A Trapping soil and nutrients

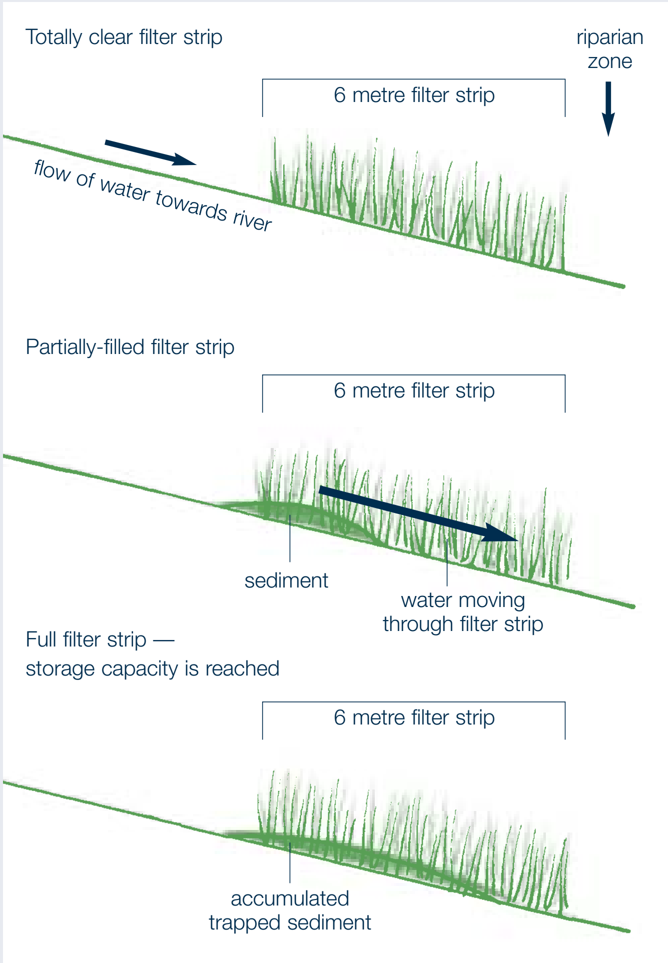
Objective

To keep soil, nutrients and other contaminants on-farm and prevent them from entering waterways where they can reduce water quality and stream health.

Recommended management approach

Soil particles, nutrients and attached pesticides/herbicides, and crop residue can move from cropped land to waterways in runoff or groundwater. The amount of soil and other contaminants reaching waterways can increase dramatically in situations where crop production involves periods of bare soil surface, where the land adjacent to waterways has a significant slope, and where rainfall can be intense (even for short periods). Under these conditions, large quantities of soil, nutrients and other contaminants can enter streams and severely reduce water quality and stream health. This problem is made worse when the flow is concentrated in irrigation furrows, shallow depressions or gullies.

Figure 5: Cross-sections of filter strips.



Carefully maintained riparian vegetation cover can be very effective in trapping soil and nutrients before they enter waterways. The mechanism of trapping is similar to that reported from past work with the cotton industry on the effect of retaining cereal stubble to reduce soil loss from irrigation furrows. This work shows that slowing the speed of surface water is the key to reduced furrow erosion and to trapping and removal of suspended sediment. Recent experimental work has shown that a well-maintained perennial grass filter strip of 6 metres wide can be highly effective at trapping sediment and much of the nitrogen and phosphorus attached to it.

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A grass riparian filter strip trapping sediment downslope of a ploughed paddock. Photo Ian Prosser.

Some grass species can grow through and stabilise the trapped sediment, gradually developing a small levee bank along the waterway. In many circumstances wider grass filter strips can be used to accommodate access tracks for cropping machinery and/or a firebreak.

Grass filter strips are most effective when the incoming overland flow is shallow, around 1 centimetre or so in depth (or less). When the overland flow is deeper as a result of high-intensity rainfall, grass filter strips become overloaded and cannot prevent soil and nutrients entering the waterway. By incorporating contour banks and additional filter strips well upslope, this problem can be managed so that the soil and nutrients stay where they belong — on the paddock. For similar reasons, wherever possible, paddock or section blow-out points should be located well away from streams, preferably where runoff will pass through a grassed area before entering a waterway.

Keeping crop residue on the paddock is also important, as the wash-off of, for example cotton stalks and the organic compounds they produce as they decay, can cause severe oxygen depletion in streams and the death of stream animals. A combination of trees and shrubs with grass filter strips along waterways may be an effective way of trapping residues as well as soil and nutrients.

