



# Weed management in riparian zones

A guide for grazing properties  
in southwest Victoria

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# Acknowledgements

This guide was written in collaboration with other DPI and DSE staff on the Productive Grazing, Healthy Rivers (PGHR) subproject team. Alan Crouch and Graeme Ward in particular provided many comments and helpful suggestions. Members of the southwest Technical Reference Group for PGHR also provided important feedback on drafts of the guide. Information on noxious weeds is taken from the DPI Landcare Note **Declared noxious weeds** (LC 0252) by Ian Faithfull, Rebecca Lester (Monash University) and Trevor Hunt (DPI) contributed to preparing the final document.

## **Weed management in riparian zones**

A guide for grazing properties in southwest Victoria.

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# 1 Introduction

This guide has been prepared by the Productive Grazing, Healthy Rivers subproject of the Ecologically Sustainable Agriculture Initiative (ESAI), which involves staff of the Victorian Government Departments of Primary Industries and Sustainability and Environment. The aim of the Productive Grazing Healthy Rivers subproject is to improve native biodiversity and environmental quality in high rainfall, intensive grazing systems through better management of riparian land and associated remnant native vegetation. Weed management is just one of the issues being dealt with by the subproject, which is focused on intensive grazing industries within the Warrnambool Plain, Otway Plain, Gippsland Plain and Strzelecki Ranges bioregions. This guide is applicable to the Warrnambool Plain and Otway Plain bioregions only. A separate document will be produced for the Gippsland Plain and Strzelecki Ranges bioregions to deal with their differing weed issues.

The riparian zone is the land that adjoins, and is heavily influenced by, the waterway or wetland. For practical management purposes within intensive grazing systems however, the riparian zone is best defined as the strip of land alongside a waterway that is managed differently from the adjoining pasture, often being fenced off with restricted or no grazing.

There are many advantages in restricting or removing grazing on the banks of waterways such as improved water quality, erosion control and easier stock management, as well as enhanced appearance and benefits for native plants and animals<sup>1</sup>. However, removing frequent grazing from riparian zones can cause some weeds to increase or new weeds to appear. Riparian zones that have already been protected can also be invaded by weeds from a variety of sources. Landholders will be familiar with pasture weeds but a fenced-off riparian zone may contain other weeds or may require pasture weeds to be managed in a different way.

This guide aims to assist land managers in planning and carrying out riparian weed management.

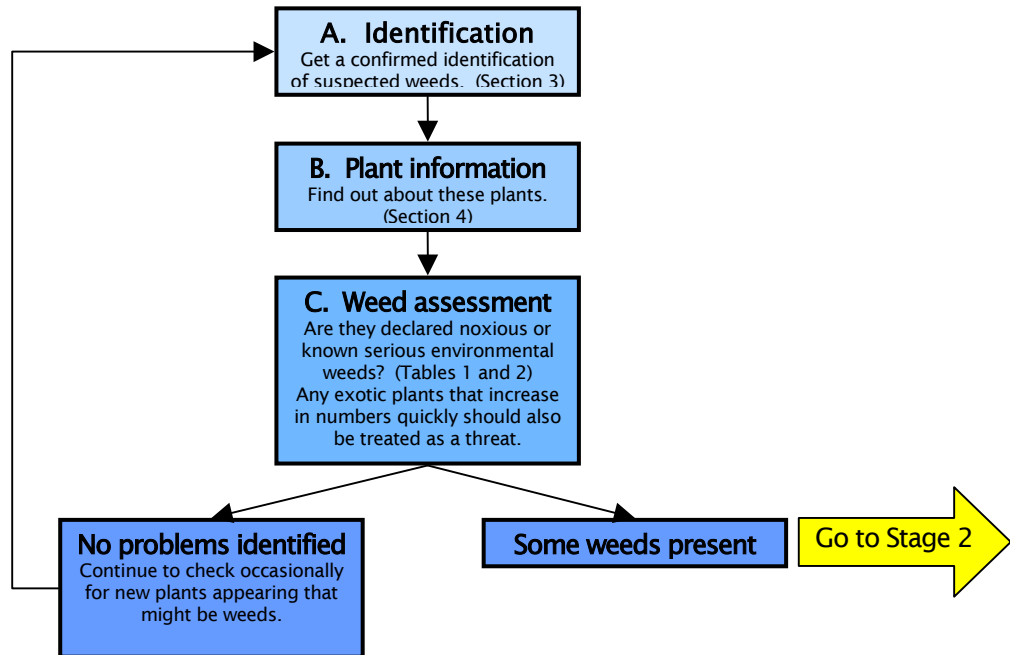
Flow charts to assist the assessment of riparian weed problems and planning their management are provided on the next two pages. Most of the boxes in the flowcharts refer you to detailed information on the later pages. Alternatively you can read the whole document and come back to the flowcharts afterwards.

Throughout the text small numbers like these<sup>2,5,8</sup> indicate which sources of information (listed in section 11) will be helpful.

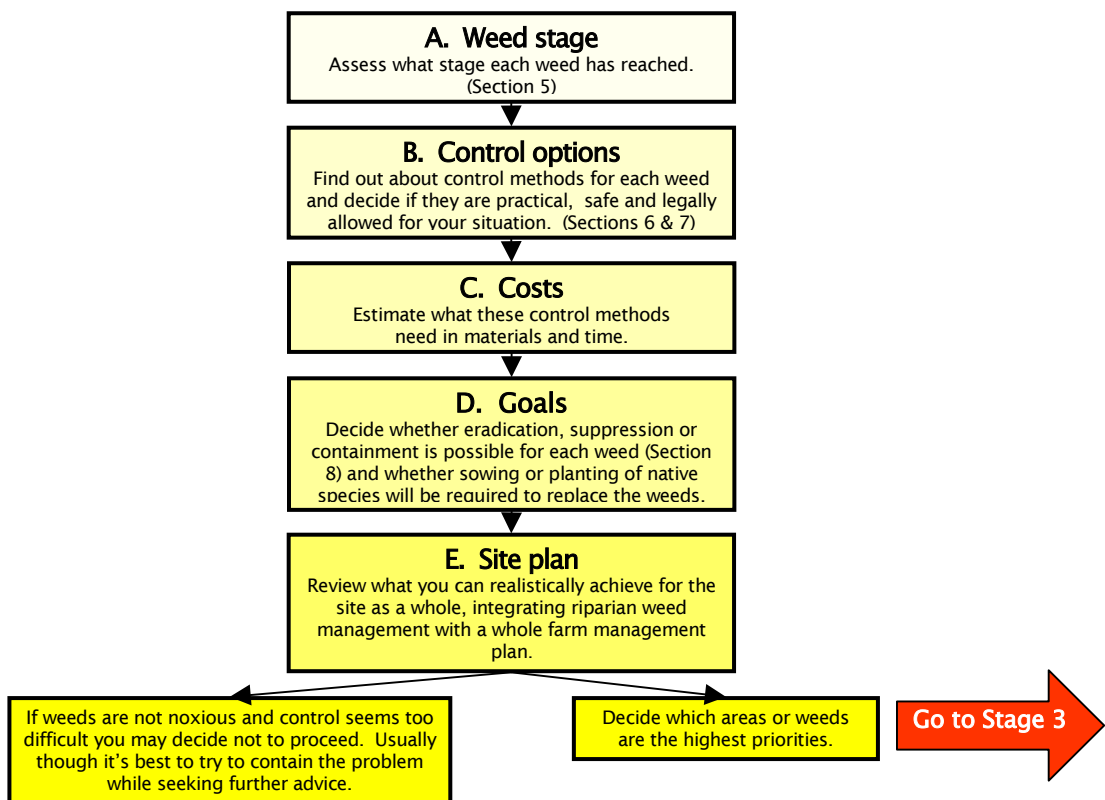
## 2 Flow charts

The flow charts below provide a process to assess whether a weed problem exists, to review control options and plan any weed management that is required. Boxes in the flowcharts refer you to sections where further information is provided, or if you already know the information at that step you can go straight on to the next box. You might want to work through the flowchart referring to the other sections only where necessary, or you can read the whole publication and then use the flowcharts afterwards.

