

2 The importance of riparian land

What is riparian land?

Riparian land can be defined in a number of ways — *how* it is defined in particular situations largely depends on *why* it is being defined. This guide aims to help cotton growers improve and protect the health of riparian land and associated waterways on cotton farms, as well as to minimise the impacts of cotton production on water quality, and river health. As a result, the definition in the flash box below refers to the roles, or functions, that riparian land plays. Using this functional approach, riparian land is defined as:

Any land which adjoins, directly influences, or is influenced by, a body of water.

Using this definition, riparian land includes:

- the land immediately alongside small creeks and rivers, including the riverbank itself;
- gullies and dips, including those adjacent to cropping paddocks that sometimes run with surface water;
- land adjacent to drains and channels that empty into streams or wetlands;
- areas surrounding lakes and dams;
- wetlands, billabongs and floodplains that are linked with the river in times of flood; and,
- vegetation dependent on groundwater supplied by a river.

Any part of the farm that is linked to the local river system by water flow, including parts linked only during storm events, should be considered as covered in these guidelines. This is because what happens on them and how they are managed can have a significant influence on the river's health and its water quality.

Examples of riparian land.



Cudgegong River. Photo Guy Roth.



Cox's Creek. Photo Guy Roth.



Open channel on cotton farm. Photo Guy Roth.



Artificial wetland on cotton property. Photo Mick Rose.

It is important to remember that the width of riparian land will depend on its purpose and management objective. For example, the width required to trap soil from a cultivated paddock (filter strip) may be a fraction of the width required to provide wildlife habitat, yet both are appropriate riparian management objectives. The main aim of this guide is to help cotton growers understand the basic requirements for sustainable management of riparian land. It also provides information about how these requirements can be incorporated into farm design and cotton production operations. At the same time, various legislation contains legal definitions of riparian land that cotton growers must be aware of, and these are described in Appendix B.

'Filter strip' means a grassed area established to trap soil and attached contaminants moving in shallow surface flows after rain or irrigation, so that they do not enter adjacent streams (see Section A).

Why is riparian land important?

Riparian land is important because it is usually the most fertile and productive part of the landscape, in terms of both agriculture and natural ecosystems. It often has better quality soils than surrounding hill-slopes and, because of its lower position in the landscape, often retains moisture over a longer period.

The term **'ecosystem'** refers to a community of plants and animals that interact with each other, as well as with the physical and chemical environment in which they live. A lake or a stream with its adjacent riparian lands, may be referred to as an ecosystem.



The meandering line of trees running through the middle of this photograph is a riparian area providing a corridor for wildlife and protecting the river from the impacts of adjoining land uses. Photo CSIRO Sustainable Ecosystems.

Ecosystems are everywhere — in agricultural fields, suburban gardens and national parks — and perform functions that allow humans to live on earth and fulfil our lives in a variety of ways. We call these functions **'ecosystem services'** and they are essential for human health and survival. Examples of the kinds of services we receive from nature include water filtration, regulation of atmospheric composition, maintenance of soil fertility and pollination.

Riparian land often supports a greater diversity of plants and animals than non-riparian land. This is a result of its wide range of habitats and food types, its closeness to water, its microclimate and its ability to provide refuge. Many native plants and animals are found only, or mainly, in riparian lands, and this makes these areas essential to many animals for all or part of their lifecycle. Riparian land also provides a refuge for native plants and animals in times of drought and fire, as well as providing corridors for wildlife in highly-cleared landscapes.

For waterways, vegetation on riparian land regulates in-stream life by: moderating undesirable temperature changes through shading; supplying the energy and nutrients (for example, leaves, twigs, fruits and insects) essential to in-stream food webs; and by providing the logs and branches that fall into the stream to create habitat for fish, plants and animals (see Figure 1). As well as being environmentally productive, riparian land is also a vulnerable part of the landscape. It is at particular risk of damage from over-clearing, cultivation, uncontrolled grazing, weed invasion, spraydrift from chemicals, soil eroded from upslope, and natural events such as floods and fire. This combination of productivity and vulnerability means that careful management of riparian land is vital for the conservation of Australia's unique biodiversity.

