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Preventing creek erosion

This fact sheet has been prepared through the Land, Water & Wool Program and provides advice for woolgrowers on managing creek erosion in the mid north grasslands and shrublands of South Australia. The fact sheet explains how erosion occurs, and outlines a range of different management strategies that woolgrowers can use on-farm to prevent erosion or rehabilitate creeks that may currently be affected.

An example of bed erosion occurring along a creek at Burra, South Australia. Photo Emma MacKenzie.



Erosion of creek beds and banks is a natural process. However erosion rates are significantly increased by human activities such as clearing land for agricultural production, and uncontrolled grazing by stock.

Erosion of bank soil by water during intense rainfall or flood events, as is typical in the pastoral country near Burra, can move large quantities of sand, silt and clay and make the water highly turbid (muddy), reducing its quality for downstream users. Many creeks in the mid north flow only occasionally, but their bare, exposed banks are very susceptible to erosion by the infrequent floods that often follow storms.

The key principle in preventing or reducing erosion along creeks is to maintain good ground cover over the surface of the banks. This reduces contact between falling rain or floodwaters and the banks, decreasing the amount of soil eroded. The roots of vegetation growing along and on top of the bank also help to reinforce the soil and reduce the erosion rate, while vegetation growing within the creek channel can also slow water flow and trap sediment.

Riparian means any land which adjoins, directly influences or is influenced by a creek or river.

There are two common forms of creek erosion, bank erosion and bed erosion.



Top: A healthy riparian area near Burra, South Australia, with a diversity of vegetation. Photo Kerri Muller. **Above: Erosion of soil by water during flood events and a lack of protective ground cover can cause large gullies and channels to form over time.** Photo Phil Price.



An example of sub-aerial erosion occurring along a creek at Burra, South Australia. Photo Emma MacKenzie.



Repeated scouring along a creek will cause undercutting of the bank. An example of undercutting occurring along a creek at Burra, South Australia. Photo Emma MacKenzie.

Bank erosion

There are three processes at work when bank erosion occurs — sub-aerial erosion, fluvial scour and mass failure (or slumping). These processes can occur singly or in combination and in different parts of the creek.

Sub-aerial erosion

This involves processes that loosen the soil of the creek bank, making it vulnerable to being carried away by water moving past in the next big flow. Loosening processes include trampling by livestock, frost heave (when expanding ice forces pieces of soil away from the bank surface), desiccation by sun and wind, and the direct impact of wind and rain moving soil particles.

Fluvial scour

Fluvial scour occurs when a force applied to the bank by flowing water exceeds the resistance to erosion of the bank surface. On outer bends of a creek meander, water flow is fast and there is strong contact between the flow and the bank itself. Scouring tends to take place in the area known as the toe of the bank, at the water's edge. Repeated scour at this point can undercut the bank, which then topples into the water or creek bed when its weight can no longer be supported.



An example of slumping occurring along a creek at Burra, South Australia. Photo Emma MacKenzie.

Mass failure

Mass failure (or slumping) can occur anywhere along a creek and often follows undercutting by scour. It can occur when the bank soil itself has been saturated, for example by heavy rain or from a flood peak and the level of the flow in the creek drops quickly, leaving the heavy saturated soil of the bank unsupported.

Mass failure can often be seen in the middle part of the creek system where the bank height exceeds the rooting depth of riparian vegetation and where native vegetation has been cleared or lost from the banks.

Bed erosion

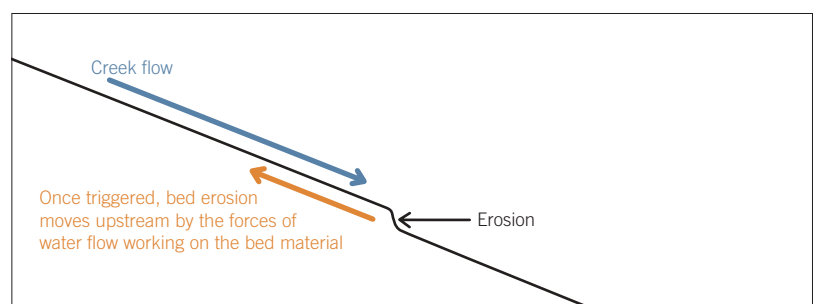
Erosion of the creek bed (called bed deepening or incision) can occur due to a range of changes in the landscape over many years. The removal of vegetation by clearing or grazing, or the cultivation of land all impact on the amount of surface runoff into creeks. The construction of roads and other infrastructure in and