Nutrients (including nitrogen and phosphorus) and other contaminants such as pesticides, can also be carried in sub-surface flows. Sub-surface flow rates are generally slow, except in very open-textured soils. Deep-rooted riparian vegetation can reduce nutrient levels in sub-surface flows by absorbing them for plant growth. The effect of dense riparian vegetation in helping to dry out soils may also help to reduce sub-surface flows (see Figure 6).

The recommended management approaches for using grass filter strips on riparian lands are as follows.

1. Map all waterways on the farm including areas that carry overflows. Where these waterways drain cropping land with slopes of 2% or more (dryland farms), farm layout should be designed so that furrows run parallel to, and not perpendicular to,

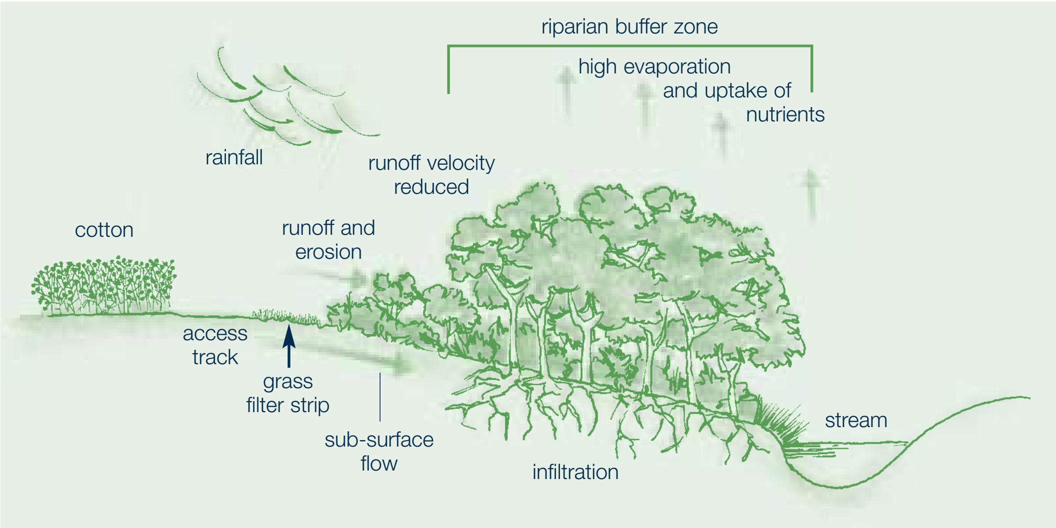

Figure 6: Different functions performed by riparian areas to protect waterways. Illustration Carolyn Brooks.

drains and streams. This is because these areas are often major sources of suspended sediment and nutrients. Once these waterways have been identified, keep natural riparian vegetation along them to a width of at least 10 metres.

2. Identify potential sources of sediment, nutrients and other contaminants, and implement the measures described in the Australian Cotton Industry Best Management Practices (BMP) Manual and SPRAYpak. These include:
   - locating blow out points as far as possible from streams and waterways;
   - maintaining stubble or other cover in the field and on headlands (e.g. through opportunity cropping);
   - limiting furrow length according to slope and soil type;
   - maintaining in-field surface roughness;
   - laser-levelling paddocks;
   - ensuring tail drains are no more than 25 centimetres below the bottom of furrows;
   - designing culverts so that they reduce flow speed and allow sediment to settle;
   - incorporating drop boxes and stilling ponds into tailwater systems;
   - designing return drains with low slope;
   - capturing tailwater for recirculation;
   - ponding and filtering runoff;
   - using low fields to temporarily pond excess stormwater; and,
   - after high intensity rainfall retain at least 15 millimetres of runoff from treated areas (pesticides etc.).

All these methods help to reduce sediment and nutrient loads BEFORE water draining from fields reaches riparian land and waterways.

John and Robyn Watson have moved this cotton field 80 metres back from the river so that a riparian buffer can be maintained, Boggabri. Photo Guy Roth.

3. Work out the best location and width of grass filter strips, based on slope and shape of the land and soil type, so that maximum trapping of sediments and nutrients can occur. Where flow is concentrated in depressions or shallow gullies, the filter strip will need to be proportionately wider. Filter strips may need to be located along each side of drains within paddocks where there is a risk of soil erosion and where the crop itself does not provide an adequate buffering function. For waterways with sloping banks (greater than 5%) a grass filter strip is required along the high bank as vegetation on steep banks is unable to trap sediment and nutrients.