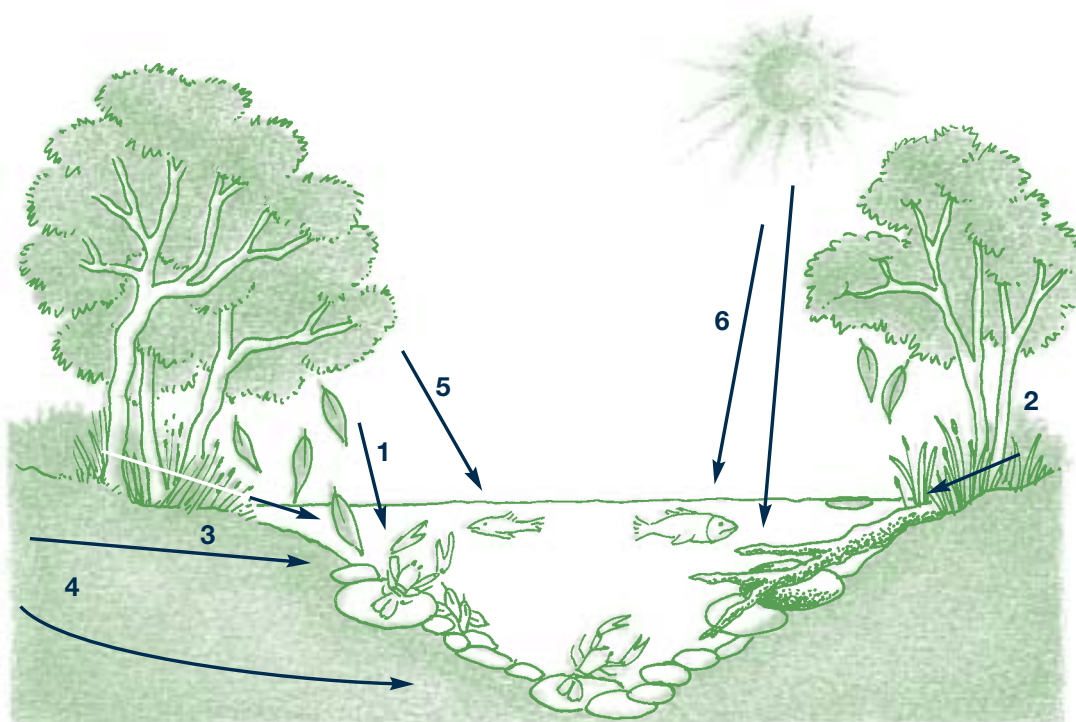


Figure 1: Land and water interactions that occur in riparian lands. Source: S. Bunn 1998.

1. Inputs of leaf litter and fruits from riparian vegetation
2. Inputs of logs and branches that provide habitat for fish and plants
3. Leaves and organic matter washed in from surrounding catchment
4. Sub-surface flow and groundwater
5. Insects falling from riparian vegetation
6. Microalgae and other aquatic plants stimulated by sunlight

The interaction between land and water

There are many types of interaction between riparian land and adjacent waterways. For example, a tree on riparian land may fall into the water creating new in-stream habitat; uncultivated riparian land can 'buffer' streams against sediment and nutrient washing off adjacent cropped land; and native vegetation on riparian land can be a source of litter and insects that fall into a waterway and become food for in-stream animals. The reverse also occurs, for example, insects that spend much of their life in the water may become food for land-based animals when they emerge. Some of the key interactions between riparian land and adjacent streams and rivers are shown in Figure 2.

