

# South East Weed Risk Assessment



**A risk assessment  
of agricultural and  
environmental weed  
species in the  
South East of  
South Australia**

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# SOUTH EAST WEED RISK ASSESSMENT

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## SUMMARY

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Weeds in general have a serious impact on a spectrum of landuses from native vegetation to agricultural operations. South Australia has over 900 exotic species, with an average of 6 new species naturalizing each year. Weeds not only cost South Australia agriculture over \$650 million annually but also have major effects on biodiversity and the functioning of natural ecosystems (APCC 2005).

The aim of this project was to determine the priority weeds of the South East region. This will allow the development of appropriate and strategic policies and actions to protect the biodiversity of the natural areas and the value of primary industries.

It is important to note that this assessment was carried out at a regional scale and will therefore not reflect all local situations or priorities. Such specific local issues can be reflected in policies, however a strategic regional approach is required for strategic planning purposes.

The project methodology followed the draft National Post-border Weed Risk Management Protocol. A committee of stakeholders representing sub-regions and landuse sectors of the South East was convened to scope and oversee the project. This included a consensus on the agreed aims and outcomes of the project and analysis of the results and recommendations.

Various stakeholders assisted with specialist technical information on the various weeds and landuses practices addressed in this project. A weed risk assessment system developed by the Animal and Plant Control Commission (APCC) was used to determine which weeds pose the greatest threats to primary industries and the environment in the South East region. The most appropriate management actions for these weeds were then identified using a feasibility of control assessment system also developed by the APCC.

Results for all landuses were then summarised to determine the top 15 agricultural weeds and the top 15 environmental weeds. Distribution maps and general information on these weeds have been provided in this report on most of these weeds.

The results of the project will provide the basis for the South East Natural Resource Management Board to complete regional weed policies. It will also assist other stakeholders to prioritise on ground works.



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## THE SOUTH EAST REGION

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The South East region is situated in the south east corner of South Australia. It is bounded by the Victorian border to the east, the Southern Ocean and the mallee district in the north. The region is made up of nine local government areas, these are;

- District Council of Grant,
- District Council of Robe
- District Council of Tatiara
- Kingston District Council
- Naracoorte Lucindale Council
- Wattle Range Council
- Coorong Council
- Southern Mallee District Council
- City of Mount Gambier.

Mount Gambier is the main regional centre and only city in the South East. The principal townships are Millicent, Naracoorte, Robe, Kingston, Penola, Bordertown, Keith, Port MacDonnell and Beachport.

The highest annual rainfalls are found in the southern area of the region where the average precipitation is approximately 850mm per annum. Rainfall decreases in the north to approximately 450mm. The majority of rain falls during the winter months, particularly in the coastal zones. The climate of the South East is a cool temperate climate, warmer in the Upper South East than the Lower South East.

The majority of soil types in the South East are sandy, including deep sands and sand over clay. These soils are scattered across the entire region and dominate in the north west of the region. Many of the soils of the coastal plains are associated with the ancient dune geological systems running north to south; these are dominated by limestone substrate with deep sand and shallow red soils on the dunes, and shallow black clays in the swales. Mt Gambier district has a large proportion of volcanic soils which are of high quality. Other patches of high quality soil includes peats in the Lower South East, well structured black clays in lower topographic areas and loam over clay soils east of the Naracoorte Range. Moderate to shallow red soils associated with limestone ridges are popular for the viticulture industry.

Primary production across the region varies. In the southern zone, there is high forestry activity, dairy production and livestock production. In the north of the region, large scale cropping, vineyards and grazing are the prominent practices. The majority of the region consists of grazing lands (modified pasture) used for prime livestock (cattle and sheep) production. There is a large spread of native vegetation across the entire region, which varies greatly to include unique wetlands, mallee scrub, coastal vegetation and grassy woodlands.

The difference in rainfall and soil types across the region has resulted in significant differences in weed species distribution and abundance. The light, sandy soils and poorer pastures of the Upper South East are prone to summer burry weeds, deep rooted perennial weeds and common pasture weeds such as salvation Jane. Many weeds are more widespread in the Upper South East than the Lower South East, with some probably having reached their full potential distribution in this area of the region. The heavier and moister soils of the Lower South East are prone to winter weeds such as thistles, and woody weeds such as blackberry. The more competitive pastures of this part of the region have resulted in weeds that are common in the Upper South East being much more restricted in the Lower South East and therefore of higher priority for control.

## AIM

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The initial aim of this project was:

1. To determine the top 15 agricultural weeds and 15 environmental weeds of the South East
2. The production of electronic distribution maps for these weeds

The steering committee also broadened the aim to producing weed risk management tables for each major landuse in the South East.

## METHODOLOGY

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The plants identified are a combination of the proclaimed plant list under the Animal and Plant Control Act 1986 and other non-proclaimed plants considered to be a pest in the South East. Refer to Appendix 1 for the full weed list considered for this project.

Determining priority weeds allows effective and efficient policies to be developed that protect the economic, environmental and social assets of the region. Prioritisation is required in order to allocate scarce resources for the most beneficial outcome for the region. Every weed assessed in this project has been assigned to a strategic management action category according to its results within the particular landuse. These individual landuse results can then be summarised to determine the top 15 weeds for both primary industries and environmental landuses.

The project methodology followed the draft National Post-border Weed Risk Management Protocol<sup>1</sup> developed by the Cooperative Research Centre for Australian Weed Management (Weeds CRC). It is intended that the draft protocol will be published jointly by Standards Australia and the Weeds CRC in 2005. It is based on the national standard AS/NZS 4360:2004<sup>2</sup>. The SA Weed Risk Management System<sup>3</sup> was used as the assessment tools for the project.

Again, it is important to note that the assessment of all weeds was conducted at a regional scale, which involved averaging answers in some cases where there are differences within the landuse across the region.

The following steps were undertaken for the completion of this weed assessment project;

### ***Step 1 – Stakeholder consultation***

It was important to include a range of stakeholders in the project, both for technical input and for ownership of the results so that the findings can be successfully applied across the region.

#### **A) Discussion group**

The purpose of the discussion group was to set the context of the project and to define the projects aim and goals. The discussion group was formed from representatives of various agencies and interested parties. It was comprised of representatives from;

- Animal and Plant Control Commission (DWLBC)
- Lacepede Tatiara Robe Animal and Plant Control Board
- Coorong Animal and Plant Control Board
- Grant Animal and Plant Control Board
- Wattle Range Animal and Plant Control Board

- Rural Solutions SA
- CoastCare
- Department of Environment and Heritage
- ForestrySA
- TimberCorp
- Lacepede Tatiara Soil Conservation Board
- Local Government

This membership covered all landuses being examined by the project and also represented all geographic areas of the region.

At the first meeting the discussion group brainstormed a list of plant species they believed to either have the ability to become a weed or is currently a weed within their industry/landuse. In addition, weeds listed in the *Animal and Plant Control (Agricultural and Other Purposes) Act 1986* proclaimed plant list, National Alert List of Environmental Weeds, World Wildlife Fund Australia Report 2004 were included in the final weed list, see Appendix 1.

### **B) Steering Committee**

The discussion group nominated a smaller steering committee to help with the direction and output of the project. The steering committee had two meetings to further determine the content of the project and the criteria for the weed assessment.

### **C) Focus Groups**

Focus groups used in the assessment phase of the weed management system were established for grazing, cropping, irrigated crops and pastures, native vegetation and forestry landuses. These groups provided expert technical information on the impacts and distribution of each weed species and management practises for each landuse. Focus groups were not used for aquatic, urban and perennial horticulture, and were assessed by the project managers with expert assistance from DWLBC.

## **Step 2 – Weed List**

The weed list compiled by the discussion group was too extensive to consider all within the scope of this project. The focus groups were used to reduce the list to a manageable task for each landuse. The list was narrowed down according to the general knowledge of the focus group members as to whether the plant species was a significant weed within its landuse and the region. Whilst this was a subjective assessment, it was based on expert knowledge and was the first logical step in prioritising weeds at the regional scale.

**The criteria for eliminating weeds from list came into 5 categories which were;**

#### **1. Widespread (WS)**

Some weeds were eliminated because they are widespread across the region. An example of this is capeweed within a grazing situation.

#### **2. Low Impact (LI)**

Weeds that are present, but do not have a considerable negative impact on the landuse and would therefore result in a low weed risk score, were eliminated. An example of this is South African weed orchid in a forestry situation, where generally the weed does not have any great impact on the growth of the tree seedlings planted.

### **3. Not suited to the South East or Landuse (NS)**

Different weeds have particular environmental requirements for growth, reproduction and survival. There are some weeds that are a significant threat but would be unable to live in the South East due to climatic conditions. An example of this is lantana, which is a significant threat to biodiversity in tropical regions but is not suited to become naturalised in the South East.

### **4. Not Present (NP)**

This category indicates those weeds that are not currently present in the region or in the particular landuse. An example of this is noogoora burr which is present at one irrigation site in the Lower South East, but as far as is known, it is not present in any other grazing situations in the region.

### **5. Routinely being successfully controlled (RC)**

Each landuse has standard weed control practices (e.g., herbicides, cultivation) which will result in successful control of some weeds but not others. Different landuses have different routine weed control practices, such as cropping, which has high levels of routine weed control, as compared to native vegetation which generally has no routine weed control.

Once this list was finalized the plants for each landuse were assessed using the *SA Weed Risk Management System*.

## ***Step 3 – Applying the South Australian Weed Risk Management System***

In South Australia, a system to rank the importance of weeds has been developed for use in planning weed control programs and in assessing new weeds for proclamation. The Animal and Plant Control Commission Weed Risk Management Scoresheet, produced in consultation with Animal and Plant Control Officers, was based on a ranking system developed to determine Weeds of National Significance in Australia.

Weeds are assessed separately for different landuses so that the most important weeds of different landuses can be most accurately identified. This project assessed weeds at a regional scale, which required some averaging of scores to account for the environmental differences across the region. This method will therefore provide a strategic regional context but may not reflect all local situations.

The assessment system consists of multiple-choice questions to derive scores for various characteristics of each weed. This allows an objective assessment to be made on a weed's threat rather than simply react to its presence and appearance.

### **Weed Risk**

The weed risk is determined by assessing the invasiveness, impacts and potential distribution. Invasiveness is used as an indicator of a weed's rate of spread, with faster spreading weeds being considered more important for urgent control and thus of higher priority. The questions to determine a score for invasiveness relate to a weed's ability to establish, tolerance to routine weed control, reproductive ability and dispersal by natural and human-influenced means. The impacts assessment relate to the economic, environmental and social effects of weeds, with the questions covering effects on establishment and growth of desired plants, reduction in product quality, effect on animal and human health, restriction to physical movement, and effect on environmental health. Potential distribution considers the area of the landuse at risk of invasion by the weed.

Scores for invasiveness, impacts and potential distribution are multiplied together to give the total weed risk score. The weed risk score was then divided into categories to allow comparison within the management action matrix. These categories can be seen below.

Frequency Band	Weed Risk Score	Weed Risk
80 - 100% (top 20% of possible scores)	192+	<i>Very high</i>
60 - 80%	< 192	<i>High</i>
40 - 60%	< 101	<i>Medium</i>
20 - 40%	< 39	<i>Low</i>
0 - 20% (bottom 20% of possible scores)	< 13	<i>Negligible</i>

### Feasibility of control

Within the landuse the feasibility of controlling the weed is also an important consideration in prioritising weed control efforts. Feasibility of control consists of scores for control costs, current distribution and persistence. Control costs questions cover how detectable the weed is, general accessibility to infestations, operating costs, labour costs and level of cooperation expected from landholders. The current distribution of the weed within its landuse is calculated together with the spatial pattern of the weed, i.e. is the weed widespread, restricted or scattered. The persistence considers how effective the targeted control is, maximum time to reproduction, maximum longevity or production of propagules and the likelihood of ongoing dispersal. The scores for control costs, current distribution and persistence are multiplied to give a feasibility score. These scores are divided into categories similarly to the weed risk, as seen below:

Frequency Band	Feasibility Score	Feasibility of Containment
80 - 100% (top 20% of possible scores)	113+	<i>Negligible</i>
60 - 80%	< 113	<i>Low</i>
40 - 60%	< 56	<i>Medium</i>
20 - 40%	< 31	<i>High</i>
0 - 20% (bottom 20% of possible scores)	< 14	<i>Very High</i>

A summary of the results for each landuse can be found in Tables 4, 7, 10, 13, 16, 19, 22, 25. The full results spreadsheet is available upon request.

### Step 4 – Determine Regional Weed Management Priorities

By comparing a weed's risk score to its feasibility of control score, recommendations can be made for the most appropriate management action. This allows priority to be allocated to those weeds that have a high risk and are feasible to control. Weeds that are very low risk will not be recommended for control over other higher priority weeds, even if they are present. Likewise, weeds that are widespread but not feasible to control will not rank as a high priority.

A matrix for doing this comparison is shown in Table 1. These management categories are described below:

## **Guiding principles for regional weed management based on weed risk and feasibility of control:**

### **ERADICATE FROM REGION**

Aims to completely remove the weed species from the region.

Management actions required to achieve this include:

- Detailed surveillance and mapping to locate all infestations
- Destruction of all infestations including seed banks
- Prevention of entry to region and movement and sale within
- Must not be grown commercially or domestically, and all cultivated plants to be removed
- Monitor progress towards eradication

### **DESTROY INFESTATIONS**

Aims to significantly reduce the extent of the weed species in the region.

Management actions required to achieve this include:

- Detailed surveillance and mapping to locate all infestations
- Destruction of all infestations, aiming for local eradication at feasible sites
- Prevention of entry to region and movement and sale within
- Must not be grown commercially or domestically, and all cultivated plants to be removed
- Monitor progress towards reduction

### **CONTAIN SPREAD**

Aims to prevent the ongoing spread of the weed species in the region.

Management actions required to achieve this include:

- Surveillance and mapping to locate all infested properties
- Control of all infestations, aiming for a significant reduction in weed density
- Must not allow to spread from cultivated plants (if grown)
- Monitor change in current distribution

### **PROTECT SITES**

Aims to prevent the spread of the weed species to key sites/assets of high economic, environmental and/or social value. Weed may be of limited current distribution but only threatens limited industries/habitats (lower weed risk), or the weed may be more widespread but is yet to invade/impact upon many key sub-regional industries/habitats (higher weed risk).

Management actions required to achieve this include:

- Surveillance and mapping to locate all infested sub-regions
- Identification of key sites/assets in the region
- Control of infestations in close proximity to key sites/assets, aiming for a significant reduction in weed density
- Limits on movement and sale of species within region
- Must not allow to spread from cultivated plants (if grown) in close proximity to key sites/assets
- Monitor change in current distribution within and in close proximity to key sites/assets

### **MANAGE WEED**

Aims to reduce the overall economic, environmental and/or social impacts of the weed species through targeted management. Management actions required to achieve this include:



- Research and develop integrated weed management (IWM) strategies for the species, including herbicides and biological control where feasible
- Promote IWM strategies to landholders
- Monitor decrease in weed impacts with improved management
- Identify key sites/assets in the region and ensure adequate resourcing to manage the weed species
- No limits on sale of commercially or domestically grown plants

### **MANAGE SITES**

Aims to maintain the overall economic, environmental and/or social value of key sites/assets through improved general weed management.

Management actions required to achieve this include:

- Promote general IWM principles to landholders, including the range of control techniques, maintaining competitive vegetation/crops/pastures, hygiene and property management plans.
- Identify key sites/assets in the region and ensure adequate resourcing to manage these to maintain their values
- Broaden focus beyond weeds to all threatening processes
- No limits on sale of commercially or domestically grown plants

### **MONITOR**

Aims to detect any significant changes in the species' weed risk.

Management actions required to achieve this include:

- Monitor the spread of the species and review any perceived changes in weediness

### **NO ACTION**

The weed species is perceived to be of insufficient risk to warrant any investment in strategic regional management actions.

### **ALERT LIST**

There were a number of weeds which were not assessed but were recognised as a serious potential threat to landuses within the region. These weeds have been listed in the various tables in this report under the heading "Alert List". These lists are specific to the South East and this project, they are not the National Alert List mentioned previously and may differ from the national list.

<sup>1</sup> Virtue, J. G., Cunningham, D.C., Hanson, C.S.T., Hosking, J.R., Miller, I.L., Panetta, F.D., Pheloung, P.C., Randall, R.P., Timmins, S.M., Walton, C.S., Weiss, J.E.R. and Williams, P.A. (2004). 'A National Protocol for Post-Border Weed Risk Management', September 2004 draft (Cooperative Centre for Australian Weed Management, Adelaide).

<sup>2</sup> Standards Australia/Standards New Zealand (2004). AS/NZS 4360:2004 Risk management. (Standards Australia International Ltd and Standards New Zealand).

