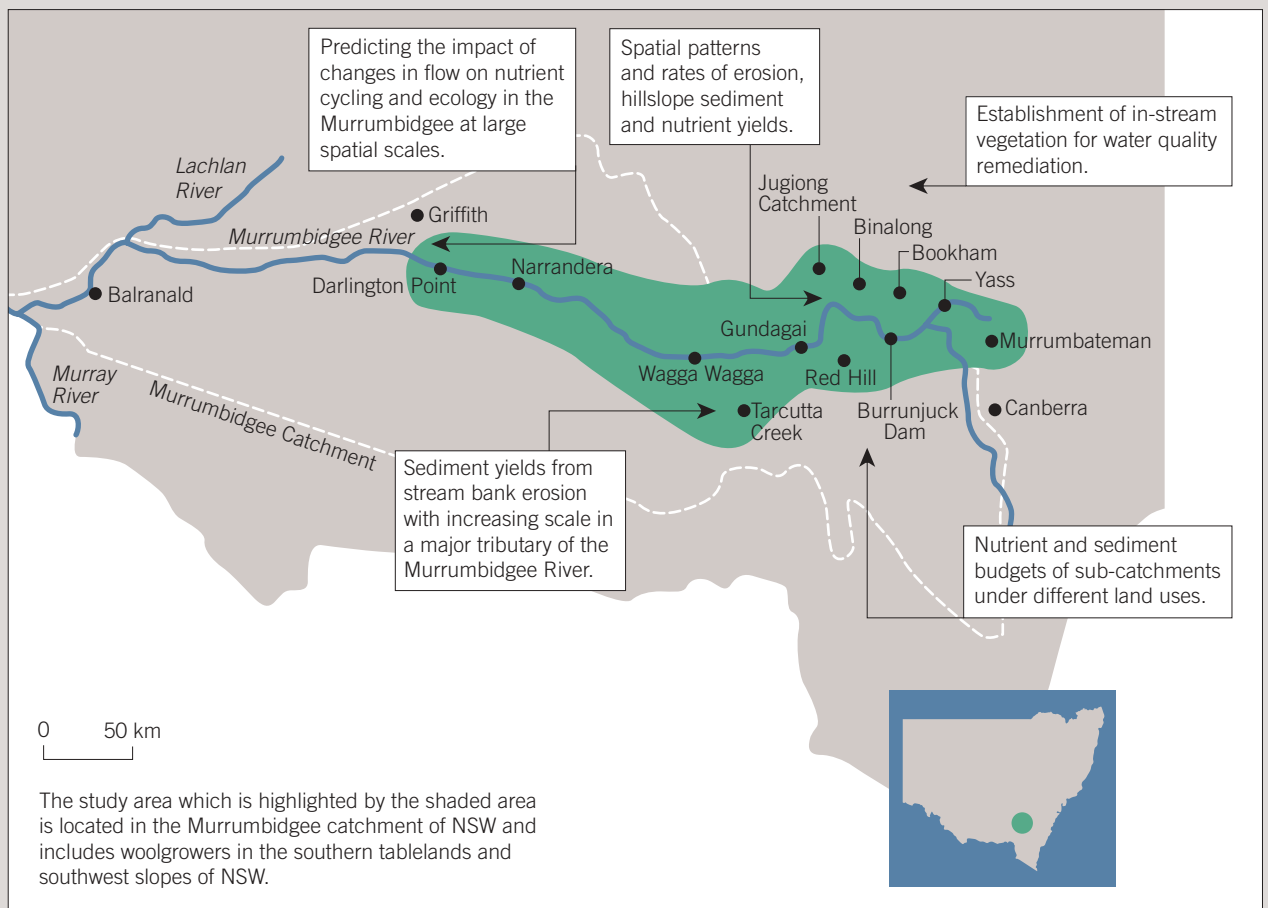
- identifying the main sources and processes which generate sediment input to rivers,
- determining nutrient sources,
- quantifying the difference in water quality upstream and downstream of in-stream wetlands,

- examining the effects of in-stream vegetation on sediment and nutrient supply,
- assessing channel bank erosion and its causes.

For further information contact Gary Caitcheon — gary.caitcheon@csiro.au

The participants were:

- Brendon Lunney, 'Bogolara', Bookham
- Mike Grogan, 'Illalong', Binalong
- Will Kelly, 'Red Hill', Bowning
- Neil and Rod McColl, 'Willow Green', Galong
- Mal and Louise Hufton, 'Naranghi', Harden, and Harden-Murrumburrah Landcare
- Pat O'Connor, 'Springfield', 'Oxton Park', Harden





'Illalong', Binalong



B weir, 'Illalong', Binalong



'Bobbara', Galong



'Naranghi', Harden



OAL monitoring equipment at different locations. Above: Checking equipment at Binalong. Photos Gary Caitcheon.



Placing feed and water troughs away from the creek can help to reduce the amount of time stock spend in and around the waterway, and this provides multiple benefits. Photo Roger Charlton.

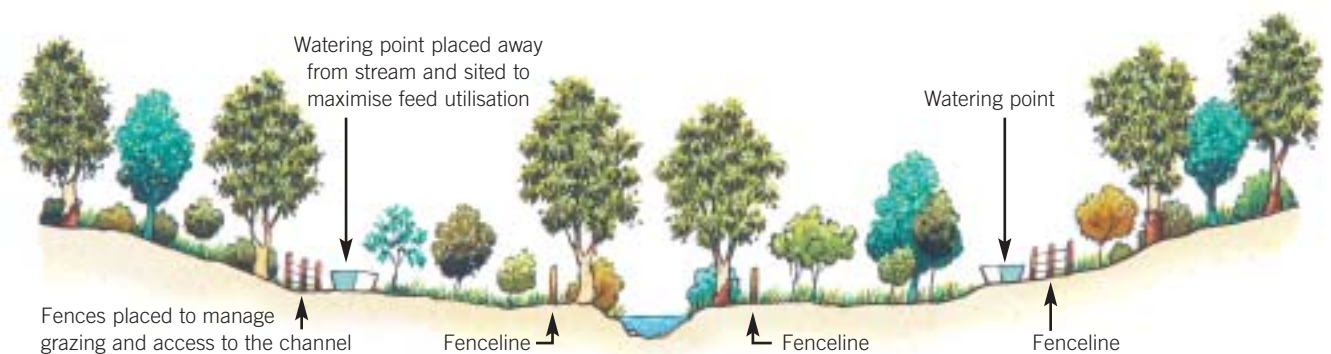
3. Water quality and off-stream stock water