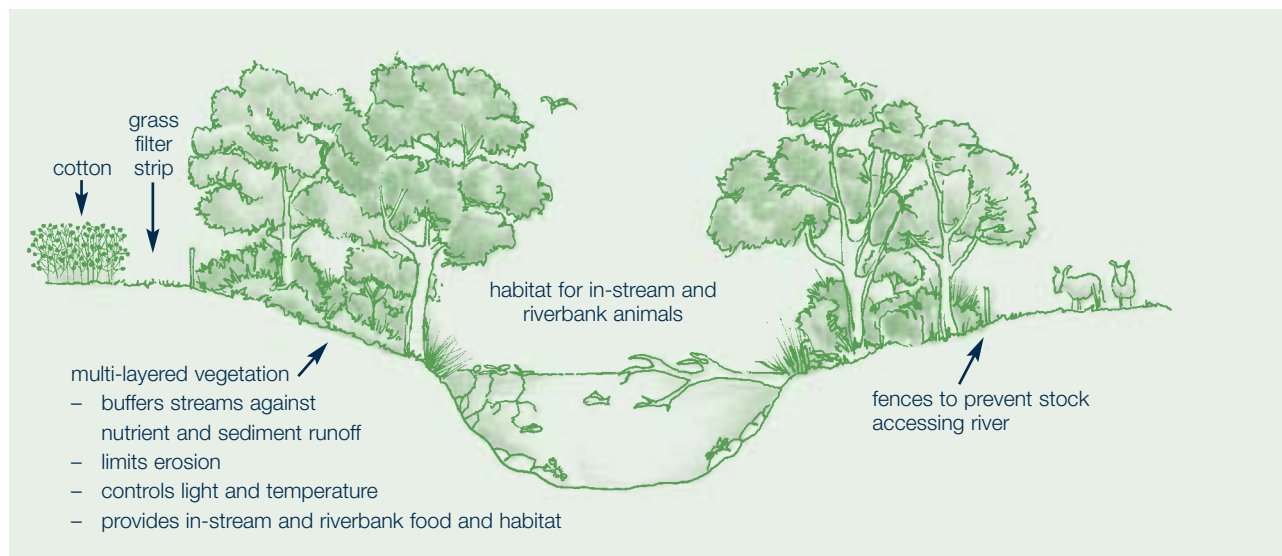


Figure 2: Key interactions between riparian land and adjacent streams and rivers.

For many years, the important linkages between land and water in riparian areas were not well recognised in Australia. There was a commonly held belief that streams and rivers could be used as drains — removing problems from adjacent land. However, research is now showing that rather than being seen as drains, waterways should be thought of as the arteries supporting the land around them. In recognition of the many potential benefits that can be achieved from better management of waterways, growers, community groups and government agencies have become actively involved in improving riparian management. They have recognised that undisturbed riparian land with its natural vegetation can:

- trap sediment (e.g. soil), nutrients and other contaminants (e.g. attached pesticides and herbicides) before they reach the waterway;
- reduce rates of bank erosion and loss of valuable land;
- control nuisance in-stream plants through shading;
- reduce water temperatures and help ensure healthy in-stream life;
- provide a source of food and habitat for stream animals;
- provide an important location for conservation and movement of wildlife;
- connect fragmented habitats for wildlife;
- help to maintain agricultural productivity;

- provide recreation and aesthetically-pleasing landscapes;
- improve water quality for human and stock consumption, as well as the environment; and,
- support beneficial insects and animals that prey on pest species (e.g. bats preying on heliothis moth).

Many of these benefits can only be achieved through careful riparian management at the farm and catchment scale.

Riverine condition assessments are being developed for most catchments in NSW and Queensland. Section 3 of this guide provides information about the priorities identified in plans covering some cotton-growing catchments.

Factors that affect the condition of riparian land

Riparian land changes under the influence of natural factors such as fire, unusual droughts or frosts, cyclones or floods. However, these are relatively infrequent events, allowing time for riparian land and its natural vegetative cover to recover. In contrast, the human impact since European settlement of Australia is very noticeable on riparian land, with large-scale changes in condition and health throughout much of southern and eastern Australia. The widespread clearing of riparian vegetation for agricultural or urban development, as well as grazing by domestic stock, have had the biggest impacts. Northern Australia is fortunate in that clearing has been less widespread, although even here there are many areas where much of the natural riparian vegetation has been removed. The major effects of ‘catchment development’ on riparian land and adjacent waterways are as follows:

- removal of riparian trees increases the amount of light and heat reaching waterways. This favours the growth of nuisance algae and weeds, and can significantly alter the conditions in the waterway so that it no longer supports native fish and other animals. Excessive in-stream weed and algal growth can trap sediments, and this can block the waterway and prevent it from carrying floodwaters. When the weeds and algae eventually die and begin to decay, the water is deoxygenated and this can contribute to fish kills downstream.