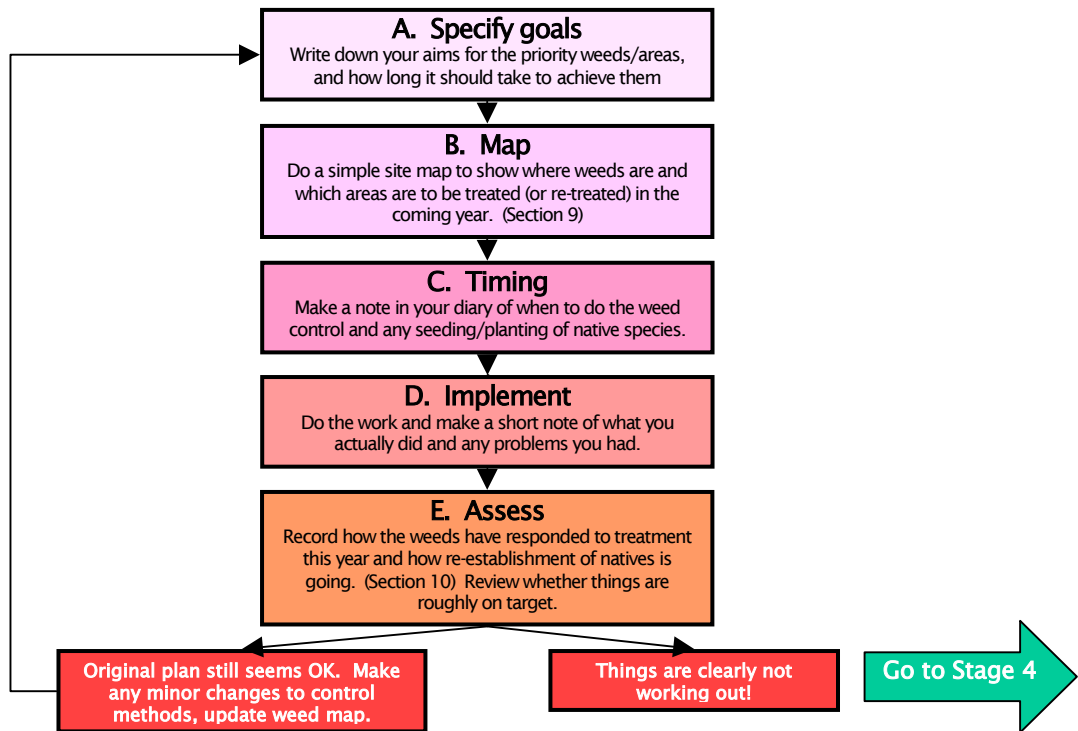
## Stage 1 – Decide whether there is a weed problem.



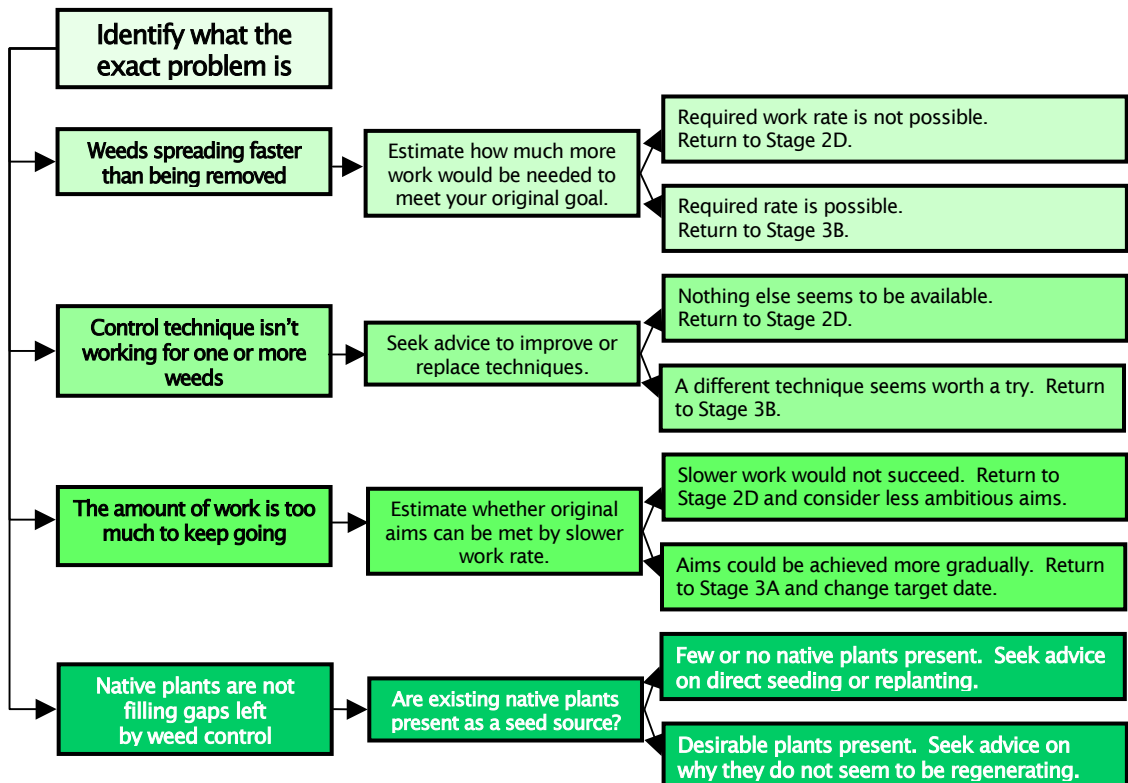
## Stage 2 – Set goals for weed management.



## Stage 3 – Implement and monitor weed management.



## Stage 4 – Adapt if things don't work out.





### 3 Collection and identification

Identification of suspected weeds is essential

Common weeds can usually be identified easily, but there may be other plants in the riparian zone that you are doubtful about. If a plant is new, seems to be spreading quickly, or is already dominant and you think it might be exotic, then an accurate identification is important. Without identification, you might be trying to kill a native species that is protected. Only when a plant has been identified can you find appropriate information on its effects in the landscape and how to manage it. Herbicide use in particular requires that you know what you are dealing with.

There are some useful weed books that may help

There are several ways to find out about an unknown plant. The simplest is often to ask neighbours however, this may not always be accurate. Staff of the Department of Primary Industries<sup>2</sup> (DPI) Department of Sustainability & Environment<sup>3</sup> (DSE) or the Catchment Management Authority<sup>4,5</sup> (CMA) may also be able to help, as may local people with botanical expertise. There are some helpful weed books<sup>6,7</sup> although because of the very large number of species involved the books contain only a selection of them. If identification proves difficult, it is also possible to send a specimen of the plant to the herbarium of the Royal Botanical Gardens in Melbourne<sup>8</sup> for identification. There may be a small charge for this service so it is best to contact the herbarium first.

Collecting a good specimen is important

Collecting a good specimen for identification is very important. A photograph of the plant before you disturb it is useful, preferably with something next to it like a spade, ruler or pencil to show how big it is. Flowers or fruit/seeds make identification much easier and make sure the specimen includes stems, leaves, shoots and roots, with any tubers or bulbs. Rinse off any loose soil. If a variety of leaf shapes occur on the same plant then include some pieces of each. To keep the plant fresh place it in a plastic bag with a wet tissue or a few drops of water, seal it and put in an esky to keep it cool. Most plants packed like this should stay fresh for a few days in the fridge. It is essential to place the plant in a plastic bag immediately to avoid the chance of seeds being spread beyond the collection site.

Sometimes it is not possible to get the plant identified while it is still fresh. Many plants can be preserved by simply placing between sheets of ordinary (non-glossy) newspaper with pieces of flat board top and bottom. This should be done as soon as possible after collection before the plant wilts. A few bricks or similar on top can then be used to flatten the specimen. Newspaper should be changed every day or two for a week, especially for fleshy-leaved plants. After a fortnight, the specimen should be dry enough to transport flat in a folder. Keep a note with the specimen saying exactly where and when it was collected and note anything that might not be obvious from a dry sample, like flower colour or a distinctive smell. More information on preserving a specimen is available on the National Weeds Strategy website<sup>9</sup> or by contacting the herbarium.