Uncontrolled stock access to riparian areas can lower water quality by both natural and induced changes. Erosion may increase due to stock over-grazing, bare tracks, and damage to the banks, making the water turbid. Sheep health and growth rate can suffer from drinking poor quality water particularly in the warmer months.

Riparian areas, when intensively grazed, become hotspots for the transmission of disease. Sheep dung can be washed into the waterway following rain also reducing the water quality and adding large quantities of nutrients which may then stimulate the excessive growth of in-stream plants including nuisance or toxic algae.

The amount of vegetable matter (contamination) in wool may be reduced through fencing off a waterway and providing an off-stream source of water, depending on the type of soil and the vegetation cover near the waterway. Keeping sheep out of riparian areas when preferred pasture species are setting seed can help to promote regeneration of those species while also reducing seed contamination of the fleece.

Fencing to allow improved grazing management of riparian areas, combined with designated access points to the waterway or an off-stream watering system, can provide significant productivity gains as well as lifting environmental condition of the stream.





4. Flood management

Floods are a natural event for waterways. The level of damage caused by flooding is influenced by the amount and type of vegetation in and immediately surrounding the stream channel. Natural riparian vegetation such as reeds, perennial grasses, and shrubs such as tea-tree and bottle-brushes are adapted to cope with flooding as they are able to bend and lie down to let water pass, slowing the water flow and trapping sediment. Other native riparian plants, including the wattles, casuarinas and eucalypts that grow higher up the bank, have extensive root systems that help to bind and reinforce the bank soil, making it less susceptible to erosion during a flood.

Most exotic vegetation, such as willows and poplars growing along the waterways, has rigid stems, that snap and break in floods. In large floods these trees and sections are carried downstream destabilising banks, and accumulating to threaten infrastructure such as bridges and river crossings.

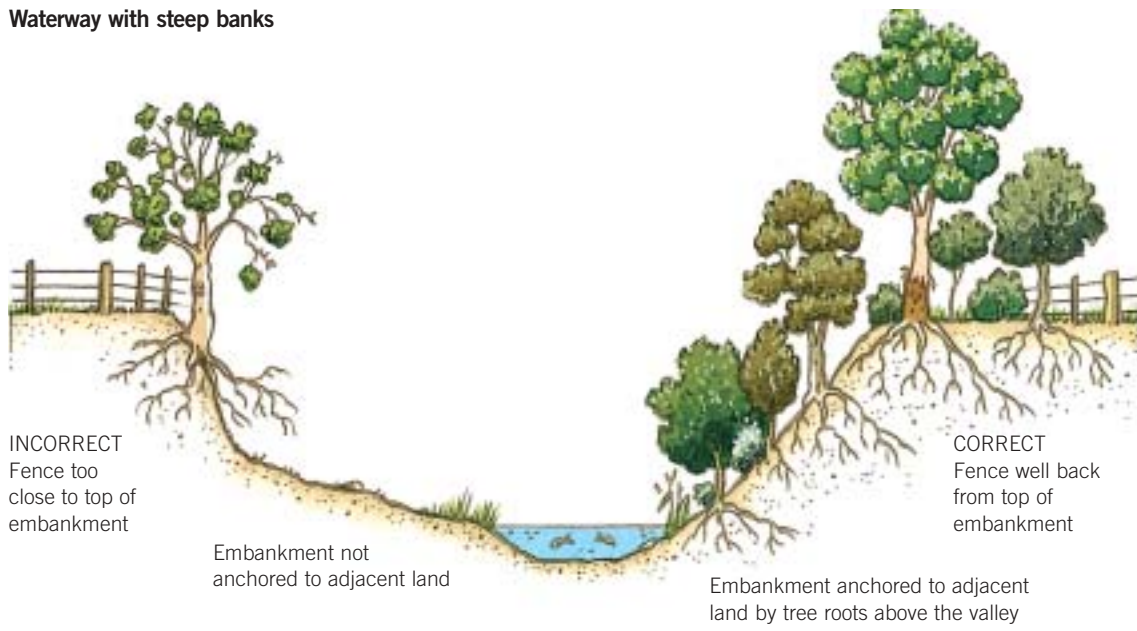
Location of fencing around a waterway is an important consideration. Keep fences well clear of at least the average flood (one in two years) high water mark, and replant riparian areas with only local native species. There are different types of fencing suitable for use in flood-prone areas both along and across the stream. For details see the publication *Stock and waterways: a manager's guide* listed in the "I'd like to know more!" section starting on page 36. For a guide to what riparian plants grow where, see page 40.