4. Use perennial grass species that are able to grow into and stabilise trapped sediments. Many grasses are able to root from nodes along the stem, and those species with a spreading rather than tussock or bunch growth habit are the most effective. Mowing, or carefully managed grazing of grass filter strips, may be required to keep them functioning effectively. Once they grow higher than 20 centimetres there is little additional benefit (no effect) to sediment trapping. For areas with intense runoff, hedges of upright grasses or similar species can be used to initially slow the surface flow.

5. Avoid disturbing grass filter strips by grazing and cultivation, or when spraying out weeds with herbicides.

6. Use a combination of a grass filter strip with trees directly adjacent to the stream to provide shade, as this will trap sediment as well as providing shade to the waterway (see Section G).

Using grass filter strips within a farm plan provides an opportunity to ensure the best mix of maintaining crop productivity while also practising environmentally sound management.

Self-assessment

Cotton growers can check their progress in better managing sediment and nutrient in runoff by including in their farm plan:

- maps of all waterways on the farm, including floodways, drainage lines and blow out points that run intermittently. These maps would also identify potential source areas for sediment and nutrient that could be transported into waterways. This step is also a requirement in the BMP Manual;
- management strategies designed for each waterway to trap sediment and nutrient runoff (see points 1 and 2, page 21);
- periodic inspection of fields and riparian areas to check for erosion on the field and build-up of sediment within the waterway or drainage line;
- management of riparian vegetation, either retained or replanted, so that it can trap sediment and nutrient and improve the health of the waterway and adjoining land;
- risk assessment using procedures described in the BMP Manual;
- planting native grasses and monitoring their progress; and,
- periodic monitoring of the health and reestablishment of riparian vegetation, and checking that the trapping capacity of filter strips hasn't been exceeded.

CASE STUDY

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Using nature to filter stormwater

Glen Whittaker — 'Yahgunyah Partnership', Quambone

By Kirrily Rourke

Five years ago, Yahgunyah Partnership purchased a 2000 acre irrigation farm on the Marthaguy Creek, near Quambone, 90 kilometres north of Warren. A Stormwater Management Plan has been prepared in accordance with the BMP Manual. Even though the first 25 millimetres of stormwater runoff could be contained in accordance with the Plan, additional stormwater would discharge directly onto the neighbours grazing country. To address this issue, the Partnership relocated the blow-out point 700 metres further up the tailwater return channel, and installed a bank so that the water filters through a reed bed to clean it of sediment before any surplus is discharged across the adjacent grazing country.

Above: The new blow-out at bottom right with the constructed bank opposite. The trees in the background line the Marthaguy Creek. Stormwater travels through the reeds to the right. Photos K. Rourke.

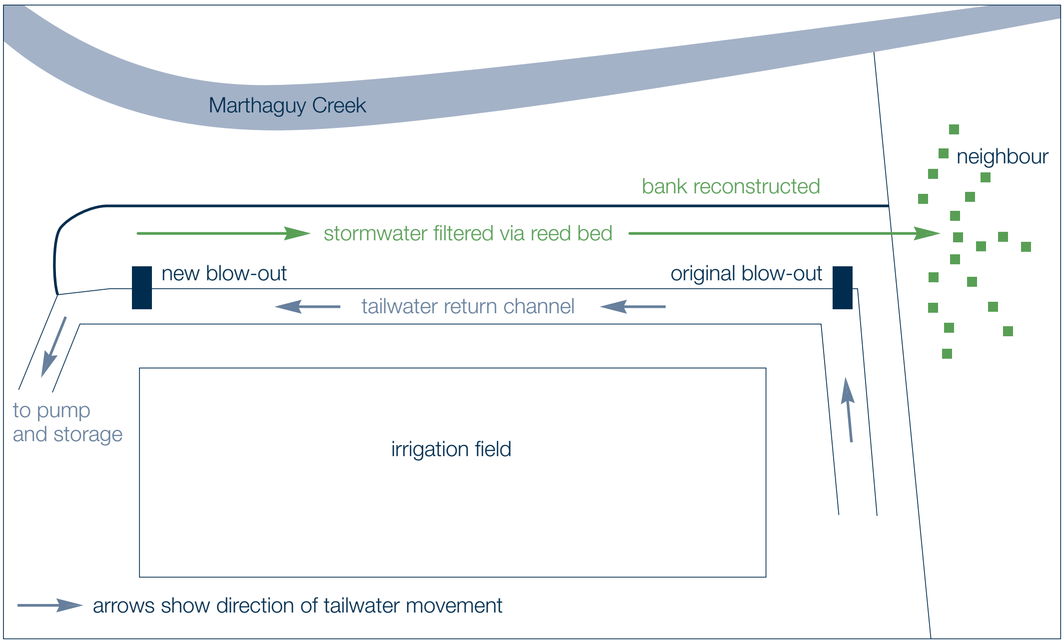
Below: The reed bed filters stormwater before it flows onto the neighbours grazing country. The reeds are regenerating well after a flush of water following the drought.