Waterway with excessive algal growth. Photo Nick Schofield.

- under natural conditions, trees occasionally fall into waterways and provide an important habitat for animals and plants living in the stream. Large tree trunks and branches in the waterway result in a range of flow speeds, which are important for some stream animals. In streams with sandy beds, this woody material provides the only secure anchor for in-stream plants and protection for animals. Removing these branches and trunks disrupts in-stream life by reducing habitat for insects, crustaceans and fish.



Woody material in the Namoi River provides habitat for in-stream animals. Photo Guy Roth.

- cropping up to the top of streambanks increases the delivery of sediments and nutrients to waterways. Large volumes of fine-grained sediment smother in-stream habitat and cloud the water, while the additional nutrients carried on the soil particles stimulate weed and algal growth. The increased sediment and nutrient loads also affect estuarine and marine life beyond the river mouth.



A poorly managed riparian zone. Almost no trees remaining, bank erosion, cattle grazing along the riverbank, algal blooms and sand slugs that smother in-stream habitat for fish. Photo Ian Prosser.



A riverbank with no riparian vegetation to protect it from erosion. Photo Guy Roth.

- removal of riparian vegetation and loss of its protective root systems destabilises riverbanks, often resulting in large increases in the width, depth and erosion of waterway channels. This channel erosion can then deliver more sediment to the waterway. Significant areas of valuable agricultural land can be lost as a result of channel erosion, and water turbidity is also increased, leading to loss of water quality for downstream users.

Turbidity refers to the cloudiness of water bodies that results from fine clay particles suspended within the water column. When soil from bare areas of paddocks or from stream or channel banks erodes into the water, the larger sand and silt particles settle out, but the fines may remain suspended for many weeks. Turbid water is often milky brown in colour, and it is not possible to see down to the stream bed; light penetration is restricted to the surface layers.

- removal of vegetation throughout a catchment can lead to raised water tables and salinisation of land. Salt carried in sub-surface flow, or washed from the surface by runoff, drains into waterways and reduces water quality, as well as damaging in-stream plants and animals. This issue is a high priority for parts of the Murray-Darling Basin, where decreasing water quality will eventually threaten the livelihood of downstream irrigators.

The removal of natural vegetation is not the only human activity that adversely affects riparian land:

- altering the streamflow by building dams and weirs, as well as pumping out water during low flows, can severely affect in-stream life and the capacity of waterways to carry flow. These structures block fish passage unless specially constructed fish ladders are provided. Reduced flow levels below dams, rapidly-changing water levels due to releases, and cold water from deep offtake points, all reduce the health of downstream riparian vegetation and in-stream plants and animals.



Weirs and dams have altered flows and changed salinity ranges. Photo Stuart Blanch.

- sand and gravel removal, channel straightening, and construction of levee banks and drains can change the waterway channel and result in increased erosion. This can lead to loss of agricultural land as well as damage to infrastructure such as roads, bridges and buildings.



Rock riprap is being used on this part of the Condamine River to protect the toe of the bank which is gradually eroding away and threatening the bridge supports. Photo Guy Roth.



Uncontrolled stock access degrades riparian lands. Photo Guy Roth.

- uncontrolled access by stock to riparian lands leads to overgrazing and trampling of vegetation, the breakdown of soil structure and contamination of the water with nutrient-rich urine and faeces. Research has shown that even a low level of unmanaged grazing pressure (a few days or at critical times of year) can be enough to prevent regeneration of native riparian species; often only the trees are left with no native understorey species and little opportunity for regeneration.
- altered fire regimes and invasion by exotic weeds also degrade riparian land.