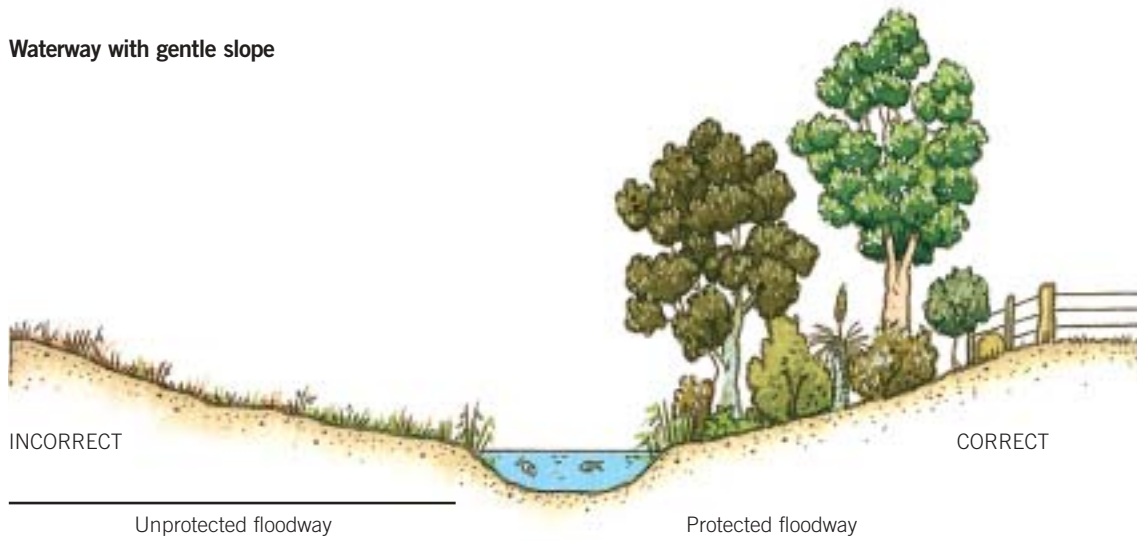
Photo Fleur Flaney

"Mal and I set a vision for how we'd like 'Naranghi' to look in 25 years. Twenty years on, we're close to achieving that goal. We've fenced off and re-vegetated, using tubestock, most of the gullies primarily to stabilise creek banks but also to increase biodiversity and decrease sediment entering the water course. These areas have gone from the most unproductive areas which were awful to muster to important areas where stock can shelter when needed."
Louise Hufton

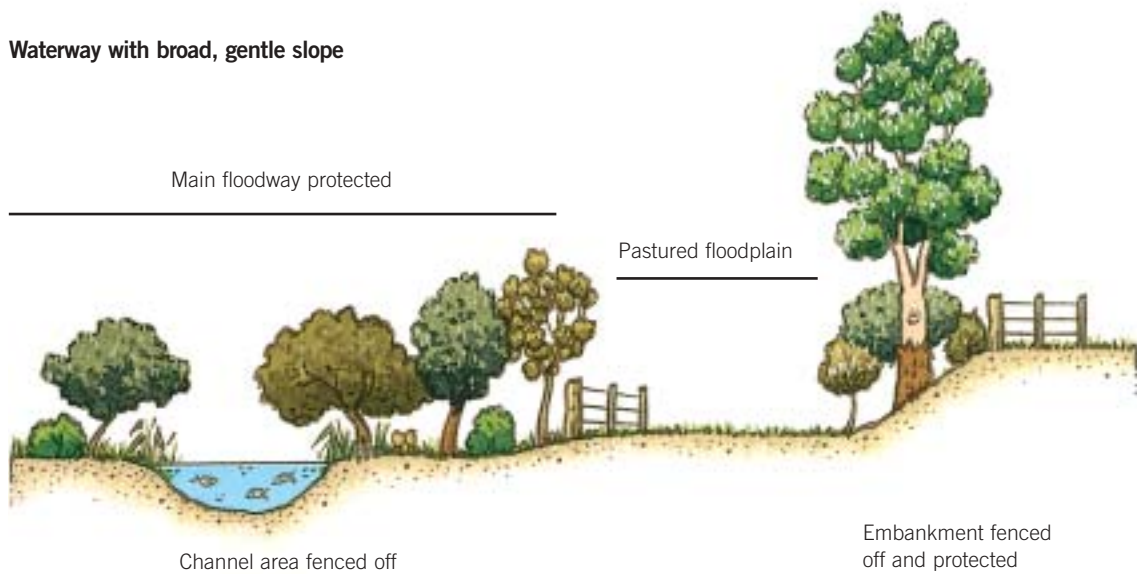
Waterway with steep banks



Waterway with gentle slope



Waterway with broad, gentle slope





When building riparian fences, ideally provide vehicle access so that you can enter the area to slash, rip rabbit warrens or lay baits. In summer the vehicle access could double as a firebreak. Photo Jenny O'Sullivan.

5. Weeds, feral animals and fire

Fenced off waterways need not be a harbour for weeds or feral animals, nor be at increased risk of fire. Fencing means controlled access by stock, not necessarily their exclusion. Riparian fencing should include vehicle access points for follow-up control of weeds or pests such as rabbits. Stock may also be grazed in the area before replanting to reduce weeds. Another method is to rehabilitate one section of the stream at a time to ensure follow-up control of any weeds or pests can be fitted easily into the farm program.

For areas where riparian vegetation is being rehabilitated, stock access should be restricted until native vegetation has had time to recover, or to establish, and grow to a sufficient height and strength where it won't be adversely affected by the sheep. In time (generally more than five to seven years) stock can intermittently graze riparian areas. Grazing duration and time of the year should be balanced so that perennial grasses are able to seed and spread.

In riparian areas, the same principles of establishing pastures should be applied to weeds management. If the deep-rooted perennial grasses and trees that, in time, provide canopy

cover, are allowed to establish, weed invasion will be limited. The most critical time for weed control is after the initial establishment of the new vegetation, or after a major disturbance such as a flood or fire. Weeds should be controlled by hand removal or spot-spraying with herbicides that are registered for use in riparian areas, to allow the grass species and other native vegetation to grow. In time the need for additional weed control will be reduced.