<sup>3</sup> Virtue, J.G. (2004). SA Weed Risk Management System and Guide - July 2004. (Animal and Plant Control Commission, Adelaide, South Australia). [www.dlwbc.sa.gov.au](http://www.dlwbc.sa.gov.au)

Table 1: REGIONAL MANAGEMENT GUIDELINES BASED ON WEED RISK AND FEASIBILITY OF CONTAINMENT

WEED RISK	FEASIBILITY OF CONTAINMENT				
	<i>Negligible</i> >113	<i>Low</i> >56	<i>Medium</i> >31	<i>High</i> >14	<i>Very High</i> <14
<i>Negligible</i> <13	NO ACTION	NO ACTION	NO ACTION	NO ACTION	MONITOR
<i>Low</i> <39	NO ACTION	NO ACTION	NO ACTION	MONITOR	PROTECT SITES
<i>Medium</i> <101	MANAGE SITES	MANAGE SITES	MANAGE SITES	PROTECT SITES	CONTAIN SPREAD
<i>High</i> <192	MANAGE WEED	MANAGE WEED	PROTECT SITES	CONTAIN SPREAD	DESTROY INFESTATIONS
<i>Very High</i> >192	MANAGE WEED	PROTECT SITES & MANAGE WEED	CONTAIN SPREAD	DESTROY INFESTATIONS	ERADICATE FROM REGION

## Landuses

The South East has various industries affected by weed species and these were divided up into 8 key landuse categories (refer to Figure 1). The spatial information was provided by the South-East Resource Information Centre (SERIC) from the current ALUM classifications datum of the region (Appendix 3). These landuses are;

- Grazing (pasture only)
- Cropping
- Irrigated crops and pastures (small seeds, lucerne, carrot seeds, vegetables)
- Perennial Horticulture (vines, apples, olives)
- Forestry (pines, bluegums)
- Aquatic (natural wetlands, drains, plants only growing in water)
- Native Vegetation (National parks, coastal vegetation, bushcare, heritage lots, crown lands, riparian & ephemeral water courses)
- Urban (within city / town limits)

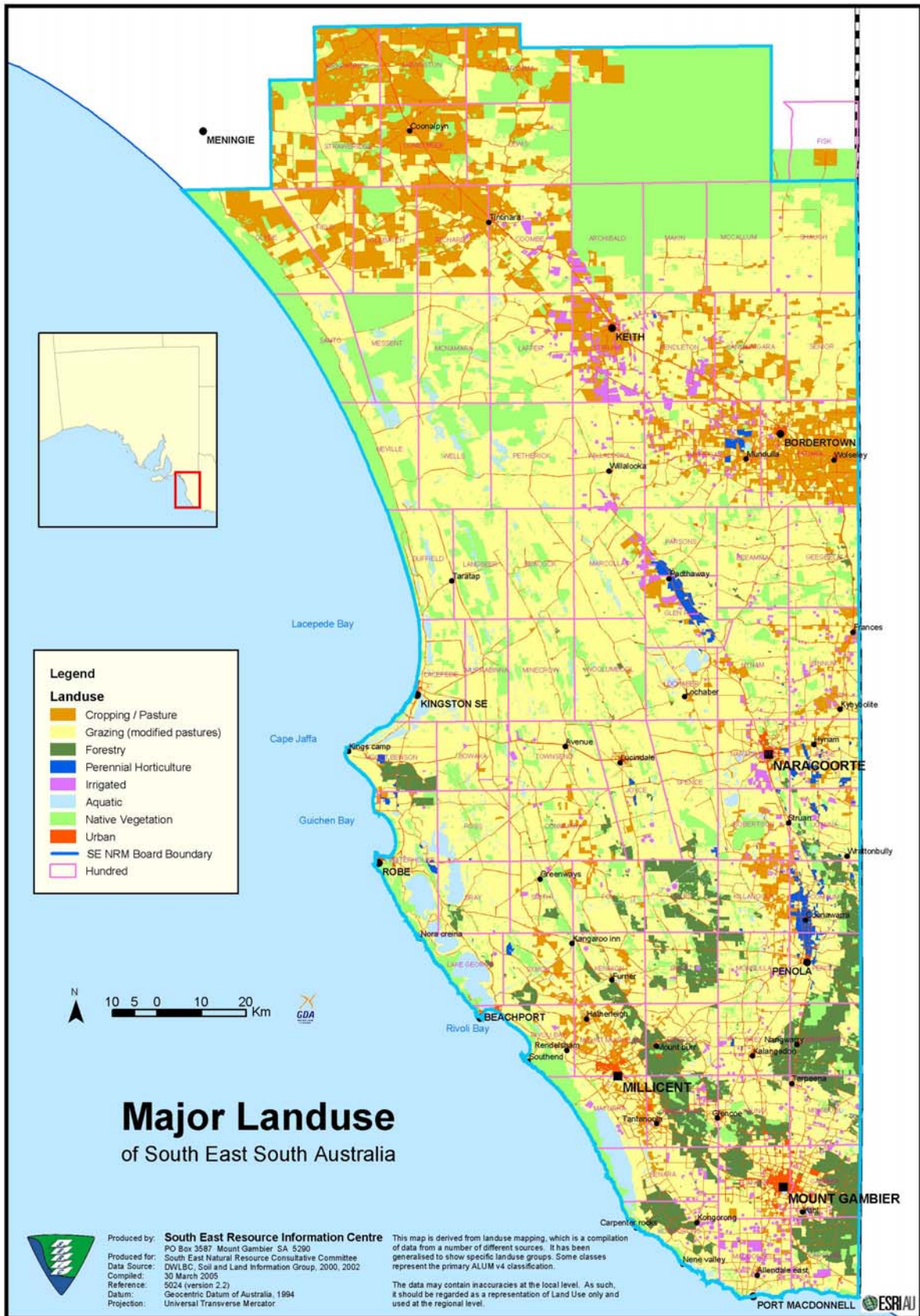
**Table 2: LANDUSE CATEGORIES IN THE SOUTH EAST REGION**

Landuse	Total Area (ha)	Percentage	Gross annual farm value
Cropping	305,868	11%	\$172,000,000
Grazing (modified pasture)	1,613,598	57%	\$386,000,000
Forestry	144,109	5%	\$1,000,000,000
Perennial Horticulture	20,939	1%	\$193,000,000
Irrigated	49,673	2%	\$124,000,000
Aquatic	66,287	2%	NA
Native Vegetation	554,763	20%	NA
Urban	51,106	2%	NA
<b>Total</b>	<b>2,806,342</b>		

Note: The biological and ecological information used in the weed risk assessment was obtained from the focus groups, with technical support from the Animal and Plant Control Commission. Records of weed distribution were obtained from local Animal and Plant Control Boards and from the input from the discussion group.

Financial information is provided here as an indication of the scale of asset that is being protected by controlling weeds. Information kindly provided by PIRSA Scorecard and ForestrySA.

Figure 1: SOUTH EAST LANDUSE MAP



## RESULTS

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1. Aquatic
2. Cropping
3. Forestry
4. Grazing
5. Irrigated crops and pastures
6. Native vegetation
7. Perennial horticulture
8. Urban

The detailed set of results completed in the SA Weed Risk Management system are available on request. A summarised version is presented in the following pages.



## 1. Aquatic

### Description of land use

The aquatic landuse of the South East comprises of natural wetlands, drains, and any areas with permanent surface water. The aquatic areas of the South East are unique due to high rainfall and an extensive drainage scheme. This landuse comprises 2% of the region. The weeds included in the assessment are only those that grow in standing water. Although there is a high proportion of aquatic land, many of the areas are high in salinity, which lowers the risk of aquatic weeds becoming established. There are also limited perennial freshwater watercourses which many of the aquatic weeds need to survive. There are only two known aquatic weeds within the region, alisma and willow spp.

### Assumptions

- No routine weed management.
- Considered both environmental and water quality issues.
- Species which only occur in areas subject to flooding also included (e.g. willows).
- Livestock may have access to waterways.

**Table 3: AQUATIC WEED LIST**

Common Name	Botanical Name	Reason for exclusion	Alert List
Alisma	<i>Alisma lanceolatum</i>		
Alligator weed	<i>Alternanthera philoxerodes</i>	NP	AL
Arrowhead	<i>Sagittaria montevidensis</i>	NP	AL
Cabomba	<i>Cabomba caroliniana</i>	NP	AL
Desert Ash	<i>Fraxinus angustifolia</i>	NP	AL
Elodea	<i>Elodea canadensis</i>	NP	AL
Horsetail	<i>Equisetum spp</i>	NP	AL
Hydrocotyle	<i>Hydrocotyle ranunculoides</i>	NP	
Largarosiphon	<i>Lagarosiphon major</i>	NP	
Leafy elodea	<i>Egeria densa</i>	NP	AL
Poison buttercup	<i>Ranunculus sceleratus</i>	NP	AL
Primrose willow	<i>Ludwigia peruviana</i>	NP	AL
Sagittaria	<i>Sagittaria graminea</i>	NP	AL
Salvinia	<i>Salvinia molesta</i>	NP	AL
Senegal tea plant	<i>Gymnocoronis spilanthoides</i>	NP	AL
Water caltrop	<i>Trapa natans</i>	NP	
Water-dropwort	<i>Oenanthe pimpinelloides</i>	NP	AL
Water hyacinth	<i>Eichhornia crassipes</i>	NP	AL
Water soldier	<i>Stratiotes aloides</i>	NP	
Willow spp.	<i>Salix spp.</i>		

*Widespread (WS), Low Impact (LI), Not suited to SE (NS), Not Present (NP), Routinely being successfully controlled (RC), Alert List (AL)*



Figure 2: AQUATIC LANDUSE MAP





**Table 4: AQUATIC WEED RISK ASSESSMENT RESULTS**

Weed	Weed Risk					Feasibility				
	Invasiveness	Impacts	Potential Distribution	Total	Ranking	Control Costs	Current Distribution	Persistence	Total	Ranking
Alisma	6.7	3.2	2.0	<b>42.0</b>	<b>M</b>	6.0	0.1	5.5	<b>3.0</b>	<b>VH</b>
Willow spp.	6.0	5.3	1.0	<b>32.0</b>	<b>L</b>	6.0	0.1	5.5	<b>3.0</b>	<b>VH</b>

**Summary**

According to the Weed Risk Assessment process, willow species have been classified into the “protect sites” category, which is defined as the prevention of spread to key sites of environmental importance. In this case willows have a limited current distribution, so therefore it is feasible to protect sites from them, even though they have a low weed risk. The willow species assessed for this project were the seed producing species in the Weeds of National Significance list.

Alisma has been allocated to “contain spread” to prevent ongoing spread of the weed species in the region. One infestation exists in the Lower South East and is constantly monitored and treated as required.

Table 5: AQUATIC MANAGEMENT GUIDELINES BASED ON WEED RISK AND FEASIBILITY OF CONTAINMENT

WEED RISK	FEASIBILITY OF CONTAINMENT				
	<i>Negligible</i> >113	<i>Low</i> >56	<i>Medium</i> >31	<i>High</i> >14	<i>Very High</i> <14
<i>Negligible</i> <13					
<i>Low</i> <39					WILLOWS SPP
<i>Medium</i> <101					ALISMA
<i>High</i> <192					
<i>Very High</i> >192					

## 2. Cropping

### Description of Landuse

Cropping in the South East is predominately practiced in the Upper South East, with some cropping also carried out in the Mid South East. Cropping occupies 11% of the region or 30,5867ha. Within this area of the region, the main crops grown are wheat, barley, canola and oats. The Lower South East is the centre for the production of beans, peas and lupins due the vast difference in rainfall and mean temperatures. These differences also alter the presence of weed species between the Upper and Lower South East, and between the different crops planted. In general, field crops produce \$172,200,000 in income to the region. The distribution of cropping areas in the South East can be seen in Figure 4.

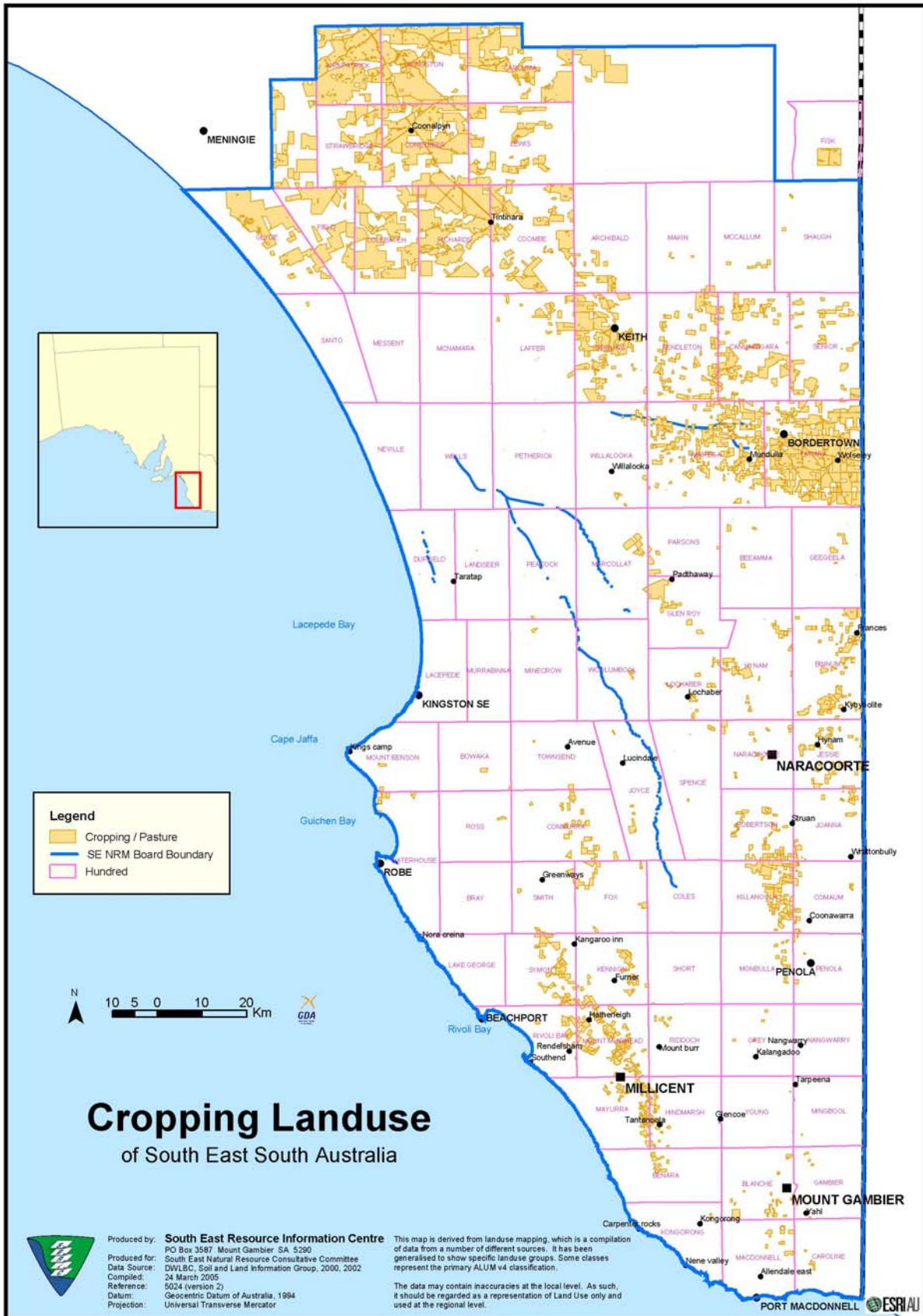
**Table 6: ESTIMATED VALUE OF FIELD CROPS IN THE SOUTH EAST**

Field Crops	(\$ millions)
Wheat	54.1
Barley	45.0
Oats	3.5
Canola	31.9
Lentils	0.8
Ryecorn	0.0
Chick Peas	0.1
Beans	18.5
Lupins	10.7
Peas	3.3
Other Feed Crops	4.4
<b>Field Crops Total</b>	<b>\$172.2</b>

### Assumptions

- The majority of the weeds of concern within a cropping situation are those that cannot be controlled through everyday weed management practices.
- Rotation is a cereal, pulse, cereal.
- Assumed management for cereals:
  - Pre-sowing cultivation or knockdown herbicides.
  - Pre-emergent sprayed at sowing for grasses and broadleaf weeds.
  - One post-emergent broadleaf spray.
- Assumed management for pulse crop: Same as above, but the post-emergent spray is for grasses rather than for broadleaf weeds.
- No herbicides used in pasture phase.
- Ignore herbicide resistance.