## 4 Weed categories

For the purpose of this guide weeds are considered in three categories: declared noxious weeds, environmental weeds and agricultural weeds. Non-declared weeds may not need to be controlled in every case. The effects of some may be minor compared to the effort needed to control them, and others may tend to decline if left alone e.g. as the canopy closes following tree planting. However, in addition to weeds declared noxious by State legislation, local laws may designate some other species as weeds and require them to be controlled. To date none of the Councils in the area covered by this publication has passed such local laws but this may change in the future.

You may be required to control some weeds because they are declared noxious

Whether or not to control weeds is ultimately a matter for the landholder to decide, with the exception of declared noxious species. When working on a designated waterway a permit may be required and management options may be reduced. Consulting the CMA and obtaining a licence if necessary is important before commencing any work that might affect a waterway.

### 4.1 Declared Noxious Weeds

Different requirements exist for the various categories of noxious weeds

In Victoria these weeds are plants which have been proclaimed under the *Catchment and Land Protection Act 1994* (the CaLP Act). The legislation requires that these weeds be controlled or eradicated. There are four categories of weeds defined under the Act: State Prohibited, Regionally Prohibited, Regionally Controlled and Restricted, and different requirements apply to each category. In addition to the specific requirements for each category ALL noxious weeds must be prevented from spreading, eg as contaminants in hay, grain, soil or sand or on vehicles. Sale or purchase of noxious weeds is also prohibited. Further information on the categories of noxious weeds and the responsibilities of land owners for the control of weeds is provided in the Landcare note **Declared noxious weeds** (2004)<sup>10</sup>. From time to time new weeds are declared or the status of existing declared weeds may change. DPI/DSE offices can provide up to date listings.

#### State Prohibited Weeds

See weeds marked with an 'S' in table 1

These weeds either do not occur in Victoria but pose a significant threat if they invade, or if they are present here, pose a serious threat and can reasonably be expected to be eradicated. If present, infestations of a State Prohibited Weed are relatively small. State Prohibited Weeds are to be eradicated if possible from Victoria or excluded from the State. The Department of Primary Industries (DPI) is responsible for their control and should be informed if they are found on your property.

#### Regionally Prohibited Weeds

See weeds marked with a 'P' in table 1

In general Regionally Prohibited Weeds are not widely distributed in a Region but are capable of spreading further. It is reasonable to expect that they can be eradicated from a Region and they must be controlled in or eradicated from the Region.

Landowners, including public authorities responsible for the management of Crown lands, are responsible for control of these weeds on their lands. The Department of Sustainability and Environment (DSE)

is responsible for control on Crown land. Private landholders are responsible for control on private land but not on roadsides adjoining their property. Regionally Prohibited Weeds on roadsides are the responsibility of Vic Roads, municipalities, or DSE, depending on the class of road. Further information can be obtained from local DPI and DSE offices.

## Regionally Controlled Weeds

See weeds marked with a 'C' in table 1

These weeds are usually widespread and are considered important in a particular region. To prevent their spread, continuing control measures are required. Declaration of a Regionally Controlled Weed can be made for the whole Region or only certain Shires within the Region.

Landowners have the responsibility to take all reasonable steps to control and prevent the spread of Regionally Controlled Weeds on their land and any undeclared roads that adjoin their land. (Contact your local council or VicRoads for advice on the classification of declared and undeclared roads.) "Roadside" means

1. the area between the made surface and the boundary of the land adjoining the road if the road is sealed, formed or graded;
2. the half width of the road in the case of an unmade road on Crown land not occupied under a lease or licence; or
3. land alienated in fee simple by the Crown or Crown land occupied under a lease or licence.

## Restricted Weeds

Currently no restricted weeds

The category of Restricted Weeds is intended to include plants that are a serious threat to primary production, Crown land, the environment or community health in another State or Territory of Australia, which have the potential to spread into and within Victoria, and pose an unacceptable risk of spreading in this State or to other parts of Australia if they were to be sold or traded in Victoria. To date no weeds have been declared Restricted Weeds.

**Table 1. Declared noxious weeds and their status in the Corangamite and Glenelg-Hopkins Catchment Management Authority regions**

Correct as on 22 April 2004. Changes to the list are proclaimed in the Victorian Government Gazette <http://www.gazette.vic.gov.au>

S = State Prohibited, P = Regionally Prohibited, C = Regionally Controlled  
 CCMA - Corangamite Catchment Management Authority  
 GHCMA - Glenelg-Hopkins Catchment Management Authority

Common name	Scientific name	GHCMA	CCMA
African Boxthorn	<i>Lycium ferocissimum</i>	C	C
African Daisy	<i>Senecio pterophorus</i>	P	
African Feather Grass	<i>Pennisetum macrourum</i>	P	
African Love Grass	<i>Eragrostis curvula</i>		
Alligator Weed	<i>Alternanthera philoxeroides</i>	S	S
Amsinckia	<i>Amsinckia</i> spp.	C	
Angled Onion	<i>Allium triquetrum</i>		C
Apple of Sodom	<i>Solanum linnaeanum</i>	C	
Artichoke thistle	<i>Cynara cardunculus</i>		
Bathurst Burr	<i>Xanthium spinosum</i>	C	C
Bindweed	<i>Convolvulus arvensis</i>		C
Blackberry	<i>Rubus fruticosus</i> agg.	C	C
Black Knapweed	<i>Centaurea nigra</i>	S	S
Boneseed/Bitou Bush	<i>Chrysanthemoides monilifera</i>	C	C
Branched Broomrape	<i>Orobanche ramosa</i>	S	S
Buffalo Burr	<i>Solanum rostratum</i>		
Californian/Perennial Thistle	<i>Cirsium arvense</i>	C	C
Caltrop	<i>Tribulus terrestris</i>	P	C
Camelthorn	<i>Alhagi maurorum</i>	S	S
Cape Broom/Montpellier Broom	<i>Genista monspessulana</i>	C	C
Cape Tulip (two-leaf)	<i>Homeria miniata</i>	C	P
Cape Tulip (one-leaf)	<i>Homeria flaccida</i>	C	P
Chilean Cestrum	<i>Cestrum parqui</i>		
Devil's Claw (purple-flower)	<i>Proboscidea louisianica</i>		
Devil's Claw (yellow-flower)	<i>Proboscidea lutea</i>		
Dodder	<i>Cuscuta</i> spp.		
English Broom	<i>Cytisus scoparius</i>		C
Fennel	<i>Foeniculum vulgare</i>	C	C
Flax Leaved Broom	<i>Genista linifolia</i>		C
Furze/Gorse	<i>Ulex europaeus</i>	C	C
Giant knotweed	<i>Fallopia sachalinensis</i>	S	S
Giraffe Thorn	<i>Acacia erioloba</i>	S	S
Golden Thistle	<i>Scolymus hispanicus</i>	P	
Great Mullein	<i>Verbascum thapsus</i>		C
Hardheads/Russian Knapweed	<i>Acroptilon repens</i>		
Hawkweeds	<i>Hieracium</i> spp.	S	S
Hawthorn	<i>Crataegus monogyna</i>	C	C
Hemlock	<i>Conium maculatum</i>	C	C
Hoary Cress	<i>Cardaria draba</i>	C	C
Horehound	<i>Marrubium vulgare</i>	C	C
Horsetail	<i>Equisetum</i> spp.	S	S
Illyrian Thistle	<i>Onopordum illyricum</i>		
Ivy-leaved Sida	<i>Sida leprosa</i>	S	S
Japanese Knotweed	<i>Fallopia japonica</i>	S	S
Japanese knotweed hybrid	<i>Fallopia x bohémica</i>	S	S
Karoo thorn	<i>Acacia karroo</i>	S	S
Khaki Weed	<i>Alternanthera pungens</i>		
Lagarosiphon	<i>Lagarosiphon major</i>	S	S
Lobed Needle Grass	<i>Nassella charruana</i>	S	S