There is risk that riparian areas, if left unused and unchecked, will become harbours for feral animals such as rabbits and foxes. Management of these pest species needs to be considered for the whole farm as well as the riparian area. The Department of Agriculture, Forestry and Fisheries (DAFF) and Australian Wool Innovation Limited have invested in research on the best ways to control feral animals. DAFF has developed "Pestplan" which is a guide to setting priorities and developing a management plan for pest animals. For more information go to www.affashop.gov.au/product.asp?prodid=12598

Australian Wool Innovation Limited is investing in research to manage foxes. For more information go to www.wool.com.au.

What's the problem with willows?

Crack willows (*Salix fragilis*) now dominate much of the Yass River and other farm waterways in the region. In the late 1800s willows were introduced as an emergency food source for stock, and to stabilise banks as they establish easily and have fine matted roots. They serve both purposes well but can grow into stream channels and block them, causing more erosion. They also limit aquatic biodiversity. They are aggressive colonisers and their strong shade in summer reduces the opportunity for other plants to grow. They are deciduous and drop all their leaves in winter which restricts the food supply for aquatic life to one short time of the year. This leaf fall 'en masse' can alter the pH (acidity level) of the water which can be dangerous to crustaceans like yabbies, and the massive leaf decomposition can starve the water of oxygen needed by fish and other aquatic animals.

Willows also spread rapidly over long distances as they are able to spread vegetatively. This means if a branch falls off and is swept downstream it is able to embed itself into the bank and grow into a new plant if conditions are suitable. More recently, several types of willow have become a pest. Initially all willows that were introduced into Australia were the same sex (i.e. all males or all females). With the introduction of new species this has changed and now both sexes exist which means they can now spread rapidly by seed. Following the introduction and spread of both male and female plants, they are now able to produce millions of viable seeds that float long distances in the wind and establish huge populations along waterways.

Some willows are now listed as Weeds of National Significance, with limitation on their sale and the required control of them (www.weeds.org.au).

Willows extract large volumes of water from streams, which has implications for the amount of water that is available for domestic and stock consumption.

Source: Department of Land & Water Conservation NSW.

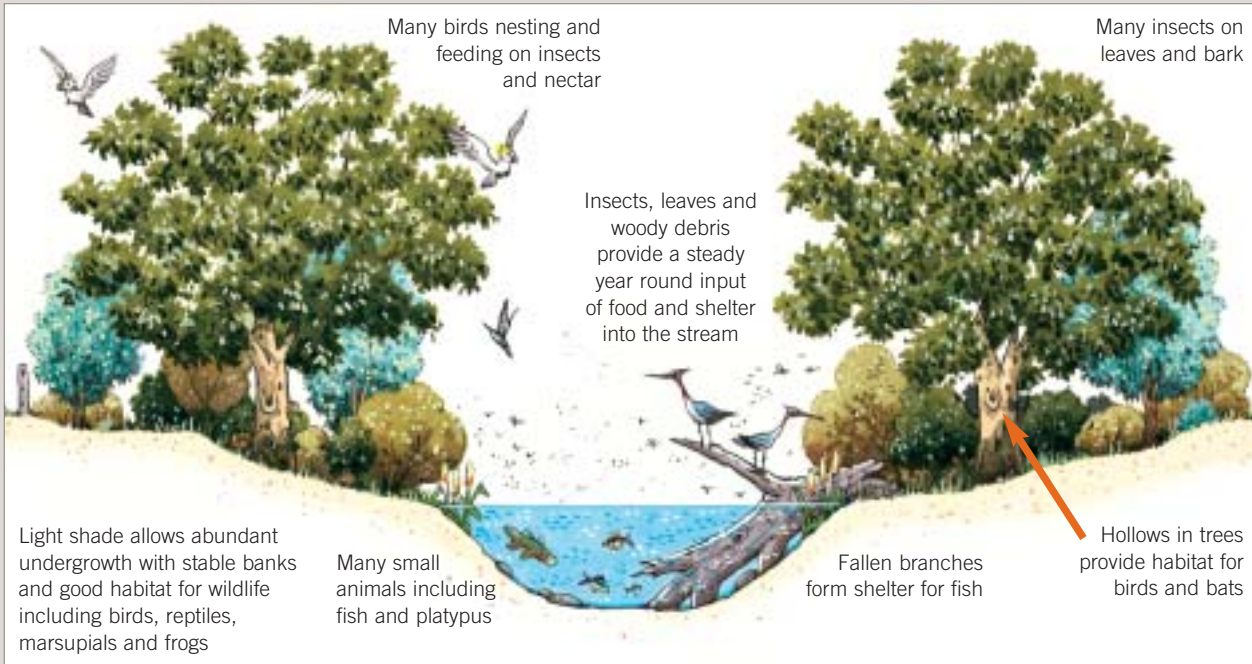
See also: Pope, L. et al. 2006, 'Controlling willows along Australian rivers', *River and Riparian Management Technical Update*, number 6, Land & Water Australia.