Figure 3: CROPPING LANDUSE MAP



**Table 7: CROPPING WEED LIST**

Common Name	Botanical Name	Reason for exclusion	Alert List
Annual ryegrass	<i>Lolium rigidum</i>		
Bathurst burr	<i>Xanthium spinosum</i>		
Bedstraw	<i>Galium asparine</i>		
Bladder campion	<i>Silene vulgaris</i>		
Blue mustard	<i>Chorispora tenella</i>	NP	AL
Broomrape	<i>Orobanche spp.</i>	NP	AL
Buchan weed	<i>Hirschfeldia incana</i>		
Caltrop	<i>Tribulus terrestris</i>	LI	
Capeweed	<i>Arctotheca calendula</i>	WS	
Couch	<i>Cynodon dactylon</i>	WS	
Creeping knapweed	<i>Acroptilon repens</i>		
Cutleaf mignonette	<i>Reseda lutea</i>	LI	
Dock	<i>Rumex crispus</i>	WS	
Dodder (Chilean & red)	<i>Cuscuta spp</i>	NP	
Field bindweed	<i>Convolvulus arvensis</i>	LI	
Field garlic	<i>Allium vineale</i>	LI	
Fleabane	<i>Conyza spp.</i>	LI	
Hoary cress	<i>Cardaria draba</i>	LI	
Horehound	<i>Marrubium vulgare</i>	RC	
Innocent weed	<i>Cenchrus incertus/longispinus</i>	LI	
Lesser loosestrife	<i>Lythrum hyssopifolia</i>	RC	
Lincoln weed	<i>Diplotaxis tenuifolia</i>	LI	
Muskweed	<i>Myagrurn perfoliatum</i>	NP	AL
Nightstock	<i>Matthiola longipetala</i>		
Pheasant's eye	<i>Adonis microcarpa</i>	NP	
Salvation Jane	<i>Echium plantagineum</i>	RC	
Skeleton weed	<i>Chondrilla juncea</i>		
Sliverleaf nightshade	<i>Solanum elaeagnifolium</i>		
Soursob	<i>Oxalis pes-caprae</i>		
Tall Wheat Grass	<i>Thinopyrum ponticum</i>	WS	
Three horned bedstraw	<i>Galium tricornutum</i>		
Variiegated thistle	<i>Silybum marianum</i>		
Wild oats	<i>Avena fatua</i>		
Wild Radish	<i>Raphanus raphanistrum</i>		
Yellow burrweed	<i>Amsinckia spp.</i>	WS RC	

Widespread (WS), Low Impact (LI), Not suited to SE (NS), Not Present (NP), Routinely being successfully controlled (RC), Alert List (AL)

**Table 8: CROPPING WEED RISK ASSESSMENT RESULTS**

Weed	Weed Risk					Feasibility				
	Invasiveness	Impacts	Potential Distribution	Total	Ranking	Control Costs	Current Distribution	Persistence	Total	Ranking
Bathurst burr	5.3	1.6	2	17	L	2.7	0.9	6.4	16	H
Bladder campion	4.7	2.6	1	12	N	4	0.1	3.6	1	VH
Buchan weed	4.7	2.6	1	12	N	1.3	0.4	2.7	2	VH
Creeping knapweed	3.3	3.7	6	74	M	5.3	0.4	4.5	2	VH
Nightstock	4.7	1.1	1	5	N	2.7	0.1	2.7	1	VH
Ryegrass (annual)	6	2.1	10	126	H	2.7	0.1	5.5	97	L
Silver nightshade	8	2.1	6	101	H	6	6.7	7.3	18	H
Skeleton weed	7.3	6	6	69	M	5.3	0.4	7.3	65	L
Soursob	4	1.1	8	34	L	2.7	1.7	7.3	18	H
Three horned bedstraw	4.7	2.6	4	49	M	2.7	0.9	4.5	1	VH
Variiegated thistle	3.3	3.2	2	21	L	2.7	0.1	4.5	11	VH
Wild oats	6.7	3.2	8	168	H	2	6.7	3.6	48	M
Wild radish	5.3	3.2	6	101	H	2.7	8.3	5.5	121	N

### Summary

The highest priority weeds for this landuse are silverleaf nightshade, three horned bedstraw and creeping knapweed, which fall in the “contain spread” category. The aim of this management action is to prevent the ongoing spread of the weed species in the region. This includes the control of all infestations, aiming for a significant reduction in weed density and the prevention of entry, movement and sale within the region.

Table 9: CROPPING MANAGEMENT GUIDELINES BASED ON WEED RISK AND FEASIBILITY OF CONTAINMENT

WEED RISK	FEASIBILITY OF CONTAINMENT				
	<i>Negligible</i> >113	<i>Low</i> >56	<i>Medium</i> >31	<i>High</i> >14	<i>Very High</i> <14
<i>Negligible</i> <13					BLADDER CAMPION BUCHAN WEED NIGHTSTOCK
<i>Low</i> <39	WILD RADISH			BATHURST BURR SOURSOB	VARIEGATED THISTLE
<i>Medium</i> <101		SKELETON WEED			3 HORNED BEDSTRAW CREEPING KNAPWEED
<i>High</i> <192		RYEGRASS WILD OATS		SILVERLEAF NIGHTSHADE	
<i>Very High</i> >192					





### 3. Forestry

#### Description of Landuse

The forestry industry in the South East is an expanding industry comprising of softwood production (pines) and more recently hardwood production (bluegums). The majority of plantations are located in the Lower South East where there is higher rainfall. Forestry covers 5% or 144108.6(ha) of the region and generates significant income and employment for the region.

The weed species examined are those that do well in forest situations and impact on the management of the landuse.

#### Assumptions

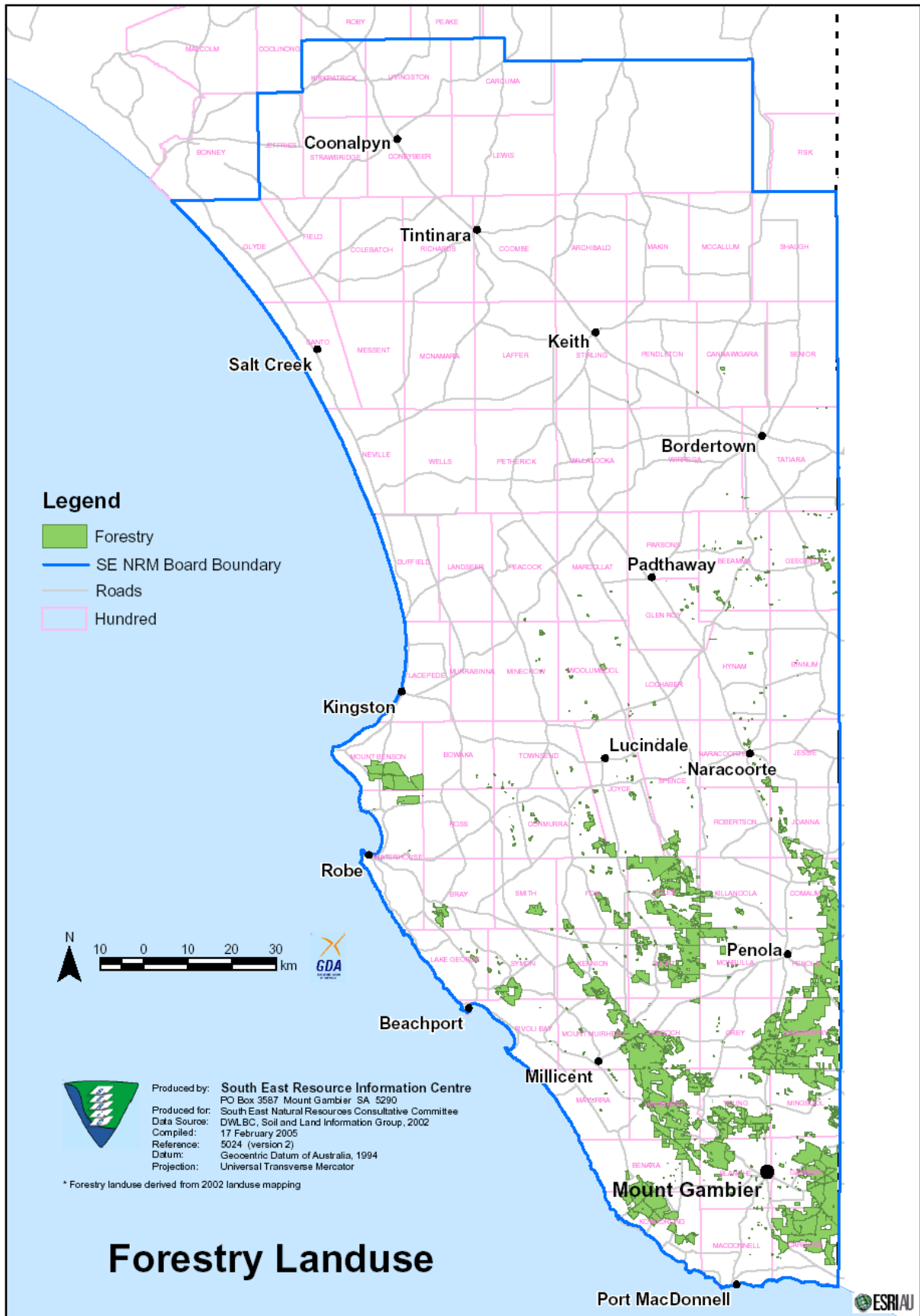
- The main weed control effort (herbicides) is at pre-planting when the weeds compete with young seedlings for space and nutrients.
- Plantations are sometimes grazed
- Weed control is generally only carried out within the first two years after establishment. Greater canopy cover of mature trees usually reduces weed infestations within plantations.

**Table 10: FORESTRY WEED LIST**

Common Name	Botanical Name	Reason for Exclusion	Alert List
African feathergrass	<i>Pennisetum macrourum</i>		
Bathurst burr	<i>Xanthium spinosum</i>	LI	
Blackberry	<i>Rubus fruticosus</i>		
Bluebell creeper	<i>Sollya heterophylla</i>		
Blue mustard	<i>Chorispora tenella</i>	NP	AL
Boneseed	<i>Chrysanthemoides monilifera</i>		
Bracken fern	<i>Pteridium esculentum</i>		
Bridal creeper	<i>Asparagus asparagoides</i>		
Cape broom	<i>Genista monspessulana</i>		
Couch	<i>Cynodon dactylon</i>		
South African Weed Orchid	<i>Disa bracteata</i>	LI	
Dock	<i>Rumex crispus</i>		
Fleabane	<i>Conyza spp.</i>		
Gorse/ Furze	<i>Ulex europaeus</i>		
Innocent weed	<i>Cenchrus incertus/longispinus</i>		
Kikuyu	<i>Pennisetum clandestinum</i>		
Pampas/ pink grass	<i>Cortaderia spp.</i>		
Phalaris	<i>Phalaris aquatica</i>		
Red gum euc.	<i>Eucalyptus camaldulensis</i>	LI/WS	
Sallow wattle	<i>Acacia longifolia</i>		

Widespread (WS), Low Impact (LI), Not suited to SE (NS), Not Present (NP), Routinely being successfully controlled (RC), Alert List (AL)

**Figure 4: FORESTRY LANDUSE MAP**



**Table 11: FORESTRY WEED RISK ASSESSMENT RESULTS**

Weed	Weed Risk					Feasibility				
	Invasiveness	Impacts	Potential Dist.	Total	Ranking	Control Costs	Current Dist.	Persistence	Total	Ranking
<b>African Feathergrass</b>	3.3	2.1	1.0	<b>7</b>	<b>N</b>	3.3	0.1	5.5	<b>2</b>	<b>VH</b>
<b>Blackberry</b>	7.3	2.6	6.0	<b>116</b>	<b>H</b>	4.7	0.4	6.4	<b>12</b>	<b>VH</b>
<b>Bluebell creeper</b>	6.0	2.1	6.0	<b>76</b>	<b>M</b>	3.3	0.4	8.2	<b>11</b>	<b>VH</b>
<b>Boneseed</b>	4.7	1.1	6.0	<b>29</b>	<b>L</b>	2.7	0.4	4.5	<b>5</b>	<b>VH</b>
<b>Bracken fern</b>	6.7	3.2	6.0	<b>126</b>	<b>H</b>	2.7	5	6.4	<b>85</b>	<b>L</b>
<b>Bridal Creeper</b>	5.3	1.1	6.0	<b>34</b>	<b>L</b>	3.3	2.1	6.4	<b>44</b>	<b>M</b>
<b>Cape broom</b>	4.7	2.6	2.0	<b>25</b>	<b>L</b>	3.3	0.1	4.5	<b>1</b>	<b>VH</b>
<b>Couch</b>	6.7	2.6	6.0	<b>105</b>	<b>H</b>	4.0	2.1	6.4	<b>53</b>	<b>M</b>
<b>Dock</b>	4.0	0.5	6.0	<b>13</b>	<b>N</b>	2.7	2.1	5.5	<b>30</b>	<b>H</b>
<b>Fleabane</b>	3.3	1.6	6.0	<b>32</b>	<b>L</b>	3.3	6.7	5.5	<b>121</b>	<b>N</b>
<b>Gorse</b>	5.3	2.6	4.0	<b>56</b>	<b>M</b>	4.0	0.1	6.4	<b>2</b>	<b>VH</b>
<b>Kikuyu</b>	6.0	2.6	6.0	<b>95</b>	<b>M</b>	3.3	1.8	7.3	<b>42</b>	<b>M</b>
<b>Pampas grass</b>	4.0	2.6	6.0	<b>63</b>	<b>M</b>	3.3	0.1	5.5	<b>2</b>	<b>VH</b>
<b>Phalaris</b>	5.3	4.2	6.0	<b>135</b>	<b>H</b>	3.3	6.7	7.3	<b>162</b>	<b>N</b>
<b>Sallow wattle</b>	6.0	2.6	6.0	<b>95</b>	<b>M</b>	4.7	0.1	6.4	<b>2</b>	<b>VH</b>
<b>Wireweed</b>	4.0	2.1	6.0	<b>51</b>	<b>M</b>	3.3	5.0	4.5	<b>76</b>	<b>L</b>

**Summary**

According to the forestry management matrix, blackberry has a high weed risk and is very high in feasibility of containment. Thus it is recommended that all infestations be destroyed within the forestry landuse. Other weeds which are very high in the feasibility of containment category are bluebell creeper, gorse, pampas grass and sallow wattle. This would aim at preventing the ongoing spread of the weed species in the region.

Weeds classed in the “no action” category are dock, bridal creeper, and fleabane. These weeds have a low weed risk and/ or low feasibility of containment thus any action would be would not be of significant benefit to the landuse on a whole. In some cases control may be warranted, such as in the establishment of tree seedlings. This is the same for phalaris and bracken fern, which have high weed risk but feasibility of containment would be minimal.

Bracken fern is a native plant in the South East, but has a significant impact on the establishment of tree seedlings. Therefore it has been considered as a weed within this landuse. As a native plant, bracken fern is protected by the Native Vegetation Act and advice should be sought from the Native Vegetation Council before any clearance or control is undertaken.

Table 12: FORESTRY MANAGEMENT GUIDELINES BASED ON WEED RISK AND FEASIBILITY OF CONTAINMENT

WEED RISK	FEASIBILITY OF CONTAINMENT				
	<i>Negligible</i> >113	<i>Low</i> >56	<i>Medium</i> >31	<i>High</i> >14	<i>Very High</i> <14
<i>Negligible</i> <13				DOCK	AFRICAN FEATHERGRASS
<i>Low</i> <39	FLEABANE		BRIDAL CREEPER		BONESEED CAPE BROOM
<i>Medium</i> <101	WIWEED		KIKUYU (P)		BLUEBELL CREEPER GORSE PAMPAS GRASS SALLOW WATTLE
<i>High</i> <192	PHALARIS	BRACKEN FERN (N)	COUCH (P)		BLACKBERRY
<i>Very High</i> >192					

(N) A native plant of South Australia.

(P) A commonly grown plant of urban and grazing landuses

## 4. Grazing

### Description of Landuse

Grazing is the dominant landuse in the South East and comprises of 1613,598ha or 57% of the region. The main stock grazed, are sheep and cattle, with other animals including goats, deer and pigs. The income generated by this landuse is \$386 million/pa. The majority of the grazing landuse is improved pastures of clovers, lucerne, and grasses. The grazing landuse covers all types of soils, rainfall and temperature, this impacts greatly on the number of weed species able to establish within the grazing landuse.

### Assumptions

- The assumptions of this landuse is that there is very little weed control conducted by landowners
- The main method of control is spray grazing using a broadleaf herbicide spray such as 2,4.D amine/MCPA formulation to increase the sugar levels in the plant to make them more palatable to stock. This reduces the volume of seed produced by the weed by reducing its ability to flower. This technique is commonly used for salvation Jane and thistles.