An example of bed erosion occurring along a creek at Burra, South Australia. Photo Emma MacKenzie.

around a watercourse can also interrupt the nature of flow along the creek bed and may trigger it to erode. Increased volume of flow, and/or increased velocity (speed) of flow, are the main triggers for bed erosion. Once triggered, the power and velocity of the water flow work to expand the bed erosion and cause it to move upstream. Bed erosion usually shows up as a step in the stream bed that progressively moves upstream leaving behind a narrow channel in the bed of the stream.

The bed erosion will continue to migrate until it reaches a control point in the creek. A control point is usually a rock bar or it can sometimes be a culvert. If the bed erosion is severe



it will undermine infrastructure such as road crossings and culverts as it moves upstream. Bed erosion lowers the creek bed deeper into the landscape causing the creek banks to become steeper and more prone to collapse. Many of the creeks in the mid north are incised and continue to erode periodically.

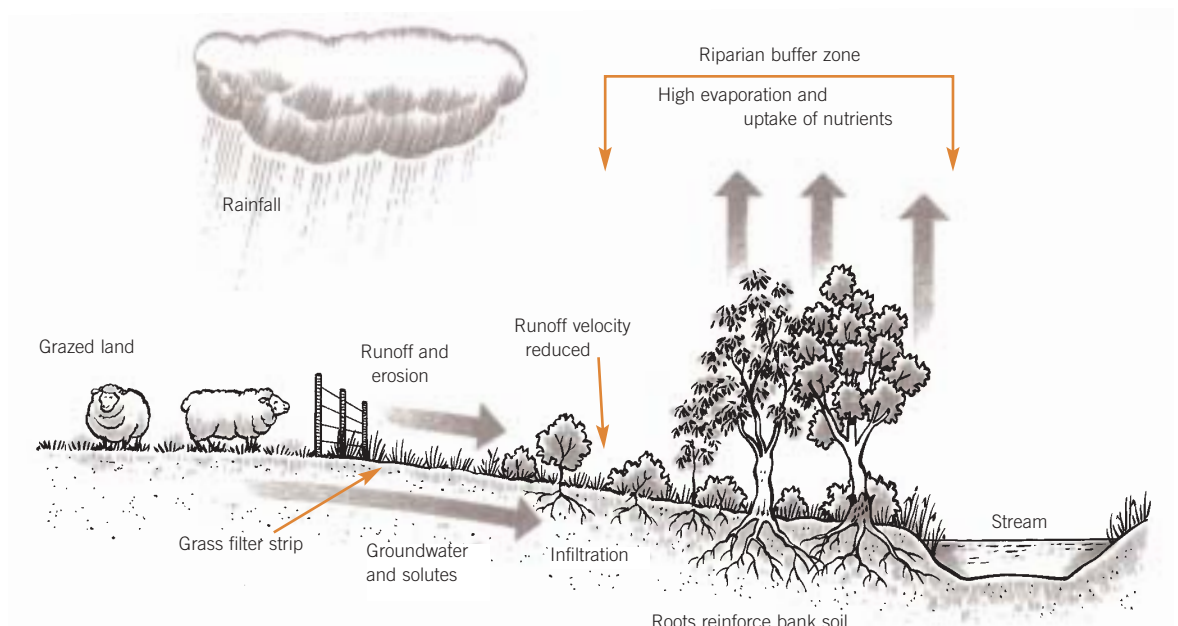
Creek erosion management

Maintaining good ground cover is the key to preventing or slowing the erosion of creek banks and beds. Vegetation cover on the banks reduces erosion due to both sub-aerial and scour processes as the bank soil is no longer directly exposed to the forces that cause erosion. Riparian vegetation also stabilises creek banks, with roots acting like reinforcing rods, holding the soil together and reducing the

risk of mass failure. Plants also help to dry the creek banks after significant rain or floods, further reducing the risk of erosion. Fencing to enable managers to control stock access and promote revegetation and regeneration is the main, low-cost option available to woolgrowers to prevent or reduce erosion of waterways. Funding may be available to help defray capital costs for fencing that will provide environmental benefits.