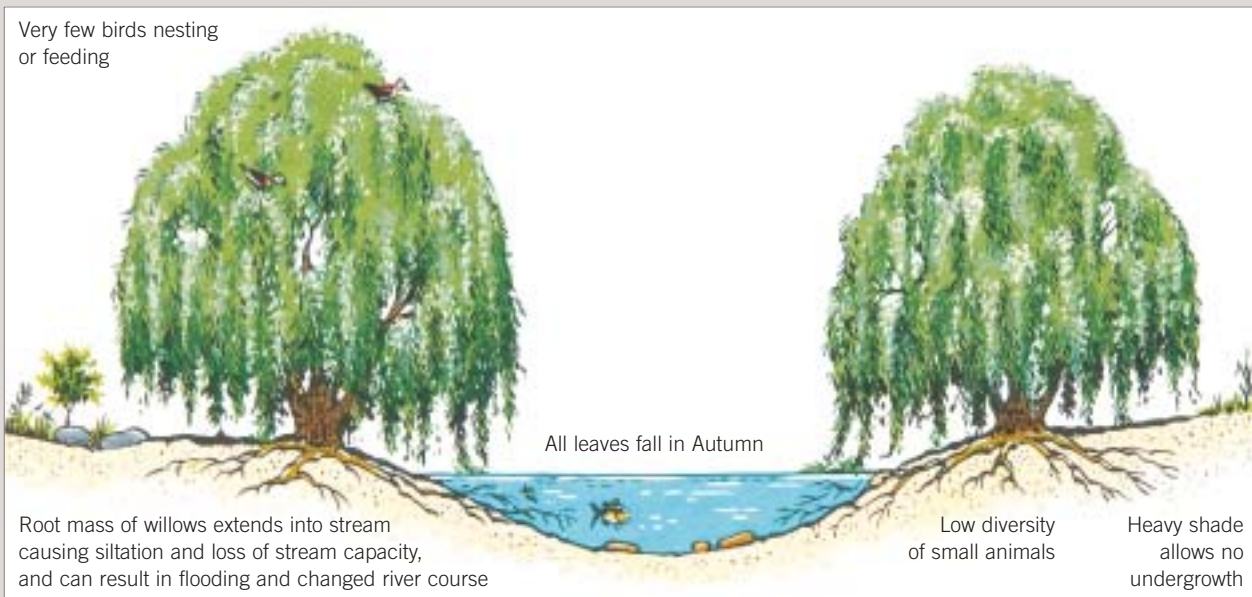
Main photo *Salix fragilis*. Photo Lizzie Pope.



The benefits of native vegetation in riparian areas



The effects of willows in riparian areas



Both illustrations Paul Lennon. Modified from 'Willows along watercourses: their impact compared to natives', Landcare Notes, no. LC0119, 1998, North East & Murray Willow Management Group.

Replanting after willow removal. Photo Lizzie Pope.



Planning for change

Remember, you don't have to do it all at once

It is often best to undertake riparian projects in stages, completing or improving one area at a time as funds become available. Taking this approach will help you to manage your time and costs, and ensure you are able to complete follow-up work such as watering or weeding, and thus make it more likely the project will achieve your objectives.



“When we bought the land on the Yass River, we shared an amazing vision and imagined how it would look when it was covered with native trees and shrubs instead of hawthorns, briars and willows. We quickly fenced off 2 kilometres of land along the river front and spent many weekends clearing hawthorns and crack willows and replacing them with native trees and shrubs using seed collected in the region. We imagined an overnight transformation.

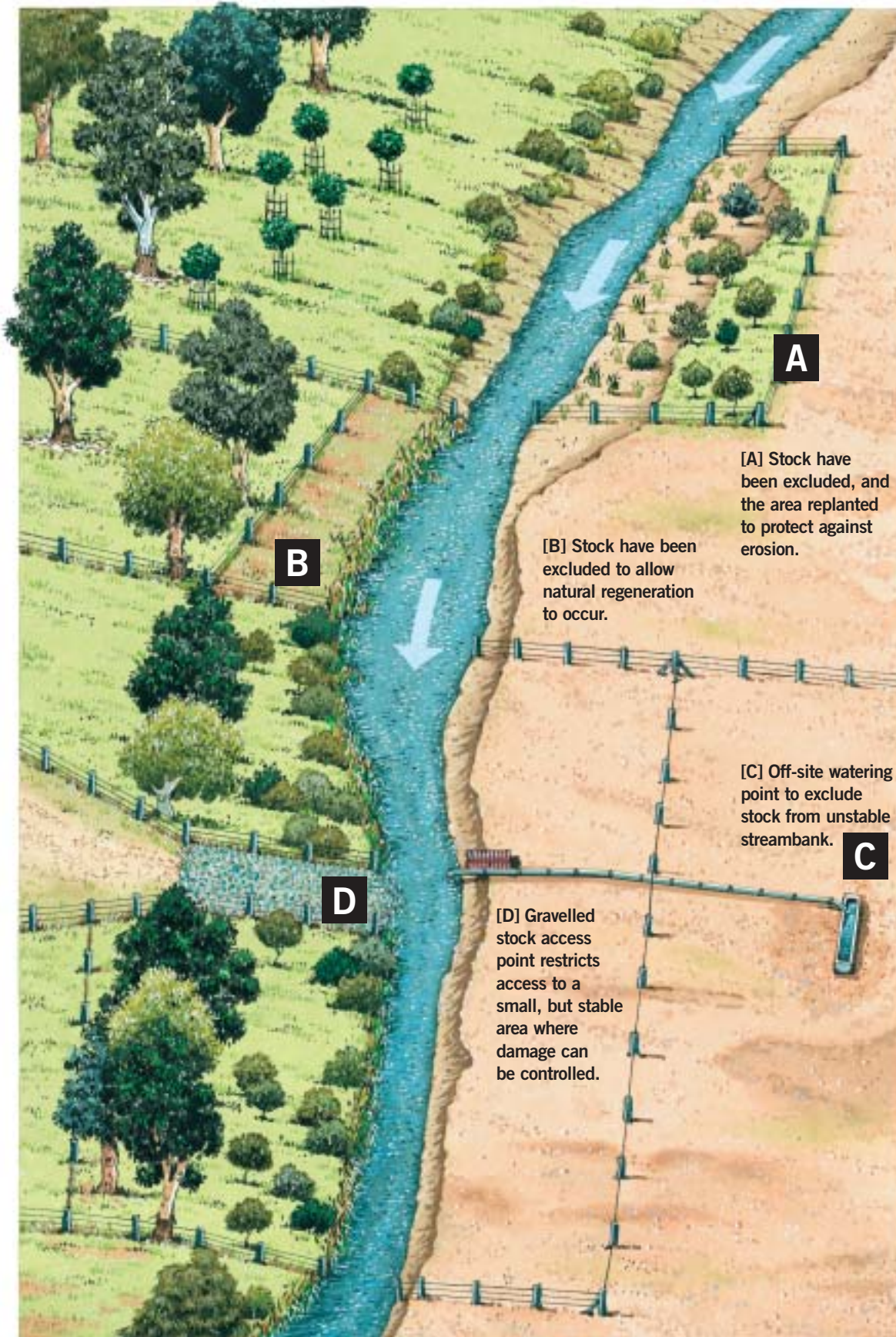
It didn't happen. We've had very little rain over the last two years with really dry springs and autumns.