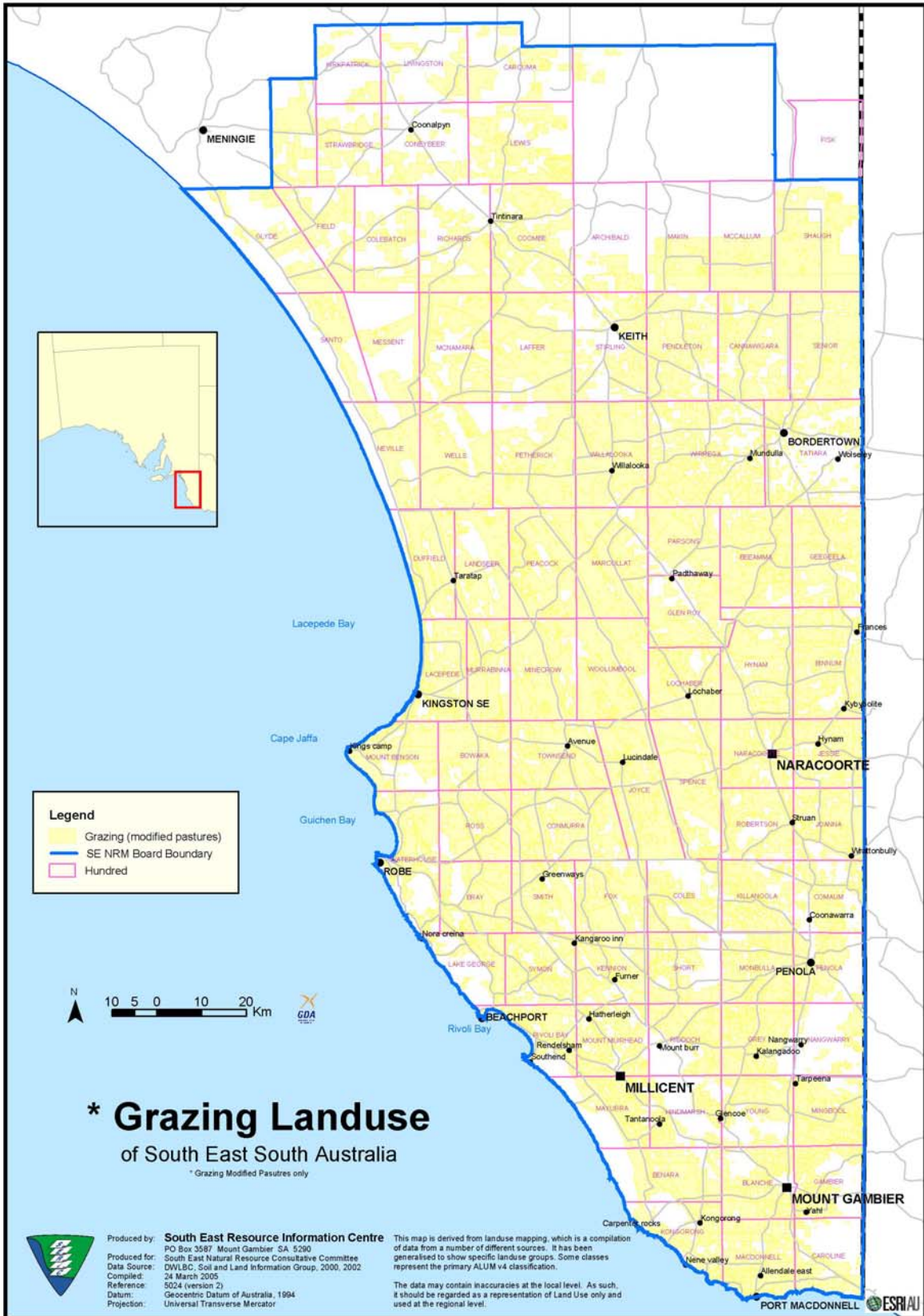
**Table 13: GRAZING WEED LIST**

Common Name	Botanical Name	Reason for exclusion	Alert List
African boxthorn	<i>Lycium ferocissimum</i>		
African feathergrass	<i>Pennisetum macrourum</i>		
African lovegrass	<i>Eragrostis curvula</i>		
Annual ryegrass	<i>Lolium rigidum</i>	WS	
Apple of sodom	<i>Solanum linnaeanum</i>		
Bathurst burr	<i>Xanthium spinosum</i>		
Blackberry	<i>Rubus fruticosus sp. agg.</i>		
Bladder campion	<i>Silene vulgaris</i>		
Bracken fern	<i>Pteridium esculentum</i>		
Broad-kernel espartillo	<i>Achnatherum caudatum</i>	NP	AL
Calomba daisy	<i>Oncosiphon suffruticosum</i>	NP	AL
Caltrop	<i>Tribulus terrestris</i>		
Cane needlegrass	<i>Nassella hyaline</i>	NP	AL
Capeweed	<i>Arctotheca calendula</i>	WL	
Chilean needlegrass	<i>Nassella neesiana</i>	NP	AL
Coolatai grass	<i>Hyparrhenia hirta</i>	NP	AL
Creeping knapweed	<i>Acroptilon repens</i>		
Cutleaf mignone	<i>Reseda lutea</i>		
Dock	<i>Rumex crispus</i>	LI	
Dodder (red & Chilean)	<i>Cuscuta spp</i>		
False caper	<i>Euphorbia terracina</i>		
Gorse/ Furze	<i>Ulex europaeus</i>		

<b>Common Name</b>	<b>Botanical Name</b>	<b>Reason for</b>	<b>Alert List</b>
Horehound	<i>Marrubium vulgare</i>		
Horsetail	<i>Equisetum spp</i>	NP	AL
Innocent weed	<i>Cenchrus incertus/longispinus</i>		
Lincoln weed	<i>Diplotaxis tenuifolia</i>	LI	
Mexican feathergrass	<i>Nassella tenuissima</i>	NP	AL
Noogoora burr complex	<i>Xanthium strumarium sp. agg.</i>	NP	
One-leaf cape tulip	<i>Moraea flaccida</i>		
Onion grass	<i>Romulea rosea var. australis</i>		
Onion weed	<i>Asphodelus fistulosus</i>	LI	
Paramatta grass	<i>Sporobolus africanus</i>		
Perennial thistle	<i>Cirsium arvense</i>	NP	
Plumerillo	<i>Jarava plumose</i>	NP	AL
Prickly acacia	<i>Acacia nilotica subsp Indica</i>	NS	
Ragwort	<i>Senecio jacobaea</i>	NP	AL
Salvation Jane	<i>Echium plantagineum</i>		
Serrated tussock	<i>Nassella trichotoma</i>	NP	AL
Silver grass	<i>Vulpia bromoides</i>		
Slender thistle	<i>Carduus tenuiflorus</i>		
Sliverleaf nightshade	<i>Solanum elaeagnifolium</i>		
Soldier thistle	<i>Picnomon acarna</i>		
Sorrell	<i>Rumex acetosella</i>	LI	
Soursob	<i>Oxalis pes-caprae</i>	WS LI	
Spear thistle	<i>Cirsium vulgare</i>		
Texas needlegrass	<i>Nassella leucotricha</i>	NP	AL
Three corner jack	<i>Emex spp.</i>		
Two-leaf Cape tulip	<i>Moraea miniata</i>		
Variegated thistle	<i>Silybum marianum</i>		
Water dropwort	<i>Oenanthe pimpinelloides</i>	NP	AL
Yellow burrweed	<i>Amsinckia spp.</i>		

Widespread (WS), Low Impact (LI), Not suited to SE (NS), Not Present (NP), Routinely being successfully controlled (RC), Alert List (AL)

Figure 5: GRAZING LANDUSE MAP



**Table 14: RESULTS OF GRAZING WEED RISK ASSESSMENT**

Weed	Weed Risk					Feasibility				
	Invasiveness	Impacts	Potential Distribution	Total	Ranking	Control Costs	Current Distribution	Persistence	Total	Ranking
African Boxthorn	6.7	3.2	2	42	<b>M</b>	5.3	1.3	4.5	30	<b>H</b>
African feathergrass	6	2.1	2	25	<b>L</b>	3.3	0.1	3.6	1	<b>VH</b>
African lovegrass	6	1.1	4	25	<b>N</b>	3.3	0.1	2.7	1	<b>VH</b>
Apple of sodom	6.7	4.2	4	112	<b>H</b>	4.7	1.7	5.5	42	<b>M</b>
Bathurst burr	6	3.7	2	44	<b>M</b>	2.7	0.1	6.4	1	<b>VH</b>
Blackberry	7.3	5.3	2	77	<b>M</b>	4.7	0.4	5.5	11	<b>VH</b>
Bladder campion	7.3	2.1	1	15	<b>L</b>	4	0.1	3.6	1	<b>VH</b>
Bracken fern	6.7	4.2	6	168	<b>H</b>	3.3	3.3	6.4	71	<b>L</b>
Caltrop	6	2.6	4	63	<b>M</b>	4	0.4	6.4	11	<b>VH</b>
Cutleaf mignonette	5.3	1.6	2	17	<b>L</b>	5.3	0.1	3.6	1	<b>VH</b>
Dodder (red & chilean)	8.7	2.1	1	18	<b>L</b>	8.7	0.1	7.3	3	<b>VH</b>
False caper	6	2.6	4	63	<b>M</b>	6	1.3	6.4	32	<b>M</b>
Gorse/ Furze	6	4.7	2	57	<b>M</b>	6	0.1	4.5	2	<b>VH</b>
Horehound	6.7	4.7	2	189	<b>H</b>	6.7	2.5	5.5	36	<b>M</b>
Innocent weed	5.3	3.2	4	67	<b>M</b>	5.3	0.1	36	1	<b>VH</b>
One-leaf Cape tulip	6.7	4.2	2	56	<b>M</b>	4	0.1	6.4	2	<b>VH</b>
Onion grass	6	1.6	6	57	<b>M</b>	4.7	3.3	7.3	113	<b>N</b>
Paramatta grass	7.3	2.1	4	62	<b>M</b>	6.7	2.5	5.5	55	<b>M</b>
Salvation Jane	5.3	4.7	8	202	<b>VH</b>	5.3	2.5	5.5	45	<b>M</b>
Silver grass	6.7	1.6	8	84	<b>M</b>	6.7	2.5	4.5	53	<b>M</b>
Silverleaf nightshade	5.3	2.1	4	45	<b>M</b>	5.3	0.1	6.4	2	<b>VH</b>
Slender thistle	4.7	3.2	6	88	<b>M</b>	4.7	2.5	4.5	38	<b>L</b>
Soldier thistle	5.3	3.7	6	118	<b>H</b>	5.3	2.5	4.5	38	<b>L</b>
Spear thistle	4	3.2	8	101	<b>M</b>	3.3	2.5	4.5	38	<b>L</b>
Three corner jack	6.7	3.7	4	98	<b>M</b>	6.7	0.1	5.5	1	<b>VH</b>
Two-leaf Cape tulip	5.3	4.2	2	45	<b>M</b>	4	0.1	7.3	2	<b>VH</b>
Variegated thistle	3.3	3.7	4	49	<b>M</b>	3.3	0.1	4.5	1	<b>VH</b>
Yellow burrweed	5.3	4.7	6	152	<b>H</b>	5.3	1.3	5.5	23	<b>H</b>



Table 15: GRAZING MANAGEMENT GUIDELINES BASED ON WEED RISK AND FEASIBILITY OF CONTAINMENT

WEED RISK	FEASIBILITY OF CONTAINMENT				
	<i>Negligible</i> >113	<i>Low</i> >56	<i>Medium</i> >31	<i>High</i> >14	<i>Very High</i> <14
<i>Negligible</i> <13					
<i>Low</i> <39					CUTLEAF MIGNONETTE FEATHERGRASS BLADDER CAMPION LOVEGRASS DODDER
<i>Medium</i> <101	ONION GRASS	SPEAR THISTLE SLENDER THISTLE	FALSE CAPER PARAMATTA GRASS SILVER GRASS	AFRICAN BOXTHORN	BATHURST BURR INNOCENT WEED CAPE TULIP CALTROP BLACKBERRY GORSE SALVATION JANE SILVERLEAF NIGHTSHADE 3 CORNER JACK VARIEGATED THISTLE
<i>High</i> <192		BRACKEN FERN (N) SOLDIER THISTLE	HOREHOUND APPLE OF SODOM	YELLOW BURRWEED	
<i>Very High</i> >192					

(N) A native plant of South Australia

## **Summary**

Many weeds were assessed for this landuse due to the wide range of weed threats to grazing in the South East. It was found that a large number of weeds were feasible to control on a regional scale. Some of these weeds included yellow burr weed, Bathurst burr, innocent weed, cape tulip, caltrop, blackberry and gorse. The aim of control for these weeds is to contain spread and reduce existing infestations.

Bracken fern is a native plant in the South East, but has a significant impact on the establishment of desired pasture plants and is toxic to livestock. It has therefore has been considered as a weed within this landuse. As a native plant, bracken fern is protected by the Native Vegetation Act and advice should be sought from the Native Vegetation Council before any clearance or control is undertaken.

## **5. Irrigated Crops and Pastures**

### **Description of Landuse**

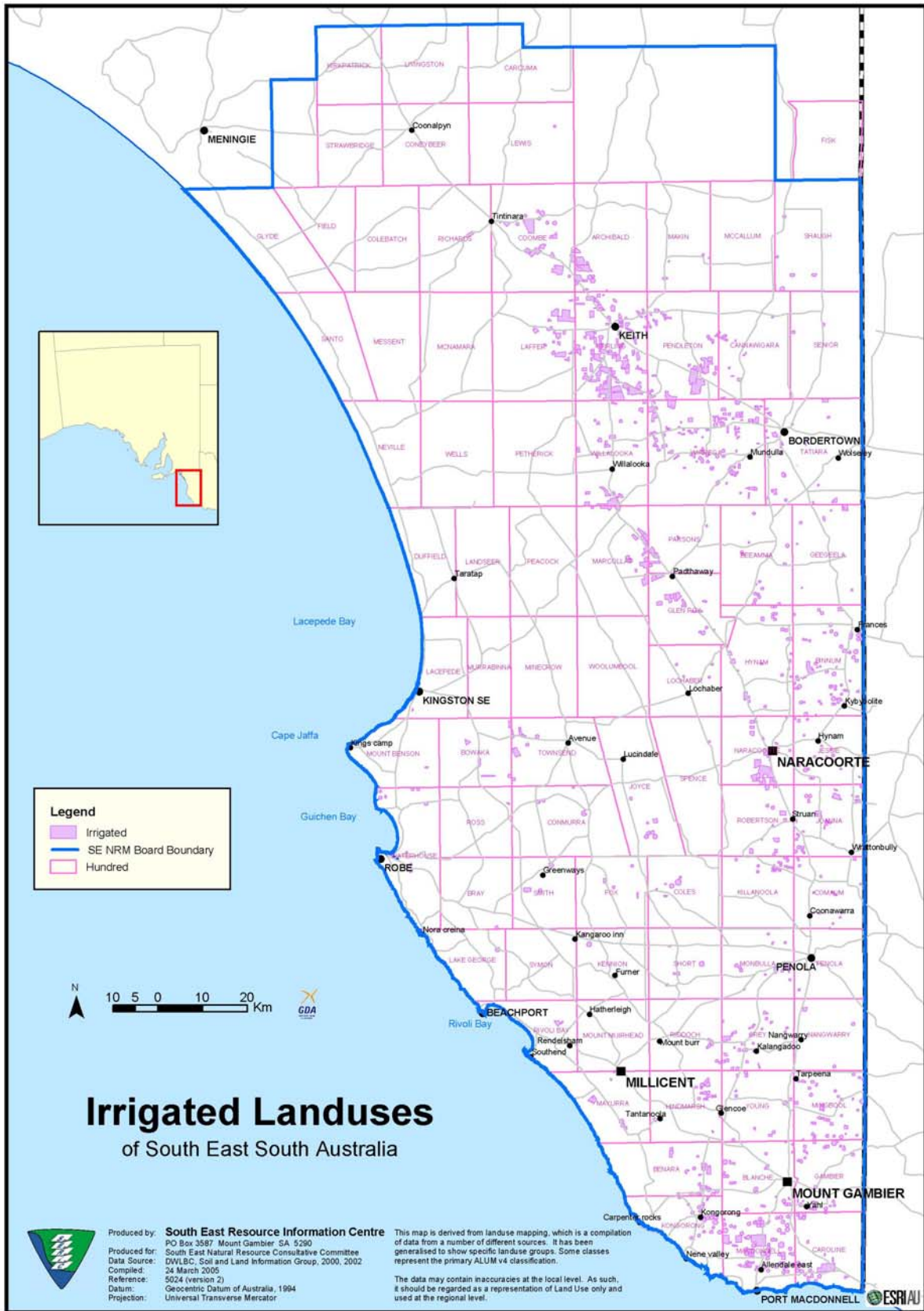
This landuse is varied in the goods it produces and the land it covers. Irrigated crops and pastures cover 49,672ha, which is approximately 2% of the region. Irrigation can be via centre pivot or flood irrigation. In the Upper South East the main irrigated crop is lucerne for hay, pasture and small seed production. In the Lower South East the main crops are potatoes, other vegetables and irrigated pastures for dairy and fat lamb production. These pastures include perennial ryegrass/legume mixes. The estimated gross income from irrigated crops and pastures is \$124 million. Much of the produce is exported out of the region for sale.