A bank was constructed that diverted the water from the new blow-out point near the creek, through about 600 metres of reed bed after which it could enter the neighbour's paddock at the original blow out point. This bank cost around $15,000 to construct.

The only concern with this system is that in a large storm event with very high water flows the reed bed may slow the water down too much, causing it to back up unless the reeds bend and allow flow to increase. The system is yet to be tested under these conditions, but it will be modified if needed.

A final word...

The Partnership was more than happy to make these changes as it gave them extra confidence in their stormwater management system. Other benefits include good relations with all neighbouring land holders, and the reed bed functioning as an on-farm wetland that enhances the biodiversity of both the farm and nearby creek ecosystem.



Yahgunyah stormwater blow-out system.

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CASE STUDY

A

Regenerating riparian areas to achieve multiple benefits

Harvey Gaynor and Terry Haynes — 'Auscott Midkin', Moree

By Julie O'Halloran

Auscott's properties in the Gwydir valley are located along the Carole Creek. About six years ago, Auscott Midkin ceased grazing and farming of their riparian areas to allow for regeneration of native vegetation. Today, a significant portion of Auscott Midkin's creek frontage (about 24% of farm area) is not farmed, with Auscott Midkin's General Manager, Harvey Gaynor and Water Resources Manager, Terry Haynes revealing that there were several prompts for this change in management. Erosion along Carole Creek was a problem, and it was felt that the riparian areas were better left to protect the creek bank, and provide a buffer for pesticides and sediments entering the waterway. Harvey and Terry also felt that farming riparian areas was inefficient as they were often oddly shaped and difficult to access. The riparian areas on the property now form a corridor for wildlife as well as protecting the creek from further erosion. These areas of deep rooted vegetation may also help prevent watertables from rising and guard against salinity problems.

For the first three years, management to regenerate the cleared riparian areas was relatively intensive. This involved slashing and selective spraying of weeds (e.g. Noogoora Burr, Sesbania Pea), and efforts continue to control weeds such as Johnson Grass. Feral animals such as cats and goats were a problem in timbered areas, however, a successful removal program has been implemented to control them. Unfortunately, feral pigs remain a problem.

Pump sites have also been considered in the management of riparian zones. At many sites engines are sitting close to water with fuel storage in close proximity. Fuel storages are now bunded to prevent contamination of Carole Creek in the event of leakage, and only biodegradable drip feed oils are used in pump sites to limit contamination of the waterway.

Part of property being allowed to regenerate and extend width of the riparian zone. Photo Julie O'Halloran.

Riparian area with mix of trees and shrubs regenerating naturally. Photo Julie O'Halloran.

Irrigation areas adjacent to Carole Creek are planted to Genetically Modified Ingard® cotton. This management practice helps to minimise the number of insecticide sprays in close proximity to the waterway. Prior to the release of Genetically Modified cotton, Auscott had a spray management plan in place, as well as guidelines for spraying these areas to minimise the potential for drift. Auscott is currently in the process of formalising and documenting their riparian zone management practices. They hope that this will help identify gaps in their current management and highlight areas that require further attention.

Harvey and Terry believe the main challenge for riparian land management is accurately defining what is natural for riparian areas and determining how to return it to that state. Non-native species are quite prolific along the creek (e.g. willows), as well as species not native to the area. The management of regrowth and controlled thinning are also challenging and require ongoing maintenance. There is also some concern over future flood events if riparian lands become heavily timbered since development of the surrounding area has altered natural flood flows.

A final word...

Harvey and Terry believe that the benefits of allowing riparian lands to revert to a 'natural' state include the value of these areas as effective buffers between different areas of the properties. As cotton growers, these areas are important to Auscott for spray drift management, as they provide a buffer between cropping areas and the creek and different types of cropping. The provision of a continuous corridor along the creek has also increased the diversity of vegetation and wildlife.

Feral animals — useful references

Choquenot, S., McIroy, J. & Korn, T. 1996, *Managing Vertebrate Pests: feral pigs*, Bureau of Resource Sciences, Canberra (series includes feral goats, foxes and rabbits).

Braysher, M. 1993, *Managing Vertebrate Pests: Principles and Strategies*, Bureau of Resource Sciences, Canberra.

The Bureau of Resource Sciences website has useful information about 'agricultural pests and feral animals'. You can find this information by going to the www.affa.gov.au website.