Common name	Scientific name	GHCMA	CCMA
Marijuana	<i>Cannabis sativa</i>	S	S
Mesquite	<i>Prosopis</i> spp.	S	S
Mexican Feather Grass	<i>Nassella tenuissima</i>	S	S
Nodding Thistle	<i>Carduus nutans</i>	S	S
Noogoora Burr/ Californian Burr	<i>Xanthium strumarium</i>	P	
Onion Weed	<i>Asphodelus fistulosus</i>	C	C
Ox-eye Daisy	<i>Leucanthemum vulgare</i>		P
Pampas Lily-of-the-Valley	<i>Salpichroa origanifolia</i>	C	
Parthenium Weed	<i>Parthenium hysterophorus</i>	S	S
Paterson's Curse	<i>Echium plantagineum</i>	C	C
Perennial Ragweed	<i>Ambrosia psilostachya</i>	S	S
Poverty Weed	<i>Iva axillaris</i>	S	S
Prairie Ground Cherry	<i>Physalis viscosa</i>		C
Prickly Pear (Drooping)	<i>Opuntia monacantha</i> *		
Prickly Pear (Erect)	<i>Opuntia stricta</i>		
Ragwort	<i>Senecio jacobaea</i>	C	C
Saffron Thistle	<i>Carthamus lanatus</i>	C	
Salvinia	<i>Salvinia molesta</i>	S	S
Sand Rocket/Sand Mustard	<i>Diplotaxis tenuifolia</i>	C	C
Scotch/Heraldic Thistle	<i>Onopordum acanthium</i>	P	
Serrated Tussock	<i>Nassella trichotoma</i>	C	P
Silverleaf Nightshade	<i>Solanum elaeagnifolium</i>		
Skeleton Weed	<i>Chondrilla juncea</i>	C	
Slender or Shore Thistle	<i>Carduus tenuiflorus</i> or <i>C. pycnocephalus</i>	C	C
Soldier Thistle	<i>Picnomon acarna</i> †		
Soursob	<i>Oxalis pes-caprae</i>	C	C
Spear thistle	<i>Cirsium vulgare</i>	C	C
Spiny Broom	<i>Calicotome spinosa</i>		
Spiny Burr Grass/Gentle Annie	<i>Cenchrus longispinus</i>	P	
Spiny Emex	<i>Emex australis</i>		
Spiny Rush	<i>Juncus acutus</i>	C	C
St. Barnaby's Thistle	<i>Centaurea solstitialis</i>		
St. John's Wort	<i>Hypericum perforatum</i>	C	P
St. Peter's Wort	<i>Hypericum tetrapterum</i>		
Star Thistle	<i>Centaurea calcitrapa</i>		
Stemless Thistle	<i>Onopordum acaulon</i>		
Stinkwort	<i>Dittrichia graveolens</i>	C	C
Sweet Briar	<i>Rosa rubiginosa</i>	C	C
Tangled Hypericum	<i>Hypericum triquetrifolium</i>	S	S
Thorn Apple (common)	<i>Datura stramonium</i>	C	C
Thorn Apple (long-spine)	<i>Datura ferox</i>	C	C
Thorn Apple (recurved)	<i>Datura innoxia</i>	C	C
Topped Lavender	<i>Lavandula stoechas</i>		
Tree of Heaven	<i>Ailanthus altissima</i>	C	C
Tufted Honeyflower	<i>Melianthus comosus</i>	C	
Tutsan	<i>Hypericum androsaemum</i>		C
Variogated Thistle	<i>Silybum marianum</i>	C	C
Viper's Bugloss	<i>Echium vulgare</i>	C	
Water Hyacinth	<i>Eichhornia crassipes</i>	S	S
Wheel Cactus	<i>Opuntia robusta</i>		
Wild Garlic	<i>Allium vineale</i>	C	P
Wild Mignonette	<i>Reseda luteola</i>		C
Wild Teasel	<i>Dipsacus fullonum</i>	C	C
Wild Watsonia	<i>Watsonia meriana</i> <i>Bulbillifera</i> '	C	C

\*gazetted as *Opuntia vulgaris* †gazetted as *Cirsium acarna*

## 4.2 Environmental Weeds

Weeds that are not declared noxious can still have bad effects on biodiversity i.e., be environmental weeds

There is no complete list of environmental weeds; any non-native plant that is spreading in your riparian zone is a potential problem

Environmental weeds are plants that threaten the values of natural ecosystems. Identification and management of environmental weeds is important because riparian zones include natural aquatic ecosystems. Environmental weeds can invade native plant communities and out-compete native species. Invasions of environmental weeds often reduce plant diversity and result in loss of habitat for native animals.

Environmental weeds may also be declared noxious weeds, e.g., blackberry and St. John's wort. However, a number of serious environmental weeds are not declared noxious weeds e.g., bridal creeper, English ivy and tradescantia. Weeds of natural ecosystems can also be native species that are not local (indigenous) to an area but have potential to damage the local plant community (e.g., sweet pittosporum). The following table lists some serious environmental weeds of riparian vegetation that are relevant to the CMA regions. The list is not comprehensive. A useful source of information is the national list<sup>11</sup> of invasive and potentially invasive garden plants written by Rod Randall of the Department of Agriculture Western Australia, which provides information on weed status in all states of Australia.

**Table 2. Some environmental weeds (in addition to noxious weeds) that are a threat to native riparian vegetation in the Glenelg-Hopkins and Corangamite CMA regions**

Common name	Scientific name	Growth form	Further Information (Section 11)
Agapanthus	<i>Agapanthus praecox</i>	perennial herb	6,12,17
Arum lily	<i>Zantedeschia aethopica</i>	perennial herb	6,12,14,17
Bluebell creeper	<i>Sollya heterophylla</i>	shrub/climber	6,7,12,17
Blue periwinkle	<i>Vinca major</i>	creeper	6,7,12,17,18
Bridal creeper	<i>Asparagus asparagoides</i>	climber	6,7,9,12,14,17
English Ivy	<i>Hedera helix</i>	climber	6,7,12,17
Flowering (cherry) plum	<i>Prunus cerasifera</i>	large shrub/tree	6,12
Holly	<i>Ilex aquifolium</i>	large shrub/tree	6,7,12
Pampas grass	<i>Cortaderia selloana</i>	tussock grass	6,7,12,17,18
Red cestrum	<i>Cestrum elegans</i>	shrub	7,12
Spanish heath	<i>Erica lusitanica</i>	shrub	6,7,12,17
Tradescantia	<i>Tradescantia fluminensis</i>	creeper	6,7,12,17,18
White poplar	<i>Populus alba</i>	tree	17
Willows	<i>Salix</i> spp.	large shrub/tree	6,7,9,12,13,17

## 4.3 Agricultural Weeds

Agricultural weeds threaten crops, horticulture and pasture production and may be declared noxious weeds. Most declared noxious weeds are agricultural weeds but some are not. For example boneseed and Japanese knotweed are declared noxious but are not threats to agriculture. Not every weed that affects agriculture is declared noxious. Capeweed and umbrella sedge, for instance, can cause problems to some farmers but are not declared noxious.

Some species are capable of having several harmful effects e.g., the Regionally Controlled weed blackberry is both a pasture weed and an

environmental weed. Non-native plants that are useful in one place may be weeds in another where the land is used for something else e.g., pines are a commercial plantation species but would be a weed in a flora reserve.

**Figure 1. Willows and stock access combine to produce a poor quality riparian zone**



#### **4.4 State and Regional Priority Weeds**

State Priority Weeds include all the weeds declared as State Prohibited (see table 1) and serrated tussock and ragwort, for which Statewide strategies are in place.

Each CMA has developed a Weed Action Plan<sup>19,20</sup>. These plans recognise that it is unrealistic to expect the eradication or control of all the declared noxious weeds within each CMA area and therefore each Weed Action Plan has, in addition to the State Priority Weeds, identified a number of Regional Priority weeds (table 3). These weeds were identified on the basis of having detrimental economic, environmental and social impacts. Regional Priority Weeds are established and require actions to reduce the impacts of existing infestations and prevent their distribution from reaching its potential. The Regional Priority lists include declared Regionally Prohibited Weeds as well as other weeds of high community concern. The Weed Action Plans also list species that are considered to be emerging weeds in the CMA area (table 3). These weeds are either new to the catchment or are of a size allowing eradication.

**Table 3. Regional Priority and Emerging Weeds**

Corangamite CMA	Glenelg-Hopkins CMA
<b>Priority weeds</b>	
Blackberry Cape tulip Gorse Ox eye daisy Paterson's curse St. John's wort Wild garlic	African feather grass Blackberry Cape tulip Gorse Paterson's curse St. John's wort
<b>Emerging weeds</b>	
Bridal creeper Chilean needle grass other <i>Nassella</i> spp.	Blue canary grass Bridal creeper Chilean needle grass Other <i>Nassella</i> spp.