Due to the variety of production from this landuse there are different weed issues within different crops and different control methods required for each situation. The common weeds within this landuse are summer growing weeds which utilise the irrigation to germinate and prosper over the summer months, such as Bathurst burr and Innocent weed.

### **Assumptions**

- The main weed control is during pasture establishment, with knockdown sprays and cultivation used before seeding.
- Pre-emergence herbicides are used, and some follow up sprays with selective herbicides such as 2,4-DB, bromoxynil (depending on the crop) .
- Mowing/grazing and selective and/or knockdown herbicides (e.g., paraquat) are used when needed.
- For flood irrigation some drain bank weed control is needed at the start of the season e.g., glyphosate.

**Figure 6: IRRIGATED CROPS AND PASTURE LANDUSE**



MAP

**Table 16: IRRIGATED CROPS & PASTURES WEED LIST**

<b>Common Name</b>	<b>Botanical Name</b>	<b>Reason for Exclusion</b>	<b>Alert List</b>
Alkali sida	<i>Malvella leprosa</i>	NP	AL
Bathurst burr	<i>Xanthium spinosum</i>		
Blackberry	<i>Rubus fruticosus</i>	LI	
Blackberry nightshade	<i>Solanum nigrum</i>	WS	
Bladder campion	<i>Silene vulgaris</i>	LI	
Broomrapes	<i>Orobanche spp</i>	NP	AL
Wild radish	<i>Raphanus raphanistrum</i>		
Buchan weed	<i>Hirschfeldia incana</i>		
Caltrop	<i>Tribulus terrestris</i>		
Capeweed	<i>Arctotheca calendula</i>	WS	
Couch	<i>Cynodon dactylon</i>		
Creeping knapweed	<i>Acroptilon repens</i>		
Dock	<i>Rumex crispus</i>		
Dodder red & chilean	<i>Cuscuta spp</i>	NP	AL
False caper	<i>Euphorbia terracina</i>	LI	
Fat hen	<i>Chenopodium album</i>	WS	
Field bindweed	<i>Convolvulus arvensis</i>	LI	
Fleabane	<i>Conyza spp.</i>	WS	
Golden dodder	<i>Cuscuta campestris</i>		
Innocent weed	<i>Cenchrus incertus/longispinus</i>		
Khaki weed	<i>Alternanthera pungens</i>		
Lincoln weed	<i>Diploaxis tenuifolia</i>	WS	
Noogoora burr complex	<i>Xanthium strumarium sp. Agg.</i>		
Ox tongue	<i>Picris echioides</i>	WS	
Paramatta grass	<i>Sporobolus africanus</i>		
Poa grass	<i>Poa annua</i>		
Salvation Jane	<i>Echium plantagineum</i>	LI	
Slender thistle	<i>Carduus tenuiflorus</i>		
Sliverleaf nightshade	<i>Solanum elaeagnifolium</i>		
Sorrell	<i>Rumex acetosella</i>	WS	
Spear thistle	<i>Cirsium vulgare</i>		
Three corner jack	<i>Emex spp.</i>		
Variegated thistle	<i>Silybum marianum</i>		
Willow herb	<i>Epilobium billardieranum</i>	NS	
Wireweed	<i>Polygonum aviculare</i>	WS	
Yellow burrweed	<i>Amsinckia spp.</i>	LI	

Widespread (WS), Low Impact (LI), Not suited to SE (NS), Not Present (NP), Routinely being successfully controlled (RC), Alert List (AL)

**Table 17: IRRIGATED CROPS & PASTURES RESULTS**

Weed	Weed Risk					Feasibility				
	Invasiveness	Impacts	Potential Distribution	Total	Ranking	Control Costs	Current Distribution	Persistence	Total	Ranking
Bathurst burr	6	2.6	4	63	<b>M</b>	4	0.1	6.4	2	<b>VH</b>
Buchan weed	6.7	4.2	2	56	<b>M</b>	2.7	0.4	3.6	4	<b>VH</b>
Caltrop	5.3	1.6	6	51	<b>M</b>	4	0.9	6.4	23	<b>H</b>
Couch	6.7	2.6	10	175	<b>H</b>	6.7	3.3	6.4	141	<b>N</b>
Creeping knapweed	3.3	3.7	6	74	<b>M</b>	5.3	0.1	4.5	2	<b>VH</b>
Dock	4.7	2.1	8	79	<b>M</b>	5.3	5	5.5	145	<b>N</b>
Golden dodder	8.7	3.7	8	255	<b>VH</b>	4	0.1	5.5	2	<b>VH</b>
Innocent weed	5.3	2.6	4	56	<b>M</b>	3.3	0.1	5.5	2	<b>VH</b>
Khaki weed	5.3	2.6	4	56	<b>M</b>	3.3	0.1	5.5	2	<b>VH</b>
Noogoora burr complex	5.3	2.6	2	28	<b>L</b>	2.7	0.1	6.4	1	<b>VH</b>
Paramatta grass	6.7	2.6	4	70	<b>M</b>	4	2.5	5.5	55	<b>M</b>
Poa grass	6.7	1.6	8	84	<b>M</b>	4.7	6.7	7.3	226	<b>N</b>
Silverleaf nightshade	8	1.6	6	76	<b>M</b>	6	0.4	7.3	18	<b>H</b>
Slender thistle	4.7	3.2	8	118	<b>H</b>	3.3	2.5	4.5	38	<b>L</b>
Soldier Thistle	5.3	3.7	8	157	<b>H</b>	3.3	2.5	4.5	38	<b>L</b>
Three corner jack	6.7	3.7	4	98	<b>M</b>	3.3	0.1	4.5	2	<b>VH</b>
Variegated thistle	3.3	3.7	4	49	<b>M</b>	3.3	0.1	4.5	1	<b>VH</b>
Wild radish	5.3	3.2	6	101	<b>M</b>	2.7	8.3	5.5	121	<b>N</b>

### Summary

Golden dodder has been identified as the highest priority for control in irrigated crops and pastures. It has come under the eradication classification which also reflects current policies for this weed. This plant is a parasitic plant that utilizes a host plant to survive. The recorded infestations within the South East have been on irrigated lucerne crops. This weed is proclaimed plant under the Animal and Plant Control Act 1986.

**Table 18: IRRIGATED CROPS & PASTURES MANAGEMENT GUIDELINES BASED ON WEED RISK AND FEASIBILITY OF CONTAINMENT**

WEED RISK	FEASIBILITY OF CONTAINMENT				
	<i>Negligible</i> >113	<i>Low</i> >56	<i>Medium</i> >31	<i>High</i> >14	<i>Very High</i> <14
<i>Negligible</i> <13					
<i>Low</i> <39					NOOGOORA BURR
<i>Medium</i> <101	DOCK POA GRASS WILD RADISH		PARAMATTA GRASS	CALTROP SILVERLEAF NIGHTSHADE	BATHURST BURR BUCHAN WEED CHILEAN & RED DODDERS INNOCENT WEED KHAKI WEED THREE CORNER JACK VARIEGATED THISTLE
<i>High</i> <192	COUCH	SLENDER THISTLE SOLDIER THISTLE			
<i>Very High</i> >192					GOLDEN DODDER





## **6. Native Vegetation**

### **Description of Landuse**

The native vegetation of the South East covers 554,762ha, which is 20% of the total region. The native vegetation landuse cover various ecosystems containing flora and fauna. These areas include mallee scrub, wetlands, coastal dunes, grassy woodlands heathlands and sedgeland. Weeds invading bushland are difficult to control due to poor accessibility to infestations and limited resources for control. Many of the native vegetation weeds are garden escapees such as dolichos pea and bridal creeper. These plants impact on the native vegetation by smothering plants and competing for water, nutrients and sunlight, thus reducing native plants ability to survive and reproduce. This in turn reduces the of the bushland and diversity of fauna dependent on the native vegetation.

### **Assumptions**

- No routine weed control being conducted in native vegetation across the South East.
- Some minor areas may have stock grazing, which are vectors for weed spread, but in this cause the assumption is that there is not any grazing occurring within the landuse.
- It was noted that all legume weeds had a negative effect on the native vegetation.
- The products and services obtained from the landuse is conservation and recreational value.
- Biological control is considered routine for bridal creeper.

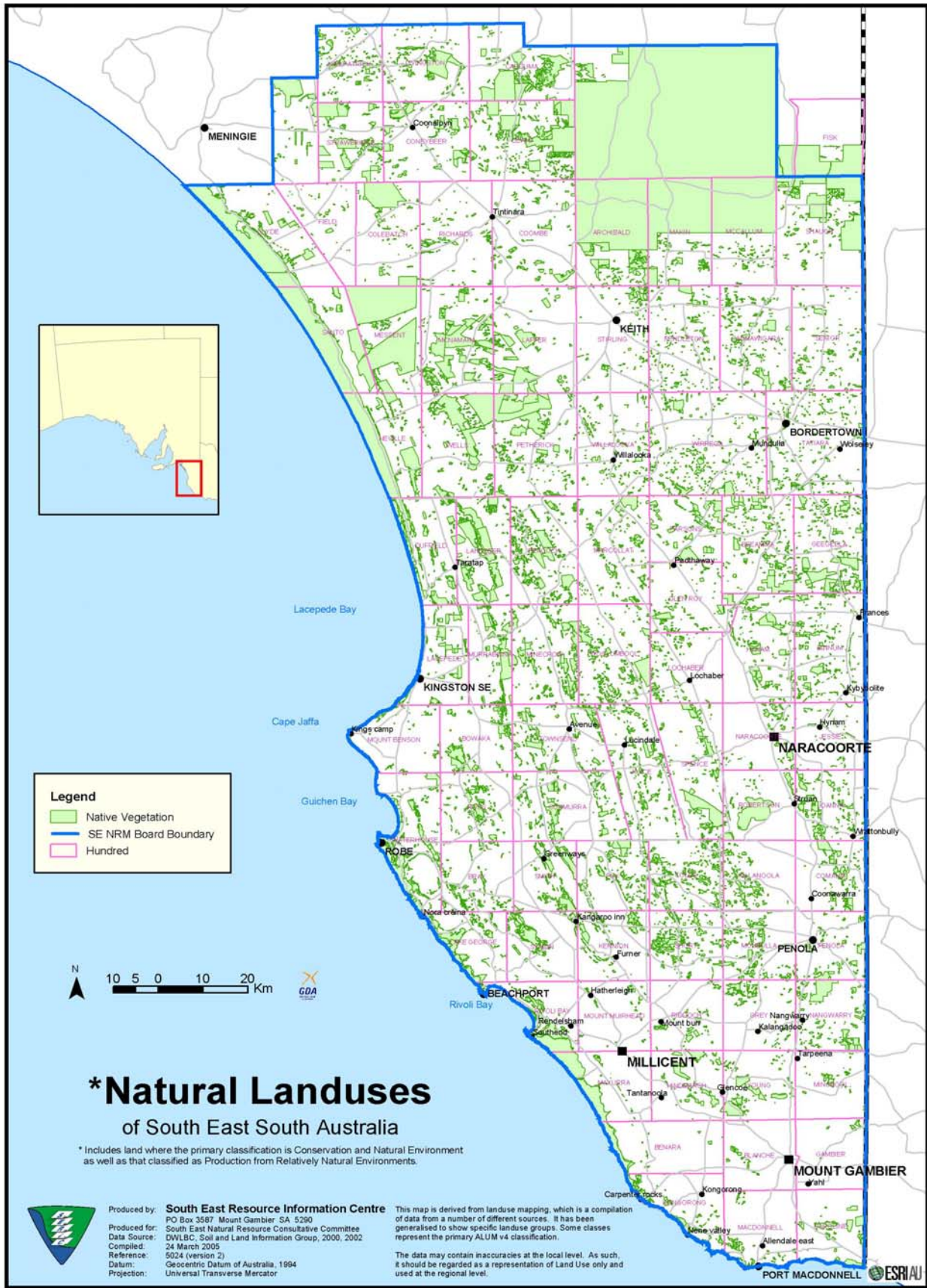
Most of the weeds listed in Table 18 have escaped from deliberate plantings for gardens, pastures and forestry, this includes plants native to other states in Australia.

Whilst coastal wattle is indigenous to the coastal area of the South East region, its increasing range and dominance inland is of concern to native vegetation managers, hence it was included in the weed list. As a native plant, coastal wattle is protected by the Native Vegetation Act in some situations, and advice should be sought from the Native Vegetation Council before any clearance or control is undertaken.

Native plants from other states have also demonstrated their weed potential in the South East. Of particular concern are sallow wattle and golden wreath wattle. Because these species are not indigenous to the region control may be carried out without legislative exemption.



Figure 7: NATIVE VEGETATION LANDUSE MAP



**Table 19: NATIVE VEGETATION WEED LIST**

Common Name	Botanical Name	Reason for Exclusion	Alert List
African Boxthorn	<i>Lycium ferocissimum</i>		
African feathergrass	<i>Pennisetum macrourum</i>	LI	
African lovegrass	<i>Eragrostis curvula</i>	LI	
Allepo pine	<i>Pinus halepensis</i>	LI	
Apple of sodom	<i>Solanum linnaeanum</i>	LI	
Asparagus fern	<i>Asparagus scandans</i>	NP	AL
Athel pine	<i>Tamarix aphylla</i>	NS	
Azzarola	<i>Crataegus sinaica</i>	NP	AL
Bamboo	<i>Arundo donax</i>	LI	
Blackberry	<i>Rubus fruticosus</i>		
Blackberry nightshade	<i>Solanum nigrum</i>	LI	
Bluebell creeper	<i>Sollya heterophylla</i>		
Boneseed	<i>Chrysanthemoides monilifera</i>		
Bridal creeper	<i>Asparagus asparagoides</i>		
Bridal veil	<i>Asparagus declinatus</i>	NP	AL
Buckthorn	<i>Rhamnus alaternus</i>		
Bulbil watsonia	<i>Watsonia meriana var. bulbillifera</i>	LI	
Cape broom	<i>Genista monspessulana</i>		
Carrot	<i>Daucus carota</i>	LI	
Chilean needlegrass	<i>Nassella neesiana</i>	NP	AL
Coastal tea tree	<i>Leptospermum laevigatum</i>		
Coastal wattle	<i>Acacia sophorae</i>		
Common lantana	<i>Lantana camara</i>	NS	
Coolatai grass	<i>Hyparrhenia hirta</i>	NP	AL
Cotoneaster	<i>Cotoneaster spp.</i>		
Dodder red & chilean	<i>Cuscuta spp</i>		
Dog rose	<i>Rosa canina</i>	WS/LI	
Dolichos pea	<i>Dipogon lignosus</i>		
English broom	<i>Cytisus scoparius</i>	NP	
Erica	<i>Erica arborea</i>	NP	AL
Evening primrose	<i>Oenothera stricta</i>	LI/ WS	
False caper	<i>Euphorbia terracina</i>	WS	
Freesia	<i>Freesia hybrids</i>	LI	
Gazania spp.	<i>Gazania spp.</i>		
Golden wreath wattle	<i>Acacia saligna</i>		
Gorse/ Furze	<i>Ulex europaeus</i>		
Hawthorn/ May	<i>Crataegus monogyna</i>	LI	
Horehound	<i>Marrubium vulgare</i>	WS/LI	
Kikuyu	<i>Pennisetum clandestinum</i>	LI/WS	
Marguerite daisy	<i>Argyranthemum frutescens</i>	LI	
Marram grass	<i>Ammophila arenaria</i>	WS	
Myrtle leaf milkwort	<i>Polygala myrtifolia</i>		
Olive	<i>Olea europaea</i>		
Pampas/ pink grass	<i>Cortaderia spp.</i>		

<b>Common Name</b>	<b>Botanical Name</b>	<b>Reason for</b>	<b>Alert List</b>
Phalaris	<i>Phalaris aquatica</i>		
Pincushion	<i>Scabiosa atropurpurea</i>	WS/LI	
Poplars	<i>Populus spp.</i>	LI	
Radiata pine	<i>Pinus radiata</i>		
Sallow wattle	<i>Acacia longifolia</i>		
Shiny leaf Coprosma	<i>Coprosma repens</i>		
South African Weed Orchid	<i>Disa bracteata</i>		
Spiny rush	<i>Juncus acutus</i>		
Sweet briar	<i>Rosa rubiginosa</i>	WS/LI	
Sweet pittosporum	<i>Pittosporum undulatum</i>	NP	AL
Tagasaste	<i>Chamaecytisus palmensis</i>	LI	
Tall Wheat Grass	<i>Thinopyrum ponticum</i>		
Veldt grass	<i>Ehrharta calycina</i>		
White arctotis	<i>Arctotis stoechadifolia</i>	LI	
White weeping broom	<i>Retama raetam</i>		
Wild oats	<i>Avena fatua</i>	WS	
Williams Grass	<i>Festuca arundinacea</i>	WS	

*Widespread (WS), Low Impact (LI), Not suited to SE (NS), Not Present (NP), Routinely being successfully controlled (RC), Alert List (AL)*

Most of the weeds listed in table 18 have escaped from deliberate plantings for gardens, pastures and forestry, this includes plants native to other states in Australia.