The first step in managing erosion along your creeks is to inspect them and determine which areas seem to be stable (have good vegetative cover) and which are clearly eroding (mainly or entirely bare soil on the banks and bed). Decide whether the bed is deepening (bed is bare and banks vertical) or whether it is mainly the banks that

Maintaining good vegetative cover is the key to preventing soil erosion. Fences can be used to control stock access to riparian areas so that the timing, frequency and duration of grazing can be managed. Fencing also enables woolgrowers to keep stock out during times when the creek is in flood. Illustration Paul Lennon.





Riparian areas are unreliable boundaries on the property and can make mustering difficult, as well as result in stock losses from sheep falling into gullies and becoming trapped in the creek bed during floods or wet periods. Photo

courtesy Australian Wool Innovation.

are eroding. A channel that is continuing to erode (incise) may require diversion of overland flow and substantial works with rock or piles before it can be stabilised for revegetation. If only the banks are eroding, decide which are the main processes at work (sub-aerial, scour, mass failure) and apply the principles noted earlier.

Management of creeks and riparian areas should be included as part of the whole property plan. Fencing of creeks and riparian areas and off-creek watering, if planned carefully, can provide some benefits to wool production by allowing improved grazing management and feed utilisation (see Land, Water & Wool fact sheet on planned grazing management), provision of shade and windbreak shelter, less contamination of wool by soil and vegetable matter, and easier mustering and stock inspection. Together with external funding for capital costs, this can make improved creek management financially viable for woolgrowers.

When planning creek rehabilitation in low rainfall areas, consider the following management principles:

1. Maintain ground cover of at least 50–70%, ideally more than 70%, in areas adjacent to a waterway to prevent soil loss through erosion into the channel. Stock access to, and grazing management of, riparian paddocks should aim to maintain at least this minimum ground cover of plants and litter throughout the year.

It is not always necessary to permanently exclude livestock from riparian areas but it is important to control their movement and manage grazing pressure. Consider using planned grazing where livestock only graze these areas for short periods of time according to plant growth rates. The paddock or riparian area then has a sufficient rest period to ensure the grasses and shrubs have recovered from being grazed. This may mean that the area is only grazed one to two times per year.



Placing feed and water troughs away from the creek can control stock and reduce erosion.

Photo Roger Charlton.

2. Maintain a well-grassed filter strip adjacent to the creek. Research has shown that a 6 metre wide strip can be effective at trapping and retaining sediment from an adjoining paddock when the depth of surface run-off flow is small. In dips and gullies next to the creek, where surface flow collects naturally and its depth and flow rate are higher, the filter strip will need to be proportionately wider.
3. When dealing with sub-aerial and scour erosion, aim to have complete cover of the bank down to the water's edge. Native vegetation should be retained wherever possible along the bank and for at least 5 metres from the flood level. If there is no vegetation present, encourage natural regeneration of this area. By removing stock from the creek channel and adjacent riparian area either permanently, if that is economically feasible, or for sufficient periods to allow seeding and regeneration to take place, ground cover can slowly be

Right: Maintaining good ground cover is the key to preventing soil erosion. Native perennial grasses such as Lemon grass (*Cymbopogon ambiguus*) will hold the soil together and self seed along creeks over time. Photo Kylie Nicholls.

established. In situations where there are no sources of seed present for regeneration, it may be possible to revegetate using direct seeding or tubestock. Low-growing native species, such as perennial grasses, as well as species that can bend with water flow, will be most successful at protecting the toe and lower bank areas along a creek. In the mid north region, a perennial grass such as Lemon grass (*Cymbopogon ambiguus*) would be suitable. Small plantings should self seed along the water course over time.