After two years of planting and ending up with dead trees, bare banks and little shade, we thought about giving up. All that hard work for very little benefit. We decided on a new approach by working on small areas and ensuring we had enough time to plant, water and watch. This seems to be working much better.” Thomas Johnson



Revegetation at the Yass Weir, April 2005.

Photos this page Fleur Flanery.



This diagram illustrates how management needs can vary along a watercourse and how you can stage your efforts to when time and resources are available. Illustration Paul Lennon.

There is help available

There are a range of organisations that can help you plan and implement a riparian improvement project. This assistance might in the form of advice, funding or practical help. Tapping into your local networks can also be of significant assistance to you. See page 36 for a list of useful resources. The local Catchment Management Authorities (CMAs) in the Yass region of the southern tablelands not only provide advice, but can also provide incentive funding for the community to improve the management of the natural resources in the catchment:

- Murrumbidgee Catchment Management Authority
www.murrumbidgee.cma.nsw.gov.au
- Lachlan Catchment Management Authority
www.lachlan.cma.nsw.gov.au

Potential funding sources

There are a number of potential funding sources to help with riparian and waterway rehabilitation activities where some of the benefits are enjoyed by the wider community. These include your local Catchment Management Authority (see web addresses above) and Australian Government Landcare and Environmental grants programs:

- National Heritage Trust — www.nht.gov.au
- Envirofund — www.nht.gov.au/envirofund

“Working on a project like this has been a real winner for everyone involved. The group includes a range of stakeholders such as the Murrumbidgee CMA, Greening Australia, Department of Primary Industries and the Bookham Agricultural Bureau that were bought in early to work alongside researchers. The meetings were always friendly, had great food and I looked forward to them. Our comments were taken on board quickly and we were able to learn from each other.” Brad Parker, Murrumbidgee CMA



Photo Land, Water & Wool.

Greening Australia and Land & Water Australia's Open Farm day at Bogolara, November 2006. Photo Sue Streetfield.





I'd like to know more!

There are a number of ways you can find more information about improved management of your riparian zone including an enquiry service, CDs, websites and publications.

Good reads for primary producers who want to know more about their waterways

Managing in-stream wetlands on wool-producing farms — this fact sheet provides information about the benefits of and management tips for, in-stream wetlands.

Product code: PF061168



Managing gullies on wool-producing farms — this fact sheet provides information about gullies, their prevention and management, so that woolgrowers can make informed decisions about what to do on their farm. This fact sheet focuses on a demonstration site near Yass on the southern tablelands of NSW that was part of the Land, Water & Wool project but it is applicable to many areas of the tablelands in Queensland, New South Wales and Victoria where sodic* subsoils are easily eroded and gullies are common.

Product code: PF061166

*Sodic soils: Soils with high levels of exchangeable sodium and low levels of total salts are called sodic soils.

Rapid Appraisal of Riparian Condition for the southern tablelands of New South Wales — the extensive degradation of riparian lands in Australia has led to the development of a rapid method of assessing riparian condition to underpin strategies for improved management. The Rapid Appraisal of Riparian Condition (RARC) Index was developed by Amy Jansen, Alistar Robertson, Leigh Thompson and Andrea Wilson from Charles Sturt University, and is applicable for southern riparian systems. It enables people to assess the ecological condition of riparian habitats using indicators that reflect functional aspects of the physical, chemical and landscape features of the riparian zone. A New South Wales tablelands RARC is now available that is tailored specifically to the region covered in this guideline.

Product code: PF071292



Stock and waterways: a manager's guide — offers practical advice on how livestock producers can manage riparian land both productively and sustainably, and includes a number of case studies from farmers throughout Australia who have seen the benefits of changing their management practices.

Product code: PR061132



The *Wool industry river management guides* bring together the latest science and recommended practices for riparian areas within the context of a commercial wool-growing property. The guides are available for the high rainfall regions (above 600 millimetres) and sheep/wheat regions (300–600 millimetres) of Australia. Each book has over 200 full colour pages. In addition www.rivers.gov.au/lww offers an active contents list which provides a snapshot of what is in each section.

High rainfall zone product code: PX050951

Sheep/wheat zone product code: PX050952

Managing rivers, streams and creeks: A woolgrowers guide is a summary of the key recommendations from the ‘Wool industry river management guides’ and provides an introduction to river and riparian management issues on-farm.

Product code: PX051003



Are my waterways in a good condition? — a checklist that provides colour coded pictures that you can use to assess the condition of your stream or creek. It is a quick and easy way to determine the health of streams or creeks and it offers management suggestions to improve or maintain these vital parts of the farm.

Product code: PB061114

These products are available from CanPrint Communications on freecall 1800 776 616 in hard copy, or can be downloaded from www.landwaterwool.gov.au or www.rivers.gov.au





River insights — a publication featuring the stories of ten woolgrowers and what has motivated them to manage their waterways in ways that make both economic and environmental sense.

Product code: PK050950



‘Controlling willows along Australian rivers’, *River and Riparian Management Technical Update*, number 6, Land & Water Australia — willows (*Salix* spp. and hybrids) are a serious weed threat to rivers, riparian areas and wetlands throughout south-eastern Australia, and are continuing to spread. Willows can cause a range of deleterious morphological and ecological changes to rivers and aquatic ecosystems. Effective methods are available for control and removal of willows, but using these methods requires careful planning and implementation, as well as follow-up maintenance. This guideline summarises some of the existing information about willows and their management, and provides links to other more detailed sources of knowledge.