**Table 20: NATIVE VEGETATION WEED RISK RESULTS**

Weed	Weed Risk					Feasibility				
	Invasiveness	Impacts	Potential Distribution	Total	Ranking	Control Costs	Current Distribution	Persistence	Total	Ranking
<b>African boxthorn</b>	5.3	2.1	4.0	<b>45</b>	<b>M</b>	6.0	1.3	7.3	<b>55</b>	<b>M</b>
<b>Blackberry</b>	7.3	4.2	2.0	<b>62</b>	<b>M</b>	7.3	0.1	7.3	<b>4</b>	<b>VH</b>
<b>Bluebell creeper</b>	8.0	5.3	2.0	<b>84</b>	<b>M</b>	8.7	0.1	9.1	<b>7</b>	<b>VH</b>
<b>Boneseed</b>	6.7	3.2	4.0	<b>84</b>	<b>M</b>	6.0	0.9	5.5	<b>30</b>	<b>H</b>
<b>Bridal creeper</b>	7.3	5.3	10.0	<b>386</b>	<b>VH</b>	5.3	6.7	6.4	<b>226</b>	<b>N</b>
<b>Bridal creeper (West)</b>	7.3	5.3	6.0	<b>232</b>	<b>VH</b>	6.0	0.1	7.3	<b>4</b>	<b>VH</b>
<b>Buckthorn</b>	8.0	3.2	4.0	<b>101</b>	<b>M</b>	6.7	0.9	3.6	<b>22</b>	<b>H</b>
<b>Cape broom</b>	4.7	2.6	2.0	<b>25</b>	<b>L</b>	3.3	0.1	4.5	<b>1</b>	<b>VH</b>
<b>Coastal tea tree</b>	6.0	3.2	3.0	<b>38</b>	<b>L</b>	6.0	0.1	2.7	<b>1</b>	<b>VH</b>
<b>Coastal wattle</b>	8.0	5.3	10.0	<b>421</b>	<b>VH</b>	6.0	3.3	8.2	<b>164</b>	<b>N</b>
<b>Cotoneaster</b>	6.0	1.6	6.0	<b>57</b>	<b>M</b>	6.7	0.9	6.4	<b>39</b>	<b>M</b>
<b>Dodder</b>	6.0	0.5	1.0	<b>3</b>	<b>N</b>	6.0	0.1	7.3	<b>4</b>	<b>VH</b>
<b>Dolichos pea</b>	7.3	5.8	2.0	<b>85</b>	<b>M</b>	6.0	0.1	7.3	<b>4</b>	<b>VH</b>
<b>Gazania</b>	6.0	0.1	2.0	<b>19</b>	<b>L</b>	6.0	0.1	6.4	<b>3</b>	<b>VH</b>
<b>Golden wreath wattle</b>	6.7	3.2	6.0	<b>126</b>	<b>H</b>	6.7	0.9	7.3	<b>44</b>	<b>M</b>
<b>Gorse</b>	4.7	5.8	2.0	<b>54</b>	<b>M</b>	6.7	0.1	6.4	<b>4</b>	<b>VH</b>
<b>Myrtle leaf milkwort</b>	6.7	3.7	4.0	<b>98</b>	<b>M</b>	7.3	0.9	7.3	<b>49</b>	<b>M</b>
<b>Olive</b>	6.0	3.7	4.0	<b>88</b>	<b>M</b>	7.3	0.9	6.4	<b>43</b>	<b>M</b>
<b>Phalaris</b>	6.0	4.2	4.0	<b>101</b>	<b>M</b>	6.7	5.0	6.4	<b>212</b>	<b>N</b>
<b>Radiata pine</b>	6.7	4.7	4.0	<b>126</b>	<b>H</b>	6.0	0.9	3.6	<b>20</b>	<b>H</b>
<b>S. Afr weed orchid</b>	6.7	0.0	8.0	<b>0</b>	<b>N</b>	7.3	0.1	7.3	<b>4</b>	<b>VH</b>
<b>Sallow wattle</b>	8.0	5.3	10.0	<b>421</b>	<b>VH</b>	5.3	2.5	4.5	<b>61</b>	<b>L</b>
<b>Shiny leaf coprosma</b>	6.0	3.2	2.0	<b>38</b>	<b>L</b>	6.7	0.1	5.5	<b>3</b>	<b>VH</b>
<b>Spiny rush</b>	6.0	3.2	2.0	<b>38</b>	<b>L</b>	6.7	0.1	7.3	<b>4</b>	<b>VH</b>
<b>Tall wheatgrass</b>	6.0	5.8	4.0	<b>139</b>	<b>H</b>	6.7	5.0	6.4	<b>212</b>	<b>N</b>
<b>Veldt grass</b>	8.0	4.2	4.0	<b>135</b>	<b>H</b>	6.7	5.0	6.4	<b>212</b>	<b>N</b>

**Table 21: NATIVE VEGETATION MANAGEMENT GUIDELINES BASED ON WEED RISK AND FEASIBILITY OF CONTAINMENT**

WEED RISK	FEASIBILITY OF CONTAINMENT				
	<i>Negligible</i> >113	<i>Low</i> >56	<i>Medium</i> >31	<i>High</i> >14	<i>Very High</i> <14
<i>Negligible</i> <13					DODDER (RED & CHILEAN) SA WEED ORCHID
<i>Low</i> <39					COASTAL TEA TREE GAZANIA SHINY LEAF SPINY RUSH CAPE BROOM
<i>Medium</i> <101	PHALARIS (P)		COTONEASTER MYRTLE LEAVED MILKWORT OLIVE (P) AFRICAN BOXTHORN	BONESEED BUCKTHORN	BLACKBERRY BLUEBELL CREEPER DOLICHOS PEA GORSE
<i>High</i> <192	VELDT GRASS (P) TALL WHEATGRASS (P)		GOLDEN WREATH WATTLE	RADIATA PINE(P)	
<i>Very High</i> >192	COASTAL WATTLE (N) BRIDAL CREEPER	SALLOW WATTLE			BRIDAL CREEPER (WEST CAPE FORM)

(N) A native plant indigenous to the South East region  
(P) A commonly grown plant of primary industry landuses

## Summary

Western cape form of Bridal creeper is a new discovery in the South East. Current known distribution is restricted to several isolated locations in the Lower South East. A mapping exercise is being conducted to discover the full extent of the infestation, and devise a plan for control. Due to this weed's tolerance to existing biological control agents (i.e. it is not susceptible to the bridal creeper rust) and limited extent, it has ranked the highest priority in native vegetation.

Other high priority weeds in native vegetation include blackberry, bluebell creeper, dolichos pea, gorse and golden wreath wattle (an indigenous plant of Western Australia). Radiata pine, which is currently planted as a forestry species with a high economic value, is also of concern where it invades native vegetation. The conflicting values of this plant between the landuses is an issue all stakeholders need to address to achieve better weed management throughout the region.

Although coastal wattle has been classed as a weed within this landuse, it is an indigenous plant of the South East within the coastal zone. Currently it has become naturalised out of its traditional distribution causing significant biodiversity issues. As a native plant, coastal wattle is protected by the Native Vegetation Act in some situations, and advice should be sought from the Native Vegetation Council before any clearance or control is undertaken.

Bridal creeper is a Weed Of National Significance and was found to have a very high weed risk through this assessment process. However, it is very widespread across the region and therefore is not feasible to control using general weed control techniques. The ideal control mechanism is integrated weed management using biological control agents together with physical and chemical control.





## 7. Perennial Horticulture

### Description of landuse

Perennial horticulture covers 20,939ha, which is 1% of the total area of the region, and is highly productive generating \$193 million gross per year. Perennial horticulture includes wine grapes, pome fruit, stone fruits and citrus. There are two main areas of wine grape vineyards at Padthaway and Coonawarra. These areas are marketed under the Limestone Coast brand.

Perennial horticulture has few weeds that impact on the yield and/or quality of the produce, therefore the majority of weeds are those that impact on the health of horticultural workers. These weeds include burry weeds such as caltrop and innocent weed, which are summer growing and can be easily spread by traffic through the vineyards.

### Assumptions

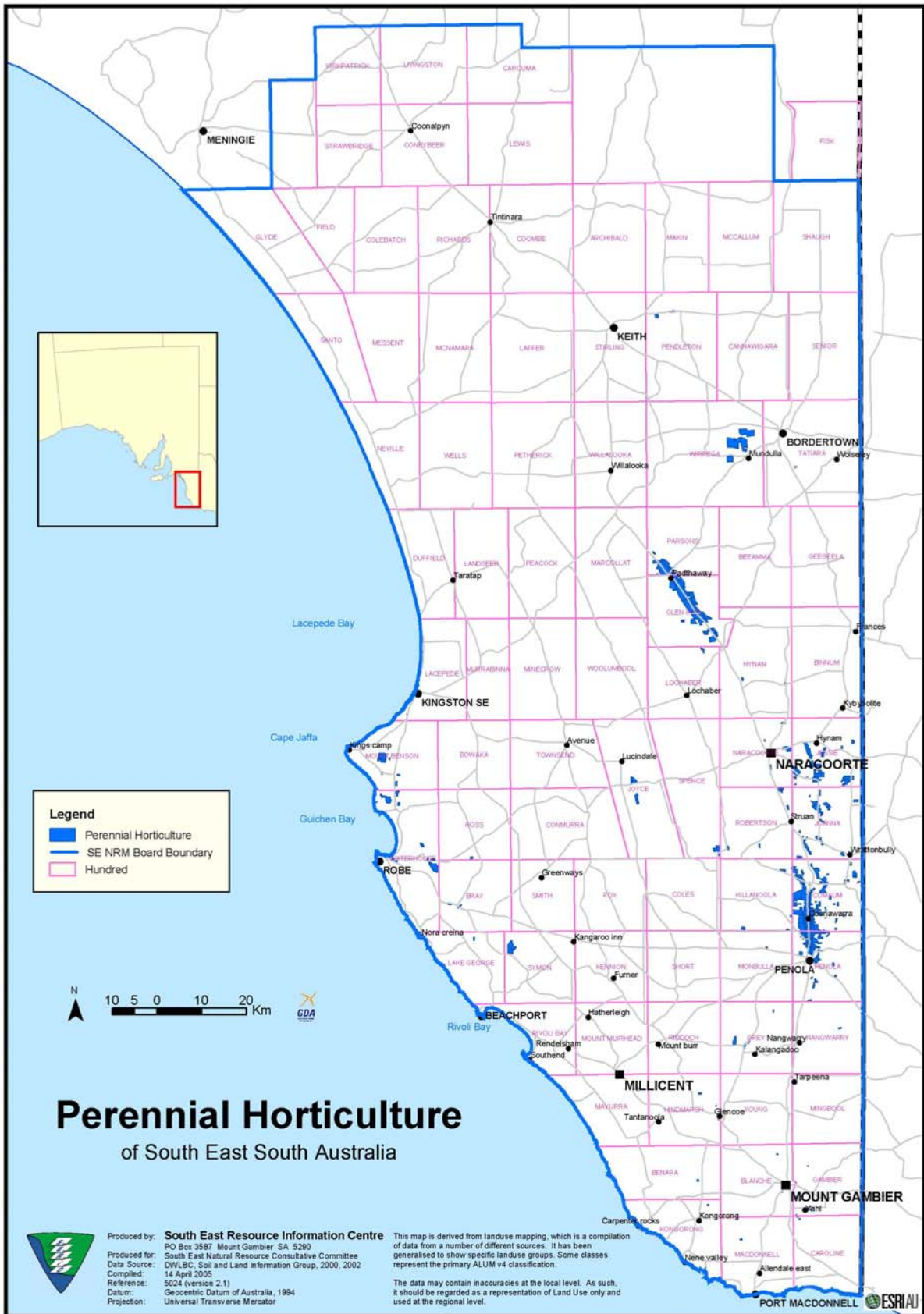
- An annual or perennial cover crop grown between rows.
- Pre-emergent and knock down herbicides used around trees/vines.
- In addition a knockdown herbicide is generally used every 4-6 weeks.
- Pre-emergent used twice a year.
- There is limited cultivation and it is assumed livestock are not normally present.
- There may be some overhead sprinkler or under tree drip/micro-jet irrigation.

Table 22: PERENNIAL HORTICULTURE WEED LIST

Common Name	Botanical Name	Reason for Exclusion	Alert List
Bathurst burr	<i>Xanthium spinosum</i>		
Caltrop	<i>Tribulus terrestris</i>		
Couch	<i>Cynodon dactylon</i>	WS	
Fat hen	<i>Chenopodium album</i>	LI	
Field bindweed	<i>Convolvulus arvensis</i>		
Fleabane	<i>Conyza spp.</i>	LI	
Innocent weed	<i>Cenchrus incertus/longispinus</i>		
Mallow	<i>Malva parviflora</i>	LI/ WS	
Red gum euc.	<i>Eucalyptus camaldulensis</i>	WS/LI	
Soursob	<i>Oxalis pes-caprae</i>	WS	
Wireweed	<i>Polygonum aviculare</i>		

Widespread (WS), Low Impact (LI), Not suited to SE (NS), Not Present (NP), Routinely being successfully controlled (RC), Alert List (AL)

Figure 8: PERENNIAL HORTICULTURE LANDUSE MAP



**Table 23: PERENNIAL HORTICULTURE WEED RISK RESULTS**

Weed	Weed Risk					Feasibility				
	Invasiveness	Impacts	Potential Distribution	Total	Ranking	Control Costs	Current Distribution	Persistence	Total	Ranking
<b>Bathurst burr</b>	4.0	1.1	2.0	<b>8</b>	<b>N</b>	3.3	0.9	4.5	<b>14.0</b>	<b>VH</b>
<b>Caltrop</b>	5.3	1.1	4.0	<b>22</b>	<b>L</b>	4.0	0.9	5.5	<b>20.0</b>	<b>H</b>
<b>Field bindweed</b>	5.3	0.5	2.0	<b>6</b>	<b>N</b>	3.3	0.1	2.7	<b>1.0</b>	<b>VH</b>
<b>Innocent Weed</b>	6.0	1.1	4.0	<b>25</b>	<b>L</b>	4.7	0.1	4.5	<b>2.0</b>	<b>VH</b>
<b>Wireweed</b>	4.7	0.5	4.0	<b>10</b>	<b>N</b>	4.0	1.8	4.5	<b>32.0</b>	<b>M</b>

**Summary**

Within perennial horticulture all of the weeds assessed received a negligible to low weed risk score. This is due to the weeds not having a high impact on the produce/ and or yield of the landuse. From the matrix above it is recommended that innocent weed, be controlled to protect other sites.

Table 24: PERENNIAL HORTICULTURE MANAGEMENT GUIDELINES BASED ON WEED RISK AND FEASIBILITY OF CONTAINMENT

WEED RISK	FEASIBILITY OF CONTAINMENT				
	<i>Negligible</i> >113	<i>Low</i> >56	<i>Medium</i> >31	<i>High</i> >14	<i>Very High</i> <14
<i>Negligible</i> <13			WIREWEED		BATHURST BURR FIELD BINDWEED
<i>Low</i> <39				CALTROP	INNOCENT WEED
<i>Medium</i> <101					
<i>High</i> <192					
<i>Very High</i> >192					

## 8. Urban

### Description of landuse

Urban areas in the South East are small and large townships, covering 51,106ha or 2% of the region, with an approximate population of 62,780. Within the urban landuse the main focus is on amenity areas where there is risk to public safety from weeds. Areas include sports fields, parks and footpaths that are prone to burry weeds and gardens and street plantings which may contain poisonous plants.