This riparian zone has been fenced out to restrict stock access. Once the area has been rehabilitated, stock may be permitted access for drought refuge or shelter in times of severe weather events. Photo Siwan Lovett.

4. Regeneration or replanting of larger native species of trees and shrubs should be considered on the upper level of the bank, especially where slumping is a problem. Use a mixture of native species to protect the bank and channel. For creeks with permanent pools, a strip along the top of the bank will also provide important shade for the creek, helping to reduce water temperature and light levels.
5. Remember to consult local experts, such as Greening Australia, when developing a plan for creek rehabilitation. Aim to select a mix of plant species focusing on early stage or pioneer species that have fast growth rates and are drought tolerant.

Plants that produce large amounts of seeds quickly are also useful to assist in natural regeneration when the weather conditions are suitable. These include saltbushes, wattles, grasses and bluebushes.

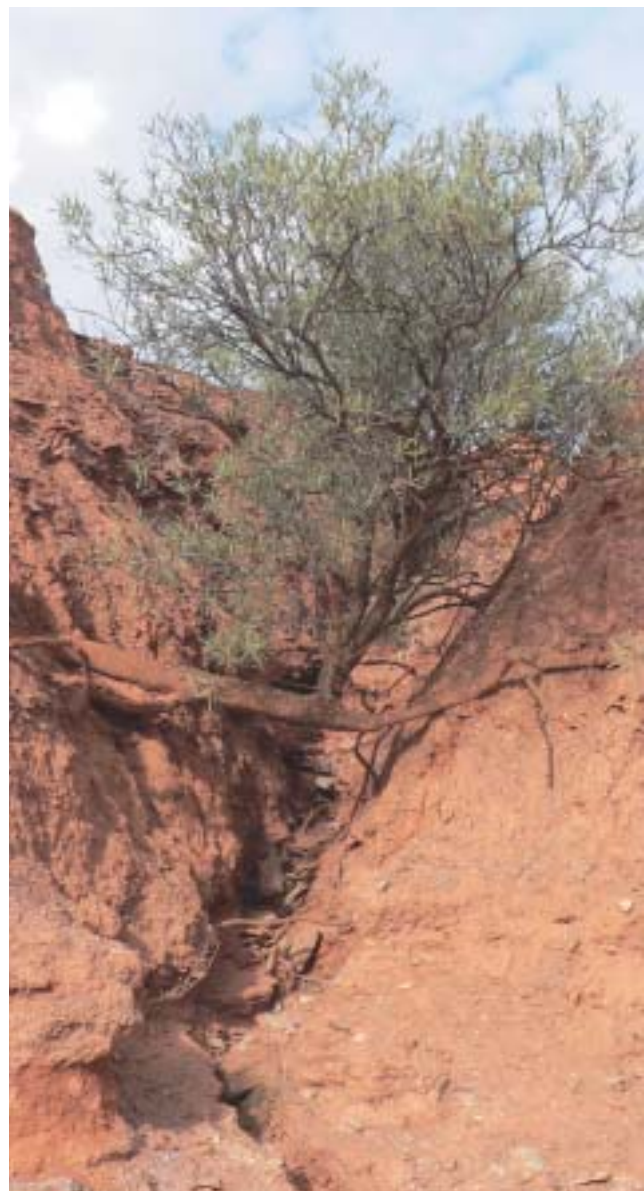
Long lived species should also be planted to take the place of the shorter lived plants once they have stabilised the site. Suckering plants are also important as they aid in stabilising the soil. These plants include Weeping Emubush (*Eremophila longifolia*), Bullock Bush (*Alectryon oleifolius ssp. Canescens*) and Hakea Wattle (*Acacia hakeoides*). Once some vegetation is established, birds, other animals, windblown seed and occasional floods are likely to bring in a diversity of additional species over time.



In a dry and heavily-grazed landscape, these trees in the riparian area provide vital protection, food and habitat for a wide range of native plants and animals. Managing access by sheep to ensure regeneration of these areas takes place is a crucial aspect of good management. Photo Phil Price.