Nogoora Burr, castor oils and willows have invaded this cleared patch of riparian vegetation. Inset: Nogoora Burr. Photos Guy Roth.

- urban development influences water quality and the condition of riparian lands.



Stormwater pipe carrying stormwater runoff directly into the river and reducing water quality. Photo Guy Roth.

The impacts of these disturbances are not only cumulative; they exacerbate each other. For example, clearing riparian vegetation from small creeks and streams multiplies, many times, the impact of nutrient enrichment from surrounding land. This is because the clearing of tall vegetation also results in higher light levels and higher temperatures, conditions that enable nuisance weeds and algae to flourish in the stream and dominate in-stream life.



Above: Riparian zone that has been cleared and stock allowed access to the river. There would be little in-stream life as a result of limited shade and low quality water. The stream is gradually eroding away the bank. Photo Guy Roth.

Right: Moderately disturbed riparian area with some willows, but overall good vegetation cover, stable banks, shade and woody habitat for in-stream life. Photo Guy Roth.



Current status of riparian land in catchments where cotton is grown

Cotton is now grown over a wide area, from central Queensland to the Lachlan Valley in southern New South Wales, as well as in the north-west of Western Australia (see Figure 3). Typically, cotton uses 5% or less of land in the catchments where it is grown, with the irrigated cotton industry mainly located along rivers and riparian areas (see Figure 4). Riparian catchments in these areas are generally in a degraded state following the widespread opening up of lands for grazing, cropping and urban development. The clearing of riparian vegetation for agricultural development, combined with continuous grazing by cattle (and in some areas sheep) has led to the loss of palatable native grasses and other species unable to cope with continued defoliation. These native grasses have disappeared, to be replaced by less-palatable but more-resistant species, as well as by a range of introduced exotic weeds (for example, Nogoora Burr and more recently Lippia). Native trees are still present in many areas but they are often scattered, nearing the end of their lifespan, and in poor condition.