### Assumptions

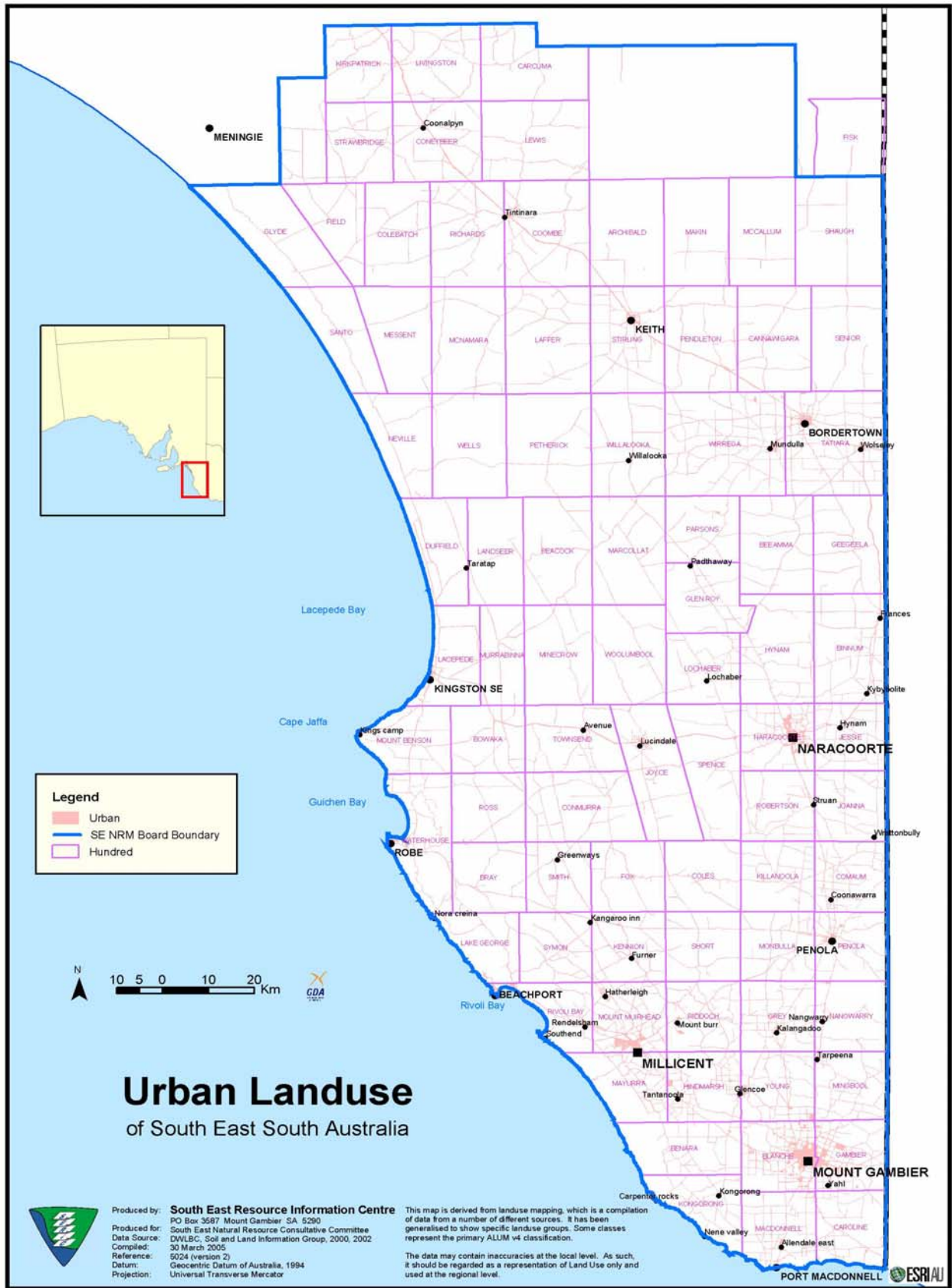
- Councils and landholders do regular mowing and irregular spot-spraying (e.g., glyphosate).
- Lawns and gardens are watered all year round.
- Ignoring vacant blocks and waste areas which are not for public use.
- Garden weeds, or weeds that are simply disliked because they are foul-are not considered.
- Effects on quality of the landuse is focused on damage to physical infrastructure (e.g. roads, paths, buildings).

**Table 25: URBAN WEED LIST**

Common Name	Botanical Name	Reason for exclusion
African Boxthorn	<i>Lycium ferocissimum</i>	
Allepo pine	<i>Pinus halepensis</i>	
Apple of sodom	<i>Solanum linnaeanum</i>	
Athel pine	<i>Tamarix aphylla</i>	NS
Blackberry	<i>Rubus fruticosus</i> sp. agg.	
Bridal creeper	<i>Asparagus asparagoides</i>	
Caltrop	<i>Tribulus terrestris</i>	
Couch	<i>Cynodon dactylon</i>	
False caper	<i>Euphorbia terracina</i>	
Gazania spp.	<i>Gazania</i> spp.	
Innocent weed	<i>Cenchrus incertus/longispinus</i>	
Khaki weed	<i>Alternanthera pungens</i>	
Kikuyu	<i>Pennisetum clandestinum</i>	
Pincushion	<i>Scabiosa atropurpurea</i>	
Poa grass	<i>Poa annua</i>	WS
Soursob	<i>Oxalis pes-caprae</i>	WS
Tree of heaven	<i>Ailanthus altissima</i>	

*Widespread (WS), Low Impact (LI), Not suited to SE (NS), Not Present (NP), Routinely being successfully controlled (RC), Alert List (AL)*

Figure 9: URBAN LANDUSE MAP



**Table 26: URBAN WEED RISK RESULTS**

Weed	Weed Risk					Feasibility				
	Invasiveness	Impacts	Potential Distribution	Total	Ranking	Control Costs	Current Distribution	Persistence	Total	Ranking
<b>African boxthorn</b>	4.0	4.7	1.0	19	<b>L</b>	2.7	0.9	4.5	11	<b>VH</b>
<b>Apple of sodom</b>	3.3	4.7	1.0	16	<b>L</b>	3.3	0.9	5.5	17	<b>H</b>
<b>Blackberry</b>	6.0	4.7	1.0	28	<b>L</b>	3.3	0.1	5.5	2	<b>VH</b>
<b>Bridal Creeper</b>	6.7	4.2	1.0	28	<b>L</b>	4.0	1.8	3.6	25	<b>H</b>
<b>Caltrop</b>	6.0	4.7	1.0	28	<b>L</b>	4.0	0.9	3.6	13	<b>VH</b>
<b>False Caper</b>	5.3	4.7	1.0	25	<b>L</b>	5.3	0.1	8.2	4	<b>VH</b>
<b>Innocent Weed</b>	6.7	4.7	1.0	32	<b>L</b>	4.7	0.1	4.5	2	<b>VH</b>
<b>Khaki weed</b>	6.0	4.7	1.0	28	<b>L</b>	4.7	0.1	4.5	2	<b>VH</b>
<b>Tree of heaven</b>	5.3	3.7	1.0	20	<b>L</b>	4.0	0.1	3.6	1	<b>VH</b>

**Summary**

The majority of the weeds in the urban landuse are feasible to control, this is due to the accessibility to infestations and the small size of current distributions. Burry weeds such as innocent weed, khaki weed and caltrop are in the “site protection” category which aims at keeping the weed out of key sites, i.e. ovals and other public amenity areas. Other management actions would be to control new outbreaks to reduce the limit of spread, thorough being accidentally transported.



Table 27: URBAN MANAGEMENT ACTIONS BASED ON WEED RISK AND FEASIBILITY OF CONTAINMENT

WEED RISK	FEASIBILITY OF CONTAINMENT				
	<i>Negligible</i> >113	<i>Low</i> >56	<i>Medium</i> >31	<i>High</i> >14	<i>Very High</i> <14
<i>Negligible</i> <13					
<i>Low</i> <39				APPLE OF SODOM BRIDAL CREEPER	BOXTHORN BLACKBERRY CALTROP FALSE CAPER INNOCENT WEED KHAKI WEED TREE OF HEAVEN
<i>Medium</i> <101					
<i>High</i> <192					
<i>Very High</i> >192					

## Discussion

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The weed risk management results found similarities in priorities between weeds in different landuses. To compare these and determine the top 15 weeds, the landuses have been divided into two groups, primary industries and environmental. The categories in the management action matrices have then been summarised into the four highest priority management action types as seen in Table 27 and 28.

The four key categories used in Tables 27 and 28 were developed in the following manner:

Alert list	Those weeds not assessed but recognised as a serious potential threat requiring surveillance
Destroy	Those weeds that fell in the red (eradicate) and orange (destroy) squares
Contain	Those weeds that fell in the yellow squares (contain spread)
Protect assets	Those weeds that fell in the green squares (protect sites)

Table 27 describes the weeds that fall in these categories for each landuse, to provide an easy reference for individual landuses/industries.

Table 28 then collates all this information into one single table to show the regional priorities irrespective of landuse. The information in this table is the basis for determining the top 15 primary industry weeds and the top 15 environmental weeds. Weeds listed in red text in this table are those that made the top 15 lists.

### ***Regional priorities***

It is important to remember that the resulting list of high priority weeds described in this project have been determined at the regional scale. This means that the assessment procedure for each weed has been averaged across the wide range of environmental conditions in the South East. This context may result in the exclusion of some weeds that are a high priority at the local level. These local priorities are still able to be recognised within policies regardless of the regional context.

### ***Conflicts of interest***

There are a number of conflicts of interests for weed species across landuses. What is grown as a production species in one landuse may be a significant weed in another landuse. For example, radiata pine is the major forestry species in the South East but is a high priority weed in native vegetation. The same applies to veldt grass, tall wheat grass and phalaris. All were planted as pasture grasses but now threaten native vegetation. The feasibility to control these grasses is very low due to their extensive distribution across the region, hence resulting in a lower priority for control despite the high level of risk they present.

Bracken fern and coastal wattle have been listed in several landuses as weeds. The conflict here is that both are locally-indigenous native plants, and as such are protected by the Native Vegetation Act which prevents clearance without a permit, except in certain circumstances. This report does not condone the blanket control of bracken fern or coastal wattle across all landuses. Each situation must be assessed on its own merits and it is recommended that land managers seek the advice of the Native Vegetation Council before undertaking any control measures.

**Table 28: SUMMARY OF HIGHEST PRIORITY WEEDS FOR EACH LAND USE continued over page**

MANAGEMENT CATEGORIES	LANDUSES			
	CROPPING	GRAZING	FORESTRY	PERENNIAL HORTICULTURE
<b>ALERT LIST</b>	Branched broomrape Blue mustard Muskweed	Broad kernel espartillo Calomba daisy Cane needle grass Chilean needlegrass Coolatai grass Horsetail Mexican feathergrass Plumerillo Ragwort Serrated tussock Texas needlegrass Water dropwort		-
<b>DESTROY</b>	-	-	Blackberry	-
<b>CONTAIN</b>	Three horned bedstraw Creeping knapweed Silverleaf nightshade	Bathurst burr Innocent weed Cape tulip Caltrop Blackberry Gorse Salvation Jane Silverleaf nightshade Three corner jack Variegated thistle Yellow burr weed	Bluebell creeper Gorse Pampas grass Sallow wattle	-
<b>PROTECT ASSETS</b>	Variegated thistle	Cutleaf mignonette African feathergrass African lovegrass Bladder campion Red and Chilean dodder African boxthorn Horehound Apple of sodom	Boneseed Cape broom Couch	Innocent weed

*continued* SUMMARY OF HIGHEST PRIORITY WEEDS FOR EACH LAND USE

MANAGEMENT CATEGORIES	LANDUSES			
	IRRIGATED CROPS AND PASTURES	AQUATIC	NATIVE VEGETATION	URBAN
<b>ALERT LIST</b>	Alkali sida Broomrapes Red and Chilean dodders	Alligator weed Arrowhead Cabomba Desert ash Elodea Horsetail Leafy elodea Poison buttercup Primrose willow Sagittaria Salvinia Senegal tea plant Water dropwort Water hyacinth	Azzarola Bridal veil Chilean needlegrass Coolatai grass	-
<b>DESTROY</b>	Golden dodder	-	Bridal creeper (west cape form)	-
<b>CONTAIN</b>	Bathurst burr Buchan weed  Innocent weed Khaki weed Three corner jack Variegated thistle	Alisma	Blackberry Bluebell creeper Dolichos pea Gorse Radiata pine Golden wreath wattle	-
<b>PROTECT ASSETS</b>	Caltrop Noogoora burr	Willows	Coastal tea tree Gazania Shiny leaf coprosma Spiny rush Cape broom African boxthorn Boneseed Buckthorn Sallow wattle	African boxthorn Blackberry Caltrop False caper Innocent weed Khaki weed Tree of heaven

**Table 29: REGIONAL WEED MANAGEMENT ACTION CATEGORIES FOR PRIMARY INDUSTRIES AND ENVIRONMENTAL LANDUSES**

	<b>PRIMARY INDUSTRIES</b>	<b>ENVIRONMENTAL</b>
<b>ALERT LIST</b>	Alkali sida Blue mustard Branched broomrape Broad-kernel espartillo Calomba daisy Cane needlegrass Chilean needlegrass Coolatai grass Horsetail Mexican feathergrass Muskweed Ragwort Serrated tussock Texas needlegrass Water dropwort	Alligator weed Asparagus fern Azzarola Bridal veil Cabomba Chilean needlegrass Coolatai grass Desert ash Erica Elodea Horsetail Leafy elodea Poison buttercup Primrose willow Sagittaria Salvinia Senegal tea plant Water hyacinth White weeping broom
<b>DESTROY</b>	Golden dodder	Bridal creeper (western cape form)
<b>CONTAIN</b>	Bathurst burr Blackberry Caltrop Gorse Horehound Innocent weed Khaki weed Pampas grass Silverleaf nightshade Three corner jack Three horned bedstraw Variegated thistle Yellow burr weed	Radiata pine Blackberry Bluebell creeper Dolichos pea Gorse Alisma
<b>PROTECT ASSETS</b>	African feathergrass Apple of sodom African boxthorn Cape tulip Creeping knapweed Red & chilean dodder Salvation Jane	African boxthorn Boneseed Buckthorn Cape broom Coastal tea tree Gazania Golden wreath wattle Sallow wattle Shiny leaf coprosma Willow sp.
<b>IMPROVE INTEGRATED WEED MANAGEMENT</b>	Bladder campion Bracken fern Cutleaf mignonette False caper Silver grass Slender thistle Solider thistle Spear thistle Soursob	Bridal creeper Phalaris Veldt grass Tall wheatgrass Coastal wattle Dodder (red and chilean) Monadenia orchid Cotoneaster Myrtle leaved milkwort Olive

## Conclusions

The purpose of this project was to determine the highest priority weeds in the South East. During the course of the project it was agreed that the 15 highest priority weeds for both primary industries and the environment would be identified as the key output of the project. These 15 highest priorities for each landuse grouping are commonly referred to as “the top 15”.

These top 15 lists have been determined by summarising the information in Table 28 to identify the highest priority weeds for primary industries and environmental landuses.

These weeds are listed in alphabetical order only.

**Table 30: THE HIGHEST PRIORITY WEEDS OF THE SOUTH EAST**

Top 15 primary industry weeds	Top 15 environmental weeds
<ul style="list-style-type: none"> <li>• Bathurst burr</li> <li>• Blackberry</li> <li>• Caltrop</li> <li>• Golden dodder</li> <li>• Gorse</li> <li>• Horehound</li> <li>• Innocent weed</li> <li>• Khaki weed</li> <li>• Pampas grass</li> <li>• Salvation Jane</li> <li>• Silverleaf nightshade</li> <li>• Three corner jack</li> <li>• Three horned bedstraw</li> <li>• Variegated thistle</li> <li>• Yellow burr weed</li> </ul>	<ul style="list-style-type: none"> <li>• Blackberry</li> <li>• Bluebell creeper</li> <li>• Boneseed</li> <li>• Bridal creeper (western cape form)</li> <li>• Buckthorn</li> <li>• Cape broom</li> <li>• Coastal tea tree</li> <li>• Dolichos pea</li> <li>• Gazania</li> <li>• Golden wreath wattle</li> <li>• Gorse</li> <li>• Radiata pine</li> <li>• Sallow wattle</li> <li>• Shiny leaf coprosma</li> <li>• Spiny rush</li> </ul>

### ***Regional priorities***

Again, it is important to remember that the resulting list of high priority weeds described in this project have been determined at the regional scale. This context may result in the exclusion of some weeds that are a high priority at the local level. This is not of concern as policies are still able to recognise local issues among regional priorities.

The assessment procedure compares the threat the weed poses to the feasibility to control it. This has also resulted in some weeds that many people would consider to be a high priority or, have serious impacts, to not make it to the top 15. Bridal creeper is a good example of this. Whilst it poses a very high weed risk to native vegetation it simply is not feasible to control current infestations, hence resulting in a low priority at the regional scale.

### ***Current weed management activities***

There is a wide range of weed control stakeholders in the South East, each undertaking works for various outcomes. It has not been within the scope of this project to described all activities in detail, a brief summary is provided in Table 30 and specific comments for individual weeds is provided in the weed information starting on page 59.