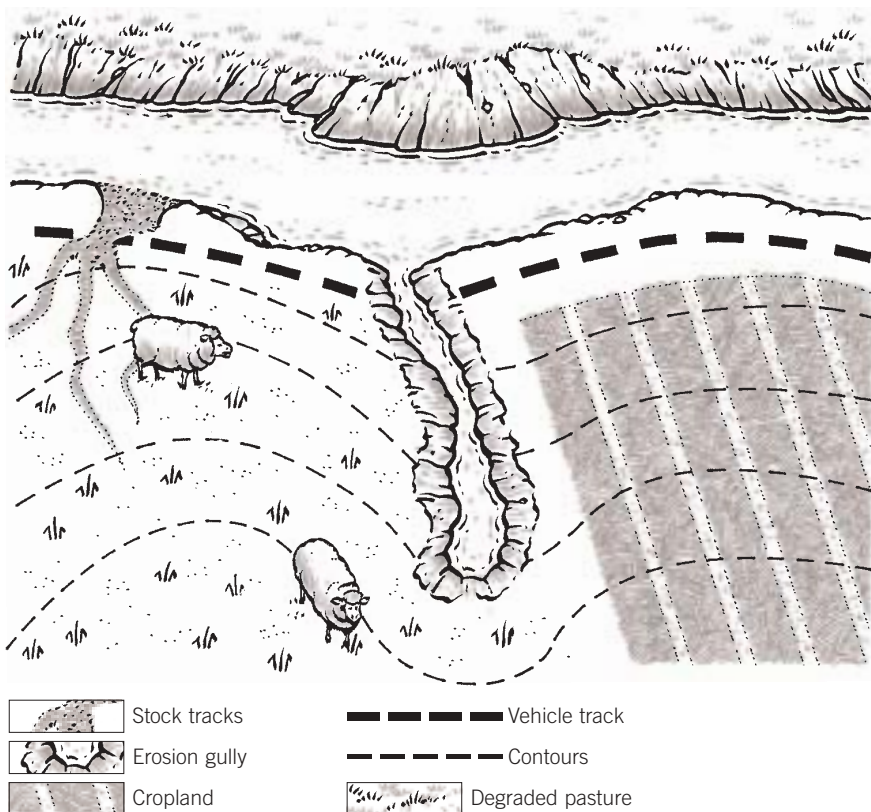
6. Implement a weed control strategy to protect the area being rehabilitated. Proclaimed weeds must be controlled. Boxthorns often occur in water courses and care must be taken in their removal. If spraying, off target damage must be avoided. If the plants are to be physically removed soil disturbance should be minimised and the cut and swab method (cut the main stem close to ground level and immediately treat the whole cut surface with herbicide) used if soil disturbance would lead to major erosion.

Other weeds should be targeted for spot-spraying or hand removal. In preparing for revegetation, spraying should be kept to a minimum to maintain some cover on susceptible soil.