Product code: PR061151

These products are available from CanPrint Communications on freecall 1800 776 616 in hard copy, or can be downloaded from www.landwaterwool.gov.au or www.rivers.gov.au

Products from Greening Australia

Riverways: Shortcuts to river management information in Australia — this publication identifies key resources about riparian management. For a copy contact Greening Australia, 1300 886 589. It will be available electronically later in 2007 via the website www.greeningaustralia.org.au



The Exchange enquiry service — telephone or e-mail the Greening Australia’s Exchange service for information about native vegetation issues for your waterway.

Telephone 1300 886 589 (freecall).

E-mail: exchange@greeningaustralia.org.au



Native Vegetation and Regional Management and *Native Vegetation and Property Management* are comprehensive directories of research and resources for vegetation management, at the property and regional scales. They summarise and direct you to the best research and resources on vegetation management currently available.

What grows in my region?

Woolgrowers wishing to rehabilitate their riparian areas should use local native plants wherever possible. These are already adapted to the local soil and climate and are likely to establish and grow more quickly than plants from elsewhere (some protection from insect pests and local browsers may be necessary). Native plants are eaten by insects and also produce the nectar required by local birds and arboreal mammals; on both counts they thus underpin the natural ecosystem of the area, whereas exotics often provide no useful food and only limited habitat for local birds and other animals. A mix of local native plant species supports a range of important riparian functions as listed above, and where possible temporary exclusion of sheep to allow natural regeneration to take place is by far the cheapest revegetation method.

The table on the following pages lists some common species found in the NSW southern tablelands and ACT region. It should be used as a guide to some of the plants that can be used in revegetation activities.

Wallaby Grass (*Austrodanthonia* species) is a prolific seeder which enables it to quickly recolonise areas after favourable rainfall.

Photo David Sloper.



Check with your local Catchment Management Authority (CMA) or respected direct-seeding expert in your area. For further information contact Greening Australia's Exchange service on 1300 886 589.

References

Planting Companion: A guide to native revegetation in the ACT region, L. Gould, Greening Australia ACT & SE NSW for ACT Forests, 2005.

A Brief Guide to Flora of the Murrumbateman Area, Murrumbateman Landcare Group, 2005.

Native Grasses — An identification handbook for temperate Australia, M. Mitchell, 2003.

Acacias of Southeast Australia, T. Tame, 1992.

Endemic riparian plants for the southern tablelands and ACT. These lists should be used as a guide when deciding what to plant near your waterway.



Species (botanical name) and common name (if any)	Location	Growth form	Function/attracts
UPPER STOREY			
<i>Eucalyptus camaldulensis</i> (Red river gum)	Anywhere on the bank from its top to the water's edge	Tree to 20 m	Deep roots reinforce and bind the bank soil, provides food, habitat and (when old) nesting sites.
<i>Eucalyptus mannifera</i> (Brittle gum)	Commonly found on hills and other areas with shallow soils	Tree to 20 m	Drought tolerant in almost any soil. Very hardy attractive tree that changes from bright white 'ghost gum' to pastels and brighter colours through the year. Useful to revegetate recharge sites to treat salinity.
<i>Casuarina cunninghamiana</i> (River she-oak)	Close to water's edge	Tree to 15 m	Often a 'pioneer' species first to colonise and stabilise point bars and bare banks after a major disturbance. Good for erosion. Wind makes a lovely whistling sound when blowing through leaves.
<i>Eucalyptus albens</i> (White box)	River banks above the high water mark	Tree to 20 m	Flowers profusely over a long period in late winter and attracts honeyeater birds such as Rainbow Lorikeets. White Box is an excellent shade tree and could also be incorporated in wind breaks and woodlots. Its timber is used for engineering construction, railway sleepers and fencing.
<i>Eucalyptus blakelyi</i> (Blakely's red gum)	River banks above the high water mark although can tolerate water logging	Tree to 20 m	Major habitat and food tree for threatened and common native fauna. Favoured nesting tree of endangered Superb parrots. Trees often show signs of dieback through insect (lerp) attack. This is possibly the result of a decline in numbers of the woodland animal species (such as honeyeaters and insects) that include lerp in their diet.
<i>Eucalyptus bridgesiana</i> (Apple box)	Generally found on gentle hillsides and in drainage lines and flats	Tree to 20 m	Flowers profusely and more regularly than most eucalypts in the area. Grows to 20 m. Useful in gully erosion control as a back up to fibrous rooted understory shrubs. Excellent habitat for bees and birds.

UPPER STOREY continued			
<i>Eucalyptus melliodora</i> (Yellow box)	High on river banks	Tree to 30 m	Occurs on more fertile soils. Invaluable habitat, honey, timber and paddock tree. Mass flowering episodes attract nomadic birds from far away: some are endangered species such as the Regent Honeyeaters and Swift Parrots. Long lived and slow growing. Helps stabilise areas prone to landslips and slumping due to high water usage.
<i>Eucalyptus polyanthemos</i> (Red box)	High on river banks	Tree to 30 m	Major habitat and food tree for threatened and common native fauna. Flowers September to December. Produces excellent hard wood/fuel. Good shade due to large spreading crown. Hollows provide nesting sites for various birds and mammals.
MID-STOREY			
<i>Acacia buxifolia</i> (Box-leaf wattle)	High on river banks. Prefers open-drier areas	Bush/shrub to 2 m	Excellent low-level cover in windbreaks. Useful in controlling erosion as it has soil-binding fibrous roots. Attractive foliage and prolific flowering.
<i>Acacia pravissima</i> (Owens wattle, Tumut wattle)	Along riverbanks	Shrub to 3 m	Fast growing. Excellent low-level cover in wind breaks and for controlling streambank erosion due to soil-binding fibrous roots. Improves soil fertility.
<i>Acacia rubida</i> (Red stem wattle)	Higher banks and open-forests	Shrub to tree	Very hardy and fast growing. Good medium level cover in windbreaks. Good for controlling soil erosion as it suckers and has fibrous roots which are soil binding. Improves fertility and fixes nitrogen. Flowers and pollen source for native moths, butterflies and other insects.
<i>Acacia siculiformis</i> (Dagger wattle)	Understorey of forests and near streams	Shrub to 1.2 m	Useful for controlling erosion as it has soil binding fibrous roots. Improves soil fertility by fixing nitrogen. Prickly foliage makes it good cover for small native animals.
<i>Bursaria spinosa</i> and <i>Bursaria lasiophylla</i> (Native blackthorn)	Common mostly as spindly trees chiefly in gullies and on some coastal dunes. Well drained soil	Shrub-small tree to 1.8 m	Hosts insects that feed on saw fly larvae (spit-fire grubs) which feed on Eucalyptus. Nectar source for wasps that parasitise leaf-eating scarab beetles and pasture grubs, generally within 200 m of plants. Useful for controlling gully erosion as fibrous roots bind soil. Thorny plant makes it an excellent refuge and nest site for birds.