## 5 Stages of a weed invasion and responses to removal of grazing

Controlling weeds before they become common saves a lot of effort later

Most weeds can be dealt with quite easily if they are noticed soon after they have arrived. Management becomes a more difficult prospect as the number and size of the plants and the area in which they are present increases. Often older plants are harder to kill than small ones because they are more difficult to dig out or because they have accumulated big reserves below ground that allow re-sprouting after being slashed or sprayed. Weeds that have long-lived seeds (like brooms and gorse) will build up a big store of seeds in the soil if they have been allowed to seed for several years. So even if all the adult plants are killed there will be years of follow-up work.

Before deciding what can be done about a weed it is important to assess how much there is and how long it has been present. Less-visible parts of the riparian zone should be checked. Ideally neighbouring properties should be checked too, especially ones upstream, to see whether the weed is likely to keep arriving from them. Information on how the amount of a weed has changed over time is extremely valuable when trying to decide whether something needs to be done and how quickly. A weed that has been present but remained uncommon for many years is obviously less of a threat than one that is increasing quickly. Table 4 will help you to decide what stage each of your weeds has reached.

**Table 4. Typical characteristics at different stages of weed invasion**

	Early stage of invasion	Middle Stage of invasion	Late Stage of invasion
<b>Number of mature weed plants</b>	Small annuals or biennials: 100-500 Large perennial herbs or grasses: less than 100 Shrubs or trees: less than 30.	Much more common than early stage. Perennial species with a high proportion of small recently established plants.	Small species far too common to count. Most of the cover of perennial weeds consists of mature individuals.
<b>Soil seed bank</b>	None to very low	Locally high near older plants	Large numbers of seeds throughout infested area
<b>Rate of weed increase</b>	May be slow at first until well established	Rapid expansion into suitable habitat	May be stable or still getting denser within the area already infested.
<b>Total area of dense weed cover</b>	Less than 100 m <sup>2</sup>	100-1000 m <sup>2</sup>	>1000 m <sup>2</sup>
<b>Feasible medium-term aim</b>	Eradicate	Suppress to low level	Contain and gradually reduce

**When you remove grazing and replant your riparian zone, conditions will change becoming more favourable for some weeds and less for others**

**If you know what to expect you can take steps to prevent a weed problem emerging**

The most likely responses of some weeds to the removal of grazing are listed in table 5. Removal of grazing usually results in increased natural regeneration of native vegetation, more shade from native trees and shrubs, less soil disturbance, more leaf litter or perennial native grass cover. New weed problems can be avoided with suitable management. The actual outcome will depend on the degree of continuing disturbance in a riparian zone (eg. floods, browsing by wallabies, digging by rabbits and wombats) and on the type of native vegetation. Some of the plants in the left column may actually increase for the first few years before declining. This table assumes complete removal of grazing; possible outcomes from using the riparian zone for limited grazing are too variable to include. Narrow (<10m) strips of replanting in riparian zones may never create as much shade as wider ones and the response to removal of grazing suggested here may be less strong.

**Table 5. Potential 5-10 year response of some weeds to removal of grazing**

<p><b>Decreasing risk</b></p> <p>Less potential to invade if not already there. If already present should decrease or at least be less vigorous.</p>	<p><b>Continuing risk</b></p> <p>Able to persist and grow reasonably well in the changed conditions and may be able to invade.</p>	<p><b>Increasing risk</b></p> <p>Higher risk of invasion if local sources exist. Likely to increase if already present.</p>
Broad-leaved Dock	Cocksfoot	Agapanthus
Capeweed	Blackberry	Angled onion
Coast wattle	Brooms	Arum lily
Couch	Gorse (furze)	Blue periwinkle
Fennel	Phalaris	Boneseed
Hawthorn	Soursob	Bridal creeper
Kikuyu	Spiny rush	English ivy
Onion grass	Sweet briar	Flowering plum
Paspalum	Willows	Pittosporum
Paterson's curse		Poplars
Ragwort		Spanish heath
St. Johns wort		Tradescantia
Teasel		Tutsan
Thistles		Watsonia
Wild radish		

**Ensure that natural regeneration or replanting keeps pace with weed removal**

already dominate the whole riparian zone and resources are limited, another option may be to create just small weed free patches. These patches can be a starting point for replanting or natural regeneration of native species. Information on revegetation of riparian zones is available from several sources <sup>1, 15, 21</sup>.

To help in planning weed control Table 6 contains information on characteristics of selected riparian weeds and recommended techniques. The information is simplified and the following should be remembered when reading it. Effects on stock are difficult to summarise. Even desirable pasture species can cause problems if suddenly fed in large amounts. Many weeds sometimes cause illness in stock but usually don't, either because the stock avoid eating them or because the amount available is too small<sup>16</sup>. If lack of alternative food and/or a sudden increase in availability occurs, these weeds may become harmful.

The column on dispersal and seed persistence is based on best available knowledge and indicates the most common situation. Downstream dispersal of seeds or plant parts is an issue with all riparian weeds and is one reason why a coordinated approach with neighbours is important. There is often a lack of information on how long seeds remain viable, which is why no time is shown for some species.

**Table 6. Effects of selected riparian weeds and how to control them**

Weed	Effect on stock	Other impacts and properties	Dispersal & persistence	Recommended control techniques R=registered herbicide treatment OL=off-label herbicide treatment
<b>Arum lily, calla lily</b> <i>Zantedeschia aethiopica</i>  Large perennial. Distinctive white flowers.	<b>Cattle deaths reported.</b> May displace pasture species in moist areas.	Displaces ground layer plants, probably inhibits regeneration of canopy species. Fruit is poisonous to humans. May block small channels. Shade tolerant.	Seeds spread by birds and in water. Short seed life. Dense mass of tubers.	Small-scale: dig out, including tubers. Large scale: herbicide spray (OL); slash to suppress seed production.
<b>Blackberry</b> <i>Rubus fruticosus</i> agg.  (Regionally controlled weed and Regional Priority weed) Shrub with long prickly stems that root at the tip.	Avoided by sheep and cattle once established and therefore reduces productivity.	Out-competes native shrubs and reduces tree regeneration. Can channel stock into narrow tracks that become eroded. Provides cover for foxes and rabbits. Suppressed by heavy shade.	Seed spread by birds. Short seed life. Crowns and roots hard to kill completely.	Small-scale: dig out or slash several times per year. Large-scale: herbicide spray (R). Goats are effective if native shrubs and grasses are not present and if erosion is not likely.
<b>Blue periwinkle</b> <i>Vinca major</i>  Low creeping perennial with tough wiry stems and distinctive blue flowers.	Not a problem with regular sheep or cattle grazing but common in horse paddocks. Leaves contain a toxin but not a frequent cause of poisoning.	Forms a dense low mat that excludes most other plants.	Mostly spread by movement of stem fragments in floods or when soil is disturbed. Occasionally spread by seed in water or when soil is moved.	Only very small infestations can be removed by hand. Alternatively slash then cover with black plastic sheet for the summer. For medium or large areas: herbicides by foliar spray (OL) over 2-4 years.