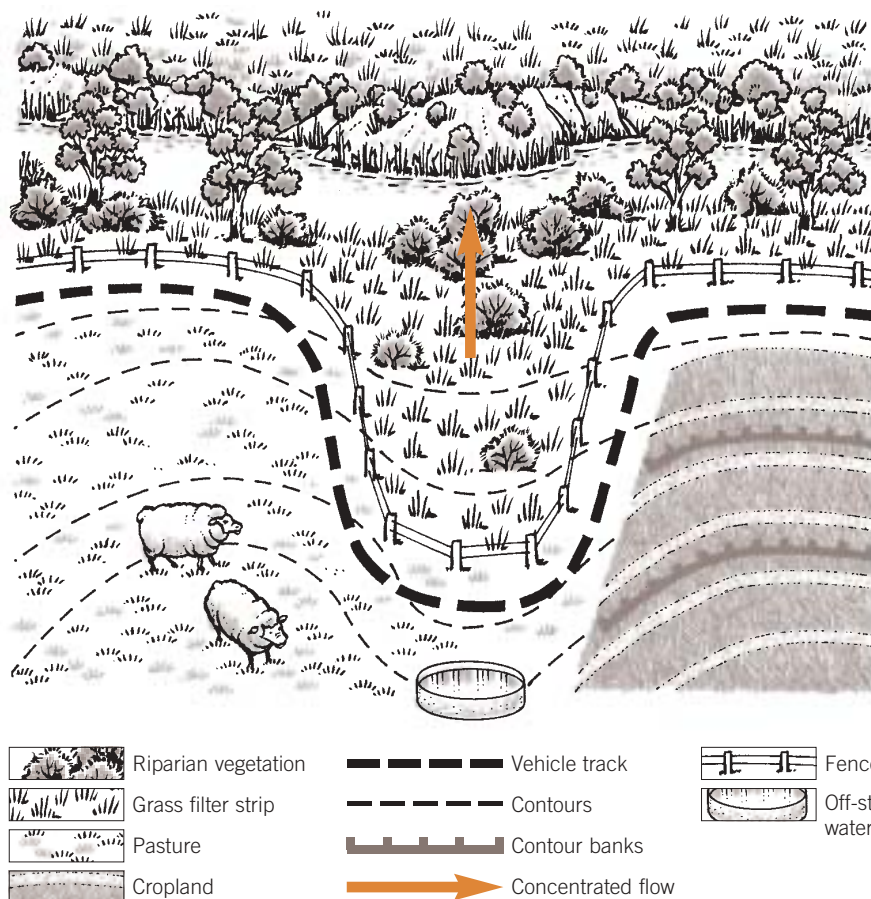
Suckering plants are useful to aid soil stability along creeks. In this gully Bullock Bush (*Alectryon oleifolius* ssp. *Canescens*) has not succeeded in completely holding the soil but it is still alive and spreading through the gullies. Photo Kylie Nicholls.

7. Avoid tidying up fallen timber and other debris in riparian areas as this wood is important habitat for plants and animals. It can make control of weeds and feral animals more difficult, but should be left wherever possible.



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.



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.



Photo Greening Australia.

Remember to take a photograph at several different locations along the creek, both before and after any rehabilitation work takes place as this provides useful visual evidence of the changes at the site.

8. When fencing off creeks, remember to place the fence as far back from the bank edge as possible. This distance should at least equal the depth of the watercourse. The type of fencing used will depend on what best suits your needs but factors to consider include the type of stock, when and how much the riparian area will be used, the size and shape of the creek, flood frequency and the size of the flood peak.
9. Seed trapping structures aid in natural regeneration. These can include contour ripping on salt pans, hay bales placed across water flow lines, branches laid across the ground and matting placed to cover bare soil. Dumping rubbish in water courses is not permitted. It doesn't aid in stopping erosion.

10. Rabbits are frequently found in gully and creek systems. Warrens must be found and the rabbits destroyed. Care must be taken if warrens are ripped to ensure that this ripping will not produce a new source of erosion.

Remember that revegetation and repair are slow processes in low rainfall areas, and it may take many years to regenerate adequate cover along creek banks. Good growth periods often coincide with severe rainfall events which increase erosion. For this reason seed trapping devices and minimal disturbance methods are recommended. They ensure a lower erosion risk and the seed can take advantage of any rainfall that may occur on the site.



Paul Besanko case study

Fencing off creeks to reduce erosion and encouraging the regeneration of riparian areas is an important part of Paul Besanko's long-term goals for his pastoral property in the mid north of South Australia.

Paul and his family purchased Saffron Downs, a 2300 hectare grazing property near Burra, in 2001, fulfilling a childhood dream of Paul's to own a farm. Currently, Saffron Downs cannot fully support his family, so Paul splits his time between a busy marketing job in Adelaide and being a woolgrower.

Saffron Downs currently runs a flock of 700 Merino ewes, mated to Merino and Wiltshire Horn sires. Paul hopes to increase the mob size to about 1500 ewes but tough seasonal conditions have prevented this. The annual average rainfall is 300 millimetres but less than half the average rainfall has fallen during the past few years with only 50 millimetres being recorded for 2006.

Saffron Downs has a mix of native and annual grass species and some shrub cover including one of the few remaining areas of Lomandra grasslands. Numerous gullies and ephemeral creek systems dissect the property, flowing



Fencing off creeks to reduce erosion and encouraging the regeneration of riparian areas is important for South Australian woolgrower Paul Besanko, Saffron Downs, Burra.