Species (botanical name) and common name (if any)	Location	Growth form	Function/attracts
MID-STOREY continued			
<i>Dodonaea cuneata</i> (Wedge leaf hop bush)	Chiefly on rocky outcrops, drier slopes and sandy sites	Spreading shrub	Fast growing. Good for windbreaks due to bushy growth. Good for stabilising soil. Pollen source for moths, butterflies and other insects. Foliage and seed good refuge and forage for small birds. Larger mammals browse foliage.
<i>Dodonaea viscosa</i> (Giant hop bush)	Mainly on rocky outcrops, drier slopes and sandy sites. Frost and drought tolerant	Bush or understory	Fast growing. Good for windbreaks due to bushy growth. Good for stabilising soil. Pollen source for moths, butterflies and other insects. Foliage and seed good refuge and forage for small birds. Larger mammals browse foliage. Reddish inconspicuous flowers September to November.
<i>Grevillea juniperina</i> (Prickly grevillea)	Often on sand or rock near rivers and larger creeks in the southern tablelands	Bush to 1.2 m	Prickly foliage provides a resting place for birds. Flowers are a nectar source for native birds, moths and butterflies.
<i>Grevillea lanigera</i> (Woolly grevillea)	Well-drained soil. Tolerates frost and drought. Full sun and semi-shade	Bush to 1.2 m	Good habitat. Flowers attract nectar feeding birds, moths and butterflies. Attractive bush.
<i>Indigofera australis</i> (Austral indigo)	Poor shallow soil in semi dappled shade. Adapts to most well drained acidic soils. Drought tolerant	Shrub to 2 m	Improves soil fertility by fixing nitrogen. Provides pollen and nectar for many native insects, including bees and wasps. Attractive.
<i>Leptospermum juniperinum</i> (Prickly tea-tree)	Poorly drained soil in lowland areas. Forest or open sandy swamps. Tolerates frost and extended dry periods	Small tree to 4 m	Useful in poorly drained sites. Controls erosion as it has soil binding fibrous roots. Excellent habitat. Prickly foliage good refuge for small birds, particularly dense thickets. Flowers good pollen and nectar source for many native insects, including moths and butterflies.
<i>Leptospermum obavatum</i> (River tea tree)	Along streams and moist areas and among granite or sandstone rocks. Tolerates inundation, most frost and dry periods	Shrub to 2 m	Dense fibrous roots bind soil making it a good plant for erosion control along banks. Shade and insect source for fish. Submerged branches provide habitat. Flowers good pollen source for many insects and a good nectar source for birds.

MID-STOREY continued	
<i>Chrysocephalum apiculatum</i> (Clustered everlasting)	Woodland and grassland hills and mountain, or on isolated rocky rises Perennial herb Excellent ground cover for bare and disturbed sites. Flowers nectar source for butterflies. Attracts insect eating birds. Cover for reptiles.
GRASSES AND LILIES	
<i>Dianella longifolia</i> (Smooth flax lily)	Prefers protected moist position in well drained soil and semi-shade Tufted perennial Good soil stabiliser and attracts seed eating birds. Popular garden plant.
<i>Themedia australis</i> (Kangaroo grass)	Adaptable. Moist to well drained soil Tufted deep rooted perennial to 1.2 m Drought and frost hardy. Provides valuable summer feed. Frequent dominant or co-dominant species in a variety of communities including grasslands or woodlands.
<i>Microlaena stipoides</i> (Weeping grass)	Moist to well drained soil and semi shade. Common along creek lines. Tolerates drought and frost Tufted slender perennial to 100 cm Persistent during drought, grazing and acid soil tolerant, high herbage value. Shade tolerant and can grow under trees and be a valuable grass in any situation from grazing through to garden lawns.
<i>Austrodanthonia</i> sp. (Wallaby grasses)	Very versatile grass. Moist to dry sites Tufted perennial to 100 cm Amongst the most valuable native grasses in pastoral areas of Australia as they are generally resilient and provide high quality feed.
<i>Lomandra longifolia</i> (Mat rush)	In water's edge. Moist well drained sites Tufted perennial to 100 cm Very versatile plant. Tolerates dryness, waterlogging and poorly drained sites. Full sun to part shade.
<i>Poa labillardierei</i> (River tussock) (wetter areas)	On banks Large tussock to 100 cm A dense, tussocky perennial grass with slender leaves. Occurs on lower slopes and valley floors that are wet in the winter months. Prefers rotational grazing. Highly invasive under set stocking. Relatively unpalatable.
REEDS	
<i>Carex</i> sp. (Sedge)	Grows in the water's edge Aquatic Good sediment trap.
<i>Juncus</i> sp.	Grows in the water's edge in slow moving water Aquatic Good sediment trap.

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Photo Laura Eves.

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