Weed	Effect on stock	Other impacts and properties	Dispersal & persistence	Recommended control techniques R=registered herbicide treatment OL=off-label herbicide treatment
<b>Bridal creeper, smilax.</b> <i>Asparagus asparagoides.</i> <b>Emerging weed</b> Perennial climber dies back in summer.	Readily eaten by stock and not a pasture problem.	Covers other plants preventing their growth. Dense mat of tubers formed. Fences may be covered too.	Seeds spread by birds and have short life in soil.	Very small-scale: dig out whole plant. Larger-scale: repeated treatments with herbicide spray (OL).
<b>Crack willow</b> <i>Salix fragilis</i>  Low, branching deciduous tree.	Grazing reduces establishment of new trees in areas accessible to stock.	Excludes native plants. Roots trap sediment and cause waterways to silt up.	Some willows set seeds but mostly spread when twigs or branches fall off and establish new trees.	Small plants (up to 2 m) may be sprayed (R) or simply pulled out if not firmly rooted. Medium-sized trees may be treated by cut-stump (R) but fragments must be removed to prevent spread. For larger trees stem injection (R) is better.
<b>English ivy,</b> <i>Hedera helix.</i>  Woody evergreen climber or creeper.	Unlikely to spread into pasture unless grazing is very light.	Grows over shrubs/small trees and may cause them to collapse. As a ground cover, it suppresses native species. Grows in full sun to deep shade.	Seeds spread by birds. Stem fragments will take root.	Small-scale: remove by hand. Larger-scale: if growing up trees cut off and treat stumps with herbicide (OL). When growing on the ground herbicide spray (R).
<b>Gorse, furze</b> <i>Ulex europaeus</i>  <b>(Regionally controlled weed and Regional Priority weed)</b> Medium to tall spiny shrub.	Young seedlings grazed, larger plants avoided, reducing pasture productivity. Dense growth limits stock movement.	Displaces native plants but may provide cover for native fauna. Harbours rabbits and foxes. Dense patches are a severe fire hazard. Suppressed by heavy shade	Seeds spread by explosive pods, also by birds and on animal hooves. Seeds last more than 25 years. Seed bank can be extremely large.	Small-scale: dig out plants or slash frequently to weaken them. Larger-scale: ideally, slash or burn then use grazing or herbicide spray (R) as a follow-up. Cut-stump herbicide treatment (R) is an alternative for larger plants.
<b>Hawthorn</b> <i>Crataegus monogyna</i>  <b>(Regionally controlled weed)</b> Deciduous tall shrub to small tree.	Young seedlings grazed by sheep, larger plants avoided. Dense growth limits stock movement.	Impedes access when dense. Competes with native shrubs and shades out ground plants. Harbours rabbits and foxes. May be a food source for native birds.	Seeds spread by birds.	Small seedlings: pull up, including the root. Larger seedlings and small bushes: herbicide spray to leaves or basal bark (R). Large bushes/trees cut-stump herbicide (R).
<b>Pittosporum, sweet pittosporum</b> <i>Pittosporum undulatum</i>  Evergreen tall shrub to small tree.	Unlikely to establish in pasture.	Creates dense shade that suppresses many other species and reduces regeneration. Native to parts of eastern Victoria.	Seeds spread by birds. Short persistence (a few years) of seeds.	Sensitive to moderate to intense fire where this is a safe option. Small plants can be dug out. Larger plants can be treated by cut and paint (OL).

Weed	Effect on stock	Other impacts and properties	Dispersal & persistence	Recommended control techniques R=registered herbicide treatment OL=off-label herbicide treatment
<b>Ragwort</b> <i>Senecio jacobaea</i>  (Regionally controlled weed and State Priority Weed) Biennial or perennial broad-leaved herb.	<b>Poisonous to sheep and cattle.</b> Cattle generally avoid ragwort (unless present in hay) and sheep tolerate quite large amounts. Reduces pasture productivity.	A problem in open sunny places where dense growth may interfere with regeneration or planting.	Seeds spread by animals and in wind and water. Seeds are moderately persistent in soil (some more than 10 years).	Small scale: hand-pull or dig out. Large-scale: herbicide spray (R). If developing tree cover is beginning to suppress ragwort it may be sufficient to prevent seed production by slashing.
<b>Reed sweet grass, Poa aquatica, glyceria</b> <i>Glyceria maxima</i>  Tall perennial grass.	<b>Can cause cyanide poisoning of stock. Cattle can become bogged after breaking through the root mat.</b>	Displaces native plants. May cover small creeks with effects on aquatic fauna. Can grow across creeks and block flow. Water may then be tainted. Suppressed by moderate to heavy shade.	Rhizome fragments spread downstream. Seeds spread in water or in mud on hooves, machinery etc.	Establish a dense shade cover or use herbicide spray (R for terrestrial, OL aquatic situations). Grazing may suppress it if this is considered safe.
<b>Serrated tussock</b> <i>Nassella trichotoma</i>  (Regionally controlled weed and State Priority weed) Perennial tussock grass.	Usually avoided, low feed value, <b>seeds contaminate wool.</b>	Competes with native grasses. Suppressed by tree or shrub cover or by vigorous improved pasture.	Seeds spread by wind and animals. Seeds are moderately persistent in soil.	Dense tree and shrub cover will suppress it. Small-scale: dig out tussocks. Large-scale: herbicide spray (R). Burning then allowing regrowth before spraying will remove dead material and kill surface seeds.
<b>Tradescantia, wandering Jew</b> <i>Tradescantia fluminensis</i>  Low succulent creeper. Referred to as <i>Tradescantia albiflora</i> on herbicide labels.	Does not invade pastures. <b>Nitrate poisoning has occurred</b> when cattle are given access to large amounts.	Dense growth out-competes other ground layer plants and seedlings of trees and shrubs. Highly shade tolerant, less vigorous in full sun.	No viable seeds seem to be produced. Spreads when stem fragments are moved around.	Small-scale: weakly rooted and easily removed with a rake. Hand-weed any regrowth. Alternatively, cover with plastic sheet. Larger-scale: herbicide spray (R).
<b>Spiny rush</b> <i>Juncus acutus</i>  (Regionally controlled weed) Large tussock-forming rush.	Not readily eaten. Sharp spines on leaves deter stock access. Mostly a problem on poorer wet land.	Eliminates almost all other vegetation. Harbours rabbits. May block drains and watercourses.	Small seeds moved by water and in mud on vehicles etc.	Herbicides registered for control of rushes may be applied by wick-wiper (R). Mature plants can be dug out, stacked and burned. Follow either method with repeated cultivation to destroy seedlings, then plant replacement species.
<b>Sweet briar, briar rose</b> <i>Rosa rubiginosa</i>  (Regionally controlled weed) Spiny shrub with red fruit.	Not usually able to invade well-used pasture. Once established thickets can restrict stock movement.	Competes with native shrubs and tree seedlings. Prevents human access and provides harbour for rabbits.	Seeds dispersed by birds and foxes that eat the fruit and by water.	Dig out whole crown of small plants. Large plants by cut-stump herbicide (R). Larger-scale: basal bark or foliar herbicide treatment (R). Goats are effective.

Weed	Effect on stock	Other impacts and properties	Dispersal & persistence	Recommended control techniques R=registered herbicide treatment OL=off-label herbicide treatment
<p><b>Wild garlic, field garlic</b> <i>Allium vineale</i></p> <p>(Regionally prohibited and a regional priority [CCMA]; regionally controlled [GHCMA]) Erect strong-smelling perennial herb, slender hollow leaves. White, pink or greenish flowers. Dies back to underground bulbs in summer.</p>	<p>Even small amounts cause a strong garlic taint in meat and milk.</p>	<p>Desirable vegetation may be damaged by efforts to control this persistent weed.</p>	<p>Flowering is rare, most stalks produce only bulbils (about the size of a wheat grain) and many plants produce neither seeds nor bulbils. Spread is slow except when disturbance moves bulbs or bulbils around.</p>	<p>On a very small scale dig out whole plants making sure all bulbs are removed. For larger scale work foliar herbicides (R). Regular mowing will weaken bulbs and prevent bulbils forming but not eliminate infestations.</p>
<p><b>Wild watsonia, bulbil watsonia</b> <i>Watsonia meriana</i> var. <i>bulbillifera</i>.</p> <p>(Regionally controlled weed) Large perennial herb, sword-like leaves. Red, orange or pink flowers on long spikes. Dies back to corms in summer.</p>	<p>Not invasive in improved pasture.</p>	<p>Dense stands dominate the ground layer and must be removed before native species can be established. Dense growth may block drains.</p>	<p>No seed is produced but bulbils develop on the flowering stem and these are spread by water or during slashing etc.</p>	<p>Dig out whole plants making sure corms are removed. For larger scale work foliar herbicides (R). Slashing new growth can prevent spread and weaken the weed but <b>MUST</b> be done before bulbils begin to form on stems.</p>

## 6.2 Protecting native plants

Any exotic plant that becomes common is displacing the native plant species that would otherwise grow there and is therefore reducing the habitat for insects and other creatures that rely on the native plants. However, sometimes native plants can survive beneath a cover of weeds, so it is always worthwhile checking before using non-selective control techniques.