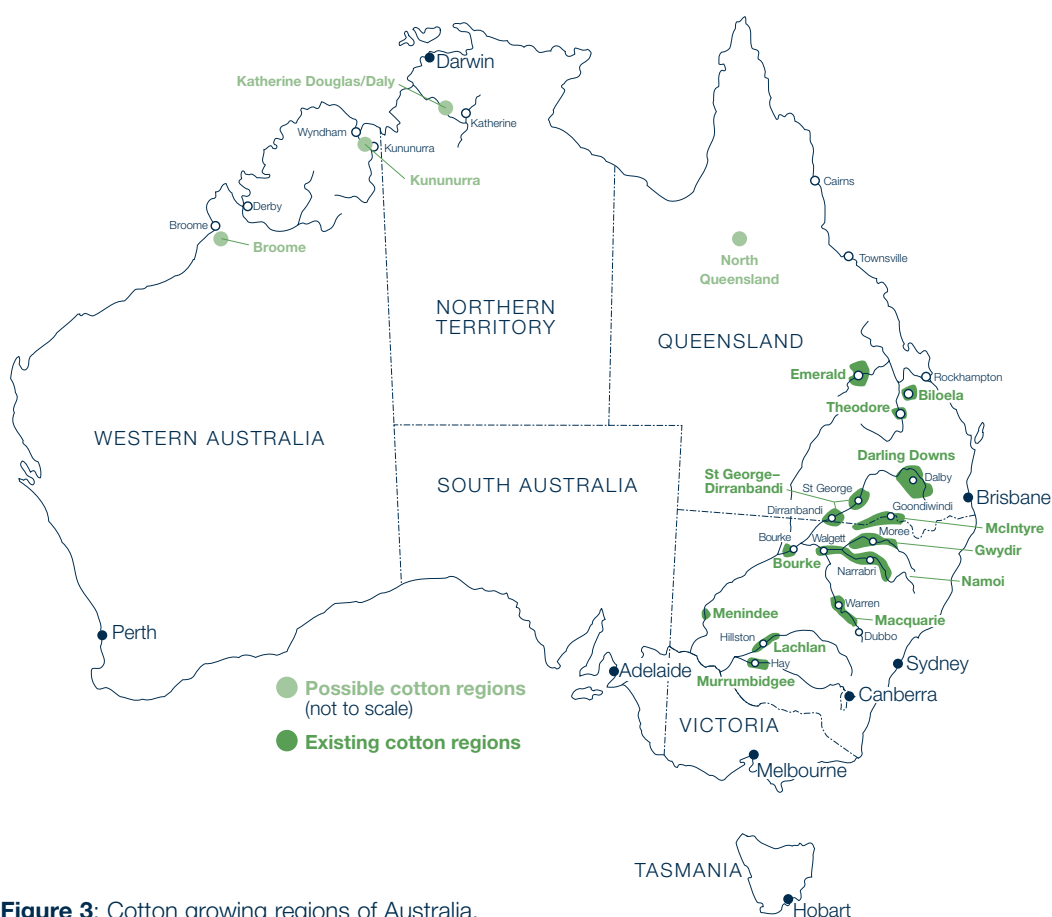


Figure 3: Cotton growing regions of Australia.

Many cotton growers also run cattle operations and see their riparian lands as an important component of feed production for stock. It is important to recognise that improved management of riparian lands does not require the permanent removal of grazing, but rather, that grazing be carefully managed to encourage regeneration of native species and to maintain productive pasture species. Some growers have made an effort to regenerate or replant riparian areas degraded by stock, often with success.



Cattle fenced out of riparian area to protect the riverbank and prevent stock losses. Photo Penny Van Dongen.

The motivation of growers to undertake this rehabilitation varies from a wish to control waterway erosion, restrict flooding effects, provide crop shelter belts, or to improve environmental management of sensitive parts of the property. Fencing and revegetation can also prevent stock wandering off the property when river levels are low, causing problems for neighbours and requiring time consuming mustering.

Restoring riparian land can be expensive if past management has led to these areas becoming degraded. This means that it is important to be clear about management objectives and priorities, so that growers who devote time and resources to riparian restoration can be assured of beneficial outcomes. If possible, riparian areas (including wetlands) should be identified prior to development for cotton production so that plans for their integration and ongoing management within the overall farm design can be made. This is a much cheaper alternative than restoration.

Planning as the key to sound riparian management

There are many things that that cotton growers can do to help improve the health of on-farm riparian land and waterways. Careful planning is the key to achieving this. Riparian areas need to be highlighted in farm or Stormwater Management Plans as requiring special management strategies that take account of the mix of land, water, vegetation and wildlife issues. In this way, a plan provides a single document that can be assessed against the requirements of local authorities and catchment plans, as well as providing the basis for environmental management systems or quality certification.

The cotton industry has made considerable progress in developing these guides and checks on the environmental soundness of production systems, and the development of plans underpins the implementation of this guidance material. Plans should be seen as living documents that can be updated and modified as regulations change and new management strategies are developed. Initially, this type of planning needs to be done at the level of individual farms. For other objectives, however, where it is important for neighbours to act together (e.g. in stabilising waterways, controlling exotic weeds or providing wildlife habitat), planning needs to be done at a local and catchment level as well.

The recent development of catchment plans and blueprints in Queensland and New South Wales provides producers with access to information about broader riverine management approaches. Using this broader catchment context, producers can integrate riparian management and property development on-farm. Appendix A in this guideline provides an overview of the catchment plans, water sharing plans and other reports that have been developed for each of the cotton growing regions. This snapshot of cotton regions provides general guidance only, and more information about the documents discussed is available from government agencies and catchment boards. In addition to catchment plans, there are also Acts and regulations that may influence the management of cotton farms with respect to riparian land, waterways and water use (see Appendix B for more information). By developing some form of a farm plan that incorporates these issues with cotton production and applies industry best management practices on-farm, growers can be confident that they are meeting statutory requirements.