Photo Kylie Nicholls.

into the Stone Chimney Creek and Baldina Creek system. Paul estimates that the creeks run on Saffron Downs only about once every five years.

Since owning Saffron Downs, Paul has focused on the rehabilitation of a major creek which had been badly eroding. Through an Envirofund grant, about 5 kilometres of fencing has been completed along either side of the creek to exclude livestock and encourage the regeneration of the native vegetation.

Paul hopes that the rehabilitation of the creek and the restricted stock access will help to prevent the erosion which was starting to encroach into the paddock, and will return some productivity to the area.

Paul hopes that over time, fencing off one of the main watercourses on his Burra property, Saffron Downs, to exclude stock will reduce the risk of further erosion and improve the ground cover along the creek bank. Control of weeds such as artichokes is also a key part of the creek management.

Photo Kylie Nicholls.



The four plain wire fence was established as far back from the creek as possible, in most places about 200 metres from the creek bank, following the contour of the land.

A range of revegetation methods have been trialled with limited success. Saltbush seedlings were planted along the edge of the creek but were eaten by rabbits.

At the head of the creek, deep rip lines were established to a depth of about 36 centimetres. The rip lines were then left for 12 months to allow any rainfall to infiltrate before being planted. A mix of native shrub seedlings was sourced from Trees For Life including *Melaleuca* species and *Acacia* species.

Although Paul said this method was more expensive and time consuming, plant survival rates have been better.

However he admits it has been difficult to see the benefits so far due to the dry seasonal conditions and the disappointingly slow growth of the planted shrub species and regeneration.

Paul has also been involved with the Land, Water & Wool – Rivers project at Burra with work on his property focusing on the control of weeds along the watercourses, including Artichokes and Boxthorn, and the establishment of long-term creek monitoring. He believes the project results will provide further information on the best way to manage the riparian areas on Saffron Downs.



Resources

There are a number of organisations that produce useful information for woolgrowers. For creek and riparian management, including detailed information on revegetation of riparian areas, weed control and managing stock along creeks the most comprehensive range of fact sheets, technical guidelines and manuals can be accessed at www.rivers.gov.au.

Other useful contacts at the national, state and local level are listed below.

Land, Water & Wool SA Rivers Project

Kylie Nicholls
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Full Bottle Media
Tel: 08 8842 3275
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SA Murray-Darling Basin Natural Resources Management Board

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Australian Water Environments

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Mob: 0407 407 520

Mid North Grasslands Working Group

Helen Weckert
Tel: 08 8846 6086
E-mail: eulunga@rbe.net.au
Web: www.nativegrass.org.au