Species that are native to the locality can sometimes seem to be a problem where particular conditions have allowed them to become unusually vigorous. Regulations in all planning schemes in Victoria exist to conserve and protect native vegetation. These regulations require a permit to remove, destroy or lop native vegetation, although some exemptions apply. If your weed problem involves native vegetation in any way always check with your local government office to determine if a planning permit is required.

**Table 7 Suitability of different control methods**

<b>Method</b>	<b>Suitable situations</b> (See also references <b>1 &amp; 7</b> )	<b>Comments</b>
<b>Remove by hand</b>	Small areas, weeds that can be removed intact without much soil disturbance.	Recommended for situations where it is otherwise difficult to avoid damaging sensitive native species or where erosion may occur due to loss of vegetative cover if too much bare earth is exposed at once.
<b>Mechanical removal</b>	Areas with no native vegetation that are accessible to machinery.	Risk of soil compaction and erosion. Replanting or reseeding and follow-up weed control essential. Consult CMA before working on a waterway.
<b>Slashing</b>	Apply in accessible areas to suppress and weaken perennial weeds or to prevent seed production. Only where native species can be avoided.	Some weeds need frequent slashing to weaken them. Take care not to spread weeds while slashing them by cleaning slasher before and after each use prior to leaving each site.
<b>Weed mat</b>	Weeds that will die when covered where weed cover is continuous and area small.	Livestock, wind, floods may disturb the mat.
<b>Goats</b>	To remove susceptible weeds where native plants are absent or only present as large trees. Several seasons may be needed.	Not recommended where goats may damage native ground flora or shrubs. Extra fencing to contain goats can be a big expense.
<b>Controlled grazing (sheep and cattle)</b>	Palatable weeds and with grazing-tolerant native plants. Where grazing can be tightly controlled.	Disturbance of the soil and damage to native species may offset weed control benefits.
<b>Biological control</b>	Applies only to some weeds for which biocontrol agents have been introduced (see Appendix 1).	Not suitable if eradication is feasible. Effects can be slow; other measures may also be needed.
<b>Ring-bark</b>	Trees that don't re-sprout.	Dead tree may be a safety concern or problem for fences when it falls.
<b>Cut-paint herbicide</b>	Trees and shrubs that would otherwise re-sprout, where the number of stems to treat is manageable.	Reduces the risk of herbicide drift or run off causing off-target damage to native plants or contaminating waterway.
<b>Herbicide by knapsack spray</b>	Small infestations of grasses, herbs or small shrubs. Basal bark treatment or seedlings of larger species.	Good where weeds are amongst sensitive native plants, but be sure to cover or avoid native plants. Not suitable for large areas or dense/tall bushes.
<b>Herbicide by hand-gun</b>	Larger infestations and tall/dense bushes.	High output requires care to avoid drift or runoff affecting waterway and non-target plants.
<b>Herbicide by wick-wiper</b>	Hand-held: best for highly selective application to small weeds in sensitive native vegetation. Machine-mounted: where weeds are taller than other plants and land is fairly even.	Seek advice on whether this technique is effective for particular species. Wiping avoids possible problems with spray drift.



Method	Suitable situations (See also references 1 & 7)	Comments
Flame gun	Small annual weeds can be killed by heat or to suppress/kill flower stems of perennials. Small-scale.	Injury to native species may be a problem; few riparian weeds are susceptible to this method.
Controlled burn	Fire-sensitive weeds in native vegetation where fire is appropriate.	Follow-up weed control needed. Many safety concerns; consult CFA and DSE/CMA (if riparian zone involves public land river frontage).

## 7 Safe and Legal Herbicide Use

Always read the label before using any herbicide and follow all the directions given on the label.

A number of herbicides are **restricted chemicals** in Victoria. An Agricultural Chemical User Permit (ACUP) is required to be held by any user of restricted chemicals in Victoria unless exempted, such as spraying contractors holding a commercial operator licence. A person working under the direct supervision of an ACUP holder may also use restricted chemicals. The user must also make and keep for a period of two years certain prescribed records of use.

Restricted chemicals are:

- Schedule 7 (S7) poisons that are agricultural chemicals
- metham sodium
- atrazine
- ester formulations of triclopyr; MCPA; 2,4-D; and 2,4DB

Further restrictions on herbicide use exist within Chemical Control Areas, but there are no such areas in southwest Victoria.

The weed information in Table 6 includes whether any herbicides are registered for that weed in Victoria. Where registered herbicides do exist the Chemical Information Service<sup>2</sup> will provide details. Many environmental weeds do not currently have any herbicides registered for their control. Using a herbicide to control a weed when it is not registered for that particular species or situation (**'off-label' use**) is sometimes legal in Victoria without a permit. Off-label use without a permit is subject to certain conditions and does not apply to restricted chemicals. Your Regional Chemical Standards Officer<sup>2</sup> is able to provide information on the conditions for legal off-label use and may be able to recommend off-label treatments for particular weeds.

Some herbicides that are persistent in soil carry warnings not to use them over the roots of desirable vegetation such as trees, or in places where they may be washed into contact with the roots. These instructions must be followed—there is in any case no point in achieving weed control at the expense of killing valued trees and shrubs that could take many years to replace.

## 7.1 Herbicides and waterways

Using herbicides around waterways requires special care

Some formulations of glyphosate are registered for aquatic situations and these are widely used when weeds are in or overhanging waterways. Other formulations of glyphosate that lack instructions for aquatic situations on the label must not be used in this way. Some other herbicides are registered for a smaller range of weeds in aquatic situations. Labels of these products carry detailed instructions for aquatic use, which must be followed carefully. Additional surfactants (wettors) or penetrants should **not** be added during aquatic use of glyphosate because none of them is registered for this purpose and they may be harmful to aquatic organisms.

Seek expert advice and always aim to minimise the amount you use

Sometimes riparian weeds are not well controlled by glyphosate, or a selective herbicide is preferable to avoid damage to non-target plants. Products without instructions for aquatic situations specified on the label may be used, so long as contamination of the waterway can be avoided. Spray must not be allowed to drift over water or applied to weeds overhanging water. Generally, no minimum distance from the water's edge to prevent contamination is specified on herbicide labels. The safe distance has to be assessed on a case-by-case basis taking into account how much herbicide is being used, method of application, mobility, persistence and toxicity of the particular herbicide and local conditions such as soil type and slope. Predicting herbicide behaviour requires specialised knowledge. For advice on your particular situation contact your DPI Regional Chemical Standards Officer<sup>2</sup> or the herbicide manufacturers.

Figure 2. Control of weeds in riparian situations is often difficult.



## 8 Setting goals for weed management

A realistic aim and timescale for your weed management is important; trying to do too much too quickly can lead to burnout

Managing weeds in a riparian zone usually involves relatively small costs for equipment or herbicides but large amounts of time. Contractors may be used for larger jobs but often landholders will opt for the cost saving and increased flexibility of doing the work themselves. It is important to have a clear idea of how much time will be required before making long term weed management plans. It is much better to set modest targets for weed management that can be met even in years where time is short, rather than start with a large commitment that has to be dropped in some years.

Goals for weed management usually take the approach of eradication, suppression or containment. Depending on current skills, knowledge and resources available it may be appropriate to adopt just one of these approaches for a period. However, as you update your Weed Management Plan (and your skills, knowledge and resources) in subsequent years you may benefit by changing the goal, e.g., from containment to suppression. Monitoring the extent of the infestation, and its adaptation to weather variations, may also help identify an opportunity to move to a more aggressive goal when its abundance or spread may naturally be retarded.

### 8.1 Eradication

Eradication of a weed strictly means that not a single plant or seed exists in the managed area. Eradication is extremely difficult to achieve unless the weed is only present in very low numbers, the whole infestation is accessible and it is not being constantly reintroduced from adjacent land. When it is feasible, eradication has the great advantage that future work is reduced to occasional checking to ensure continued weed-free status. However, attempting eradication when it is not achievable is one of the commonest mistakes in weed management and leads to great disappointment when the goal has not been met after much effort. Another common mistake is the view that the application of one treatment or control method is all that is needed. One way to assess whether eradication is a realistic goal is to ask the following questions.

- Can I be sure of always spotting this weed before it seeds?
- Do I have a good technique to kill it?
- Do I have time to treat most of the mature plants every year?
- Am I sure that this plant is not present upstream or in other places where it could spread from?