Northern & Yorke Natural Resources Management Board

Tel: 08 8636 2361
E-mail: nynrm@bigpond.com
Web: www.nynrm.sa.gov.au

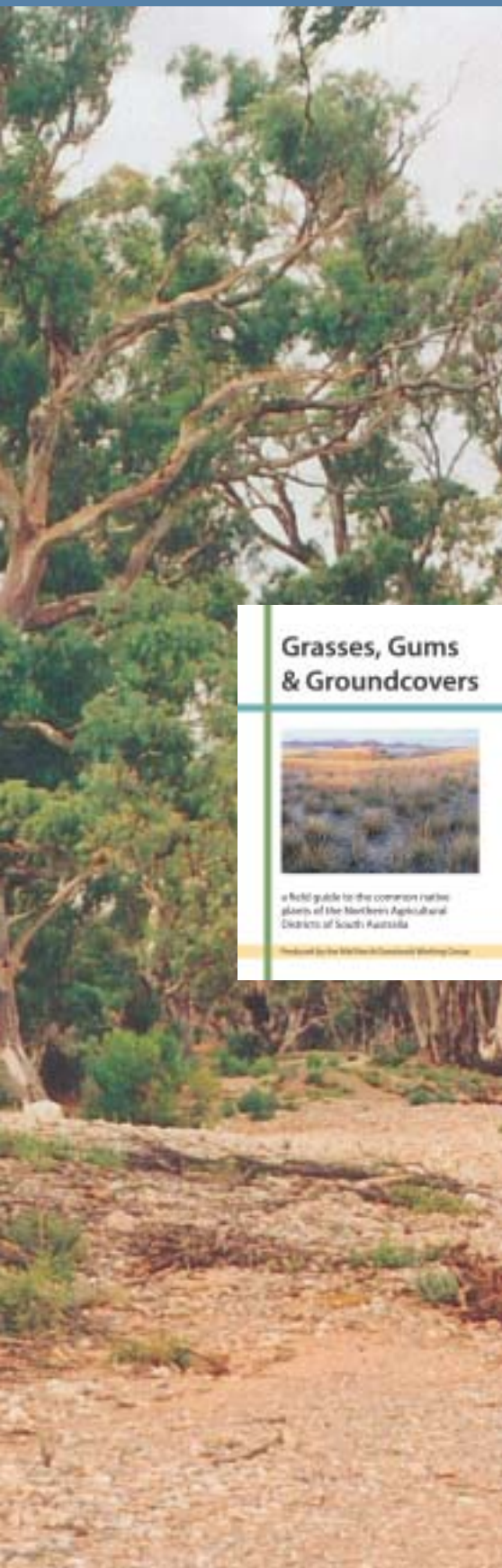
Department of Water, Land and Biodiversity Conservation (DWLBC)

Tel: 08 8463 6800
Web: www.dwlbc.sa.gov.au

Department for Environment, Heritage and Aboriginal Affairs

Tel: 08 8204 9000
Web: www.dehaa.sa.gov.au





Useful publications

Native Vegetation of the Murray Region, February 2006, Todd Berkinshaw, Greening Australia (South Australia) Inc., ISBN 0 9775143 0 7. A guide to the identification, protection and restoration of native vegetation communities and plant species of the South Australian Murray Darling Basin.

Field Guide to the Plants of Outback South Australia, Frank Kutsche and Brendan Lay, Openbook Print. Further information: The Manager, Pastoral Program, Department of Water, Land and Biodiversity Conservation, GPO Box 2834, Adelaide SA 5000.

Grasses, Gums & Groundcovers, a field guide to the common native plants of the Northern Agricultural Districts of South Australia, Mid North Grasslands Working Group, Custom Press. Information: Kylie Nicholls, PO Box 488, Clare SA 5453, Tel: 08 8842 3275, E-mail: fullbottlemedia@rbe.net.au

Managing Streamsides: Stock control, fencing and watering options, 2000, D. Wright & T. Jacobson, Department of Primary Industries Water & Environment, Tasmania.

'Managing weeds in riparian areas', *Land, Water & Wool fact sheet*, 2007, Land & Water Australia.

'Planned grazing management', *Land, Water & Wool fact sheet*, 2007, Land & Water Australia.

Managing creeks and waterways in the mid north of South Australia: A woolgrowers guide, 2007, Land & Water Australia.

Rapid Appraisal of Riparian Condition, Technical guideline for the mid north of South Australia, Jansen, A., Robertson, A., Thompson, L., Wilson, A. & Nicholls, K. 2006, Land & Water Australia, Canberra.



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Publications for woolgrowers

The *Wool industry river management guides* bring together the latest science and recommended management practices for riparian areas within the context of a commercial wool-growing property. The Guides are available for the high rainfall regions (above 600 mm) and sheep/wheat regions (300–600 mm) of Australia. Each book has over 200 full-colour pages.

In addition www.rivers.gov.au/lww will offer an active contents list which will give you a snapshot of what is in each section.

1. High rainfall zone: product code PX050951
2. 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.

3. Product code PX051003

Are my waterways in 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 work out the health of the streams or creeks running through your property, and it suggests management actions to improve or maintain these vital parts of your farm.

4. Product code PB061114

River Insights — a publication featuring the stories of ten woolgrowers and what has motivated them to manage their rivers, creeks and streams in ways that make both economic and environmental sense.

5. Product code PK050950

Stock and waterways: a manager's guide — offers practical advice on how stock farmers 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.

6. Product code PR061132

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

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