Eradication is feasible only if the answer to **all** these questions is “Yes”.

### 8.2 Suppression

Suppression involves reducing density of weeds within the infestation and at the same time preventing the infested area from expanding. The intention is to keep the weed at a level where ongoing treatment is not too much work and to prevent spread to new areas. The remaining level of the weed should be low enough that it is having little or no effect on native vegetation or beneficial uses of the riparian zone. However, it is recognised from the start that the weed is not going to be eradicated.

Reasons for choosing suppression as a goal could include a large persistent seed bank, difficulty in spotting seeding weeds or a low kill

rate from the best available control method. Reducing the infestation to the desired level can be achieved gradually. The important point is that the rate of treatment each year must be greater than the rate of weed growth until the amount of the weed is acceptable. The treatment could then be as simple as slashing once or twice a year to ensure that no seed is set or pulling out new weeds when they reach flowering size.

### **8.3 Containment**

Containment involves defining the boundary (e.g., by wooden pegs) of the existing weed infestation and preventing any spread beyond that line. Within the infested area the weed may not be treated; it may even become more dominant. This goal is most suitable when there are severe difficulties in attempting to treat the main part of the infestation. It may simply be too large for the resources available, the weed may be very difficult to kill or some obstacle such as steep banks may prevent access. Containment works best when the weed has a slow natural rate of spread so that the annual effort required removing all occurrences outside the boundary is low. Sometimes it makes sense to have suppression as the goal for the easier part of the infestation but just contain the most difficult areas.

## **9 Preparing a weed management plan**

A weed management plan should be simple because that makes it more likely that you will find time to update it in future years. The initial plan would usually consist of a rough sketch of the riparian zone with the location of the most serious weeds indicated. Reasons why certain weeds are the highest priority should be noted and aims stated. A short list of the planned work and time of year to do it should then follow. Some way of measuring the success of the plan is essential. A weed management plan should be a part of an overall Property Management or Whole Farm Plan to ensure that any weed management is undertaken with consideration given to the management of broader production and environmental assets on the farm. Courses are available to equip landholders with the necessary skills to prepare and implement such plans. Contact DPI, DSE or your CMA to obtain information on such courses.

The following example shows what a plan might look like. Even if you have the same weeds as in this example the plan for your riparian zone could be very different.

### Weed management along Ten Mile Creek

The creek was fenced off two years ago and mixed native trees and shrubs planted in gaps between some large old trees, after spraying out the mainly grass pasture.

#### Weeds identified, amount and legal status

1. Blackberry. Scattered small bushes mainly along fence line. Regionally Controlled.
2. Cape broom. 30+ large bushes on steep banks. Regionally Controlled.
3. Crack willow. Five trees over 2 m and a few smaller ones. Not declared.
4. Flowering plum. 20+ plants up to 3 m tall near bridge. Not declared.
5. English ivy. Large amounts on 2 of the old trees. Not declared.
6. Capeweed. Scarce. Not declared.
7. Phalaris. Dense in some unshaded areas. Not declared.

#### Aims

- Eradicate English ivy and flowering plum in 4 years
- Suppress blackberry by removing all new plants within 2 years (being continually re-introduced from off property so no hope of eradication)
- Suppress cape broom by killing all flowering-size bushes (seed bank too large for eradication)
- Contain willows for now, maybe remove later when new trees have stabilised banks
- No action needed on capeweed and phalaris; not increasing or threatening new plantings

#### Work plan

- Spring: cut and paint ivy and the largest plums once growth is well under way.
- Summer: spray broom and blackberry, walk the creek and pull out any willow branches that are taking root.
- Autumn: Assess results of control, review methods if necessary, note areas requiring re-treatment and any new occurrences of weeds. Prepare work plan for following year.
- Longer-term: Seek advice on willow removal and on revegetation of broom infested area once it's under control.

## 10 Monitoring the results

### Monitoring the results is an essential part of weed management

A record of whether your weed management is working is very important. Without records you might be tempted to give up because you aren't sure that you're getting anywhere, or you may carry on doing the same thing when it isn't succeeding. Records don't have to be very detailed or take much time to complete.

Photographs taken from the same place and at the same time each year are a good way to measure progress, especially for weeds that are large and easy to pick out. Try to use a fence post, large tree or similar feature as a marker for where to take the photo from and keep the direction, time of year and lens the same each time.

When trying to push back the edge of an infestation a few marker stakes, paint dots on fence posts or marker tape on trees may be enough to show how far you have got. If you are removing all the new seedlings or slashing all flower stems every year then a quick note of how much time taken compared to last year shows whether things are getting better. Remember that the point of the exercise is not just to have fewer weeds; it is to reduce the effect of the weeds. A photo or note showing an increase

**Using your records to decide  
what works and what  
doesn't will avoid wasting  
effort**

in native species is a good indication that you are succeeding even if there still seem to be many weeds.

As important as reducing the weeds is the effect on native vegetation. Records should be good enough to pick up any unintentional damage to native trees and shrubs caused by removing weeds. If damage occurs you need to rethink your control methods.

## 11 Sources of information

- 1 Lovett, S. & Price, P. (eds) 2002, *Riparian Land Management Technical Guidelines* Vol 1: Principles of sound management.  
S. Lovett P. Price (eds) 1999, *Riparian Land Management Technical Guidelines* Vol 2: On-ground management tools and techniques.  
Also other relevant technical reports at Land and Water Australia [www.lwa.gov.au](http://www.lwa.gov.au) or call 02 6257 3379.
- 2 Department of Primary Industries [www.dpi.vic.gov.au](http://www.dpi.vic.gov.au), or call the customer service centre on 136 186. For chemical information follow links on [www.dpi.vic.gov.au](http://www.dpi.vic.gov.au) to find the Chemical Standards Branch or call the Chemical Information Service on 03 9210 9379.
- 3 Department of Sustainability and Environment [www.dse.vic.gov.au](http://www.dse.vic.gov.au) or call the customer service centre on 136 186.
- 4 Glenelg-Hopkins Catchment Management Authority [www.glenelg-hopkins.vic.gov.au](http://www.glenelg-hopkins.vic.gov.au) or call on 03 5571 2526.
- 5 Corangamite Catchment Management Authority [www.ccma.vic.gov.au](http://www.ccma.vic.gov.au) or call on 03 5232 9100.
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## Appendix 1 Current Weed Biological Control Programs in Victoria

Weed	Current biocontrol agents E = established*, R = released but not established
<b>Blackberry</b>	Rust fungus <b>E</b> ; new strains approved for release.
<b>Boneseed</b>	Two moths, seed fly, several beetles; all <b>R</b> .
<b>Bridal creeper</b>	Rust fungus <b>E</b> , leafhopper <b>E</b> , leaf beetle approved for release.
<b>Dock</b>	Moth <b>E</b> .
<b>English broom</b>	Twig mining moth <b>E</b> , seed beetle <b>R</b> , psyllid (sap sucker) <b>E</b> .
<b>Gorse</b>	Seed weevil <b>E</b> , spider mite <b>E</b> .
<b>Horehound</b>	Two moths; both <b>E</b> .
<b>Illyrian and Scotch thistles</b>	Three weevils; all <b>E</b> .
<b>Paterson's curse</b>	Leaf moth <b>E</b> , seed beetle and flea beetle <b>E</b> , root weevil <b>E</b> , stem beetle <b>E</b> , and crown weevil <b>E</b> .
<b>Prickly pear</b>	Cochineal insect <b>E</b>
<b>Ragwort</b>	Two flea beetles <b>E</b> , crown moth and cinnabar moth <b>E</b> , plume moth <b>E</b> .
<b>Skeleton weed</b>	Gall midge, gall mite, rust fungus all <b>E</b> .
<b>Slender thistle</b>	Rust fungus <b>E</b> .
<b>Spear thistle</b>	Seed weevil, crown weevil, gall fly; all <b>E</b>
<b>St. John's wort</b>	Two leaf beetles, aphid, gall midge & mite; all <b>E</b> .
<b>Tutsan</b>	Rust fungus <b>E</b>
<b>Tiger pear</b>	Cochineal insect <b>E</b>
<b>Variiegated thistle</b>	Seed weevil <b>E</b>

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\* Established agents may not yet be present in all infestations. DPI can provide information on the current situation.