**Table 31: A SUMMARY OF CURRENT REGIONAL WEED CONTROL ACTIVITIES IN THE SOUTH EAST**

<b>STAKEHOLDER</b>	<b>REGIONAL PROGRAMS</b>	<b>OTHER ACTIVITIES</b>
Animal and Plant Control Boards	Biocontrol releases for <ul style="list-style-type: none"> <li>▪ Salvation Jane</li> <li>▪ Horehound</li> <li>▪ Bridal creeper</li> </ul>	Encouraging landholders to control weeds Specific special weed control projects
Department for Environment and Heritage	Bridal creeper biocontrol programs	Friend of Parks activities Encouraging landholders to control weeds Funding of proclaimed plant control
Land managers	-	Routine and ad hoc weed control activities
CRC for Weeds	Funding for biocontrol activities	Awareness campaigns
ForestrySA	Feral pine removal	
Local Government	Financial contributions to Animal and Plant Control Boards	Urban weed control activities Funding of proclaimed plant control

## **Recommendations**

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### ***How this information can be used***

The results of this project are a thoroughly analysed regional summary of weed risks and recommended management actions. It can be used by all stakeholders for considering targeted weed control activities and determining priorities for on-ground works. It is anticipated that this report will be the background information used for determining the regional weed policies of the South East NRM Board.

Interpreting this weed management information for policy development will require consideration of a much broader range of issues. For this reason it is recommended that users of this report consult an animal and plant control staff member for specific context information.

However, these results cannot stand alone without further interpretation as there are a number of important local issues that have not been described within this report that need to be considered in conjunction with the regional priorities described by this project.

The management actions recommended within the matrices should not be taken literally for every situation. Many issues will need to be considered specifically and the current distribution of each weed is a critical factor in the decision making process. As described below, there is currently an information gap in weed distribution data which needs to be addressed to complement the information in this report.

This information could also be used to review the current list of proclaimed plants for the South East region. Based on the assessment results, different weeds may require different sorts of legislative restrictions, and the current proclamations may not address the findings in this project..

### ***Further actions recommended***

1. As a result of this weed risk management assessment, several knowledge gaps were identified. The most important gap was in distribution information for non proclaimed plants. It was also found that consistent mapping methods are needed throughout the South East to provide better information for weed management decision making.
2. At this stage, the weeds on the alert lists have not been individually assessed for their risk level. It is recommended that a regional incursion management plan be drafted in consultation with animal and plant control staff to determine the risk level of weeds that are currently not present in the region and develop a response strategy for potential introduction of new weed species.
3. Current weed control programs are briefly mentioned in this report. A thorough summary of such activities should be compared against the results of this weed assessment to determine gaps in control programs for the highest priority weeds. The key action areas to consider during this review include:
  - Education and awareness campaigns
  - Investment in on-ground works
  - Research into control methods
  - Enforcement of weed control legislation



4. It has become clear from this project, that more accurate results are derived from a more specific assessment. Undertaking this assessment procedure at the regional level is important for strategic decision making but does not recognise all issues. Further assessments could be done at a more local level, particularly to reflect the differences between the Upper and Lower South East. In particular, further investigation into the priorities for environmental weeds could be undertaken to allow the division of the South East into units more consistent with their occurrence, soil type and rainfall requirements. The units can be grouped using existing Regional Ecological Units found in the South East INRM plan which allow a more accurate assessment and reduction in target area for all priority weeds and target areas.
5. Due to the confusion caused by the weed status of species such as pines, coastal wattle, bracken and pasture grasses, it is recommended that the relevant stakeholders consider developing a policy on these species that clearly outlines the weed control expectations and conditions for these species.
6. Over time, the status of a weed in any given situation will change as a result of landuse practises, control efforts and community opinion. The results of an assessment such as this will change in light of the new circumstances. Monitoring of weed distribution and regular risk assessment is therefore recommended to ensure the assessment results remain relevant.

## **WEED DISTRIBUTION MAPS AND GENERAL INFORMATION**

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Bathurst burr - *Xanthium spinosum*  
Blackberry - *Rubus fruticosus agg.*  
Bluebell Creeper – *Sollya heterophylla*  
Boneseed – *Chrysanthemoides monilifera*  
Bridal Creeper (western cape form) – *Asparagus asparagoides*  
Buckthorn – *Rhamnus alaternus*  
Caltrop – *Tribulus terrestris*  
Cape broom – *Genista monspessulana*  
Coastal tea tree – *Leptospermum laevigatum*  
Dolichos pea – *Dipogon lignosus*  
Gazania – *Gazania spp.*  
Golden dodder – *Cuscuta campestris*  
Golden wreath wattle – *Acacia saligna*  
Gorse – *Ulex europaeus*  
Horehound – *Marrubium vulgare*  
Innocent weed – *Cenchrus incertus* and *Cenchrus longispinus*  
Khaki weed – *Alternanthera pungens*  
Pampas grass – *Cortaderia selloana*  
Radiata pine – *Pinus radiata*  
Salvation jane – *Echium plantagineum*  
Shallow wattle – *Acacia longifolia var longifolia*  
Shiny leaf coprosma – *Coprosma repens*  
Silverleaf nightshade – *Solanum elaeagnifolium*  
Spiny rush – *Juncos acutus*  
Three corner jack – *Emex australis*  
Three horned bedstraw – *Galium reixoenurum*  
Variegated thistle – *Silybum marianum*  
Yellow burrweed – *Amsinckia spp.*



## ***Bathurst burr - Xanthium spinosum***

**Origin** An annual weed introduced from South America.

### **Description**

- Summer growing annual herb to 1m high.
- The upper surface of leaves are dark green and shiny, while the underside of leaves are pale green and downy
- 3-pronged yellow spines occur at the base of leaves
- Small, creamy green flowers at the end of stems.
- The fruit of this plant is a hooked spiny burr which is straw coloured and oblong in shape.
- Each burr contains two seeds that are flat, black and about 1cm long.

### **Impacts**

- The burrs are easily carried on clothing, packaging and water, and contaminate summer crops and contaminate wool.
- Spines cause physical damage to stock, people and shearing machinery.
- Competes strongly with summer crops and is host for horticultural diseases.
- Seedlings are poisonous to most stock animals.

### **Distribution**

Bathurst burr prefers highly fertile disturbed soil and is often found near watercourses, dams and flood plains.  
See map on facing page for current known distribution in the South East.

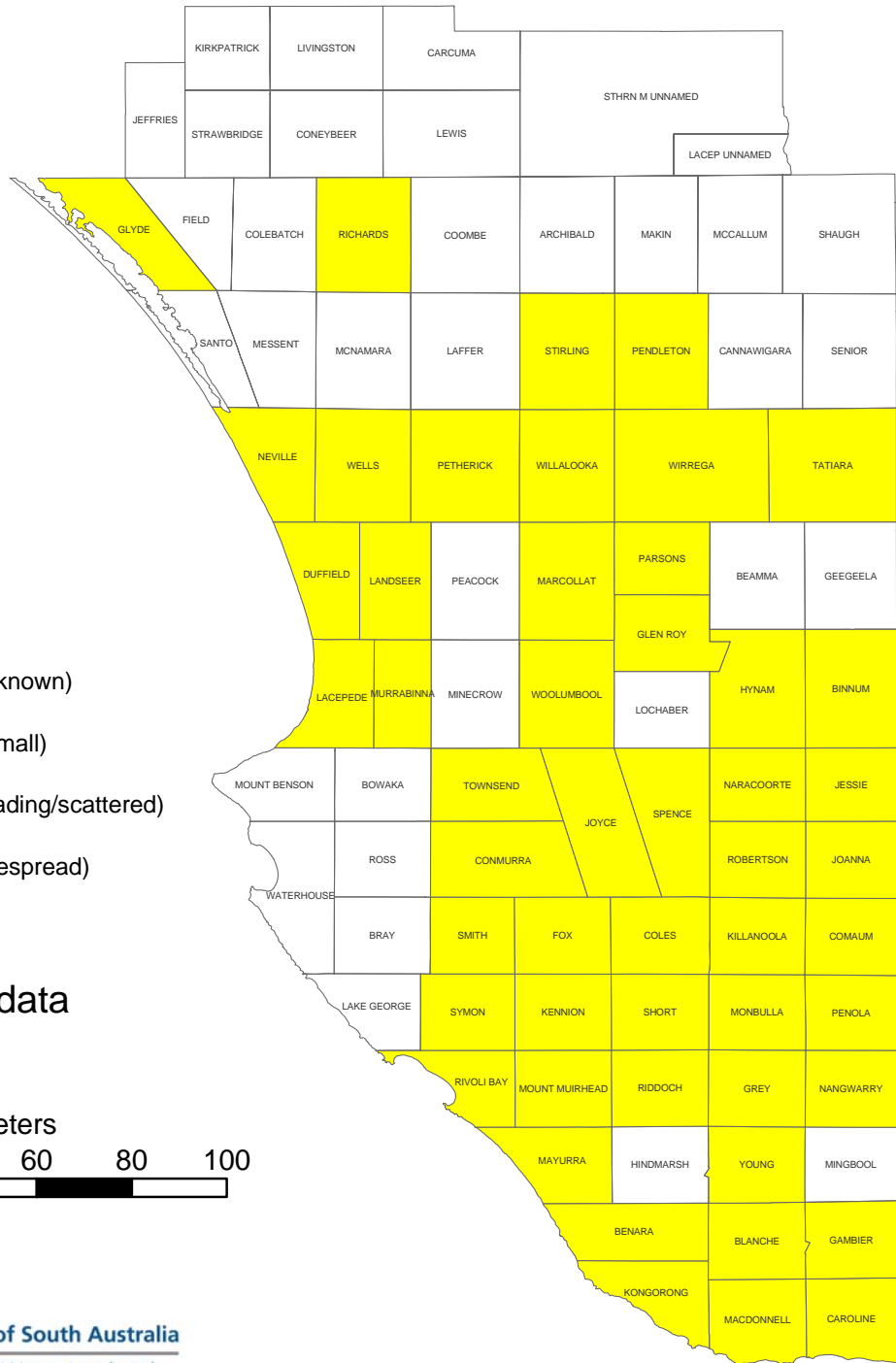
### **Control techniques**

- The use of herbicides when small before flowering.
- Grubbing small infestations is highly effective before the plant sets seed

### **Current management programs**

- Bathurst Burr is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for grazing, irrigated crops & pastures and perennial horticulture landuses.

# Current Distribution of *Xanthium spinosum* (BATHURST BURR) within Hundreds in the South-East of South Australia.\*



## Legend

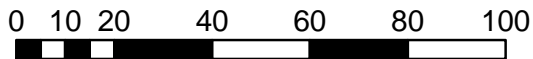
### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2002 data

Kilometers



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## ***Blackberry - Rubus fruticosus* agg.**

**Origin** A perennial weed introduced from Europe.

### **Description**

- A shrub growing several metres tall growing in dense thickets
- The canes can be smooth or hairy, round, ribbed or angular, but all have sharp thorns
- Leaves are divided into 3 or 5 leaflets with serrated edges, dark green on the upper side and lighter green with
- Flowers are 2-3cm in diameter, white or pale pink in clusters on the end of short
- The fruit formed from each flower is an aggregate of berries that, each berry contains one seed
- Blackberry reproduces by seed, root suckers and tip rooting.
- Plants may be deciduous and lose their leaves in winter.
- Recent Australian research has shown that there are actually >10 blackberry species in Australia, which will differ in their susceptibility to biological and chemical control

### **Impacts**

- Blackberry is mainly spread by birds and other animals that eat the fruit and drop the seed at a distance and along watercourses.
- Blackberry is highly invasive in other vegetation and excludes light from the soil surface by its dense canopy. As a result it out competes desirable vegetation, reduces biodiversity in native vegetation, increases the fire hazard and prevents regeneration.
- The prickly thickets inhibit movement of people, stock and machinery. They may also provide harbour for vermin.

### **Distribution**

Blackberry is often found in damp areas along the coast.  
See map on facing page for current known distribution in the South East.

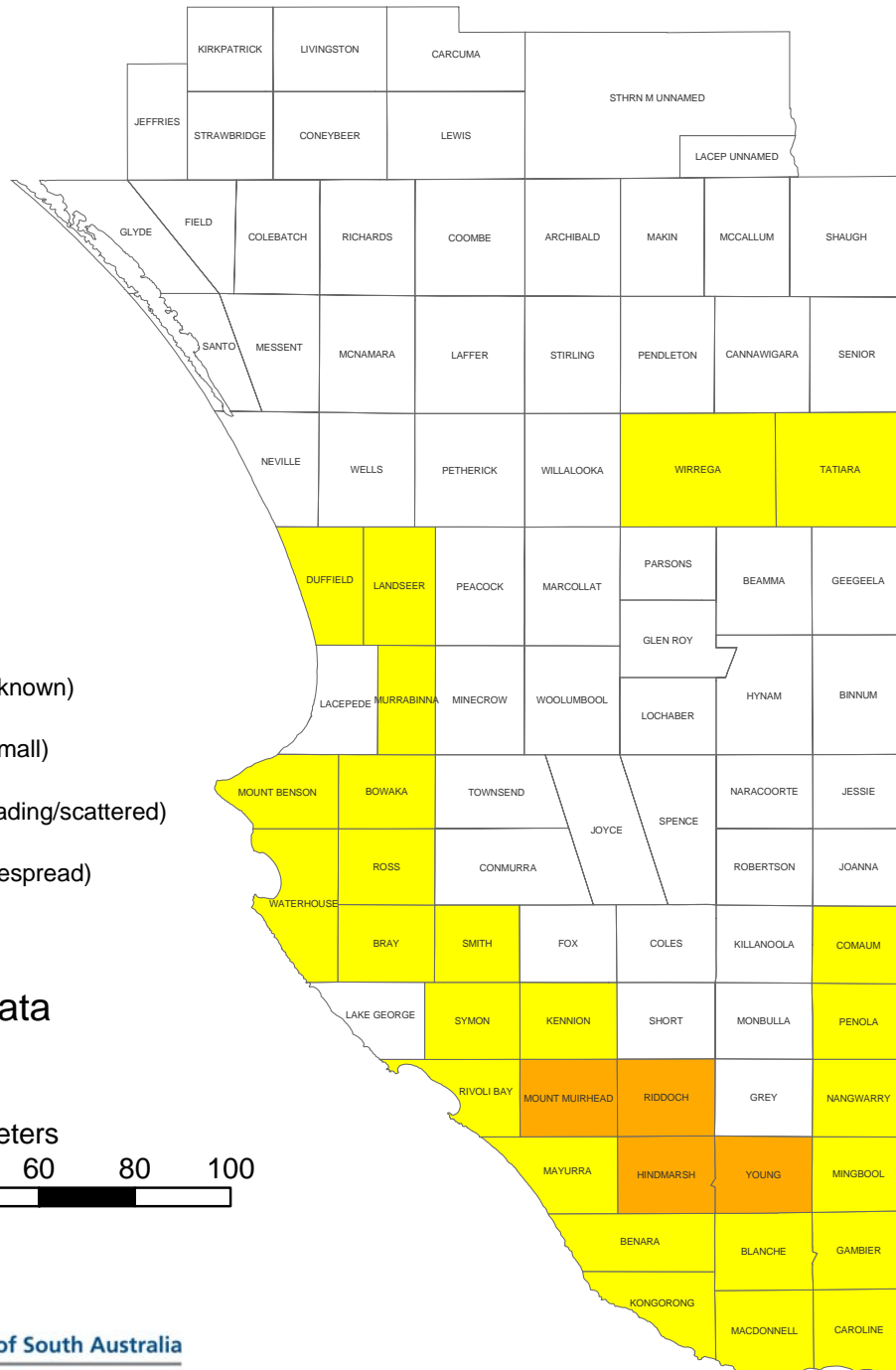
### **Control techniques**

- Herbicide treatments are not as effective once plants are fully grown
- The most effective herbicide is metsulfuron methyl (e.g. ally, associate)

### **Current management programs**

- Blackberry is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for grazing, urban and native vegetation landuse
- ForestrySA undertakes significant blackberry control work on an annual basis.

# Current Distribution of *Rubus* spp. (BLACKBERRY) within Hundreds in the South-East of South Australia.\*



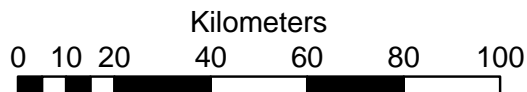
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2002 data



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## ***Bluebell creeper –Sollya heterophylla***

**Origin** A dense, rambling shrub from Western Australia

### **Description**

- Coppery-brown twining and rambling stems that are hairless and shiny.
- Leaves are 2 – 5cm long and alternate along the stem. The upper surface is bright, glossy green with a prominent mid vein and paler underside.
- Flowers are mainly blue in colour; bell shaped and droop in clusters during spring and summer.
- A cylindrical berry is produced which starts as green and matures to purple over summer and autumn. Each fruit contains many seeds.
- Bluebell creeper has a shallow, woody root system.

### **Impacts**

- Bluebell creeper smothers small native plants and shrubs and is a vigorous climber.
- Fire and soil disturbance stimulates germination and seeds are spread by birds and other animals.

### **Distribution**

Bluebell creeper is commonly grown as a garden ornamental. It is hardy and adaptable and will tolerate a range of temperature, shade, soil and moisture conditions.

See map on facing page for current known distribution in the South East.

### **Control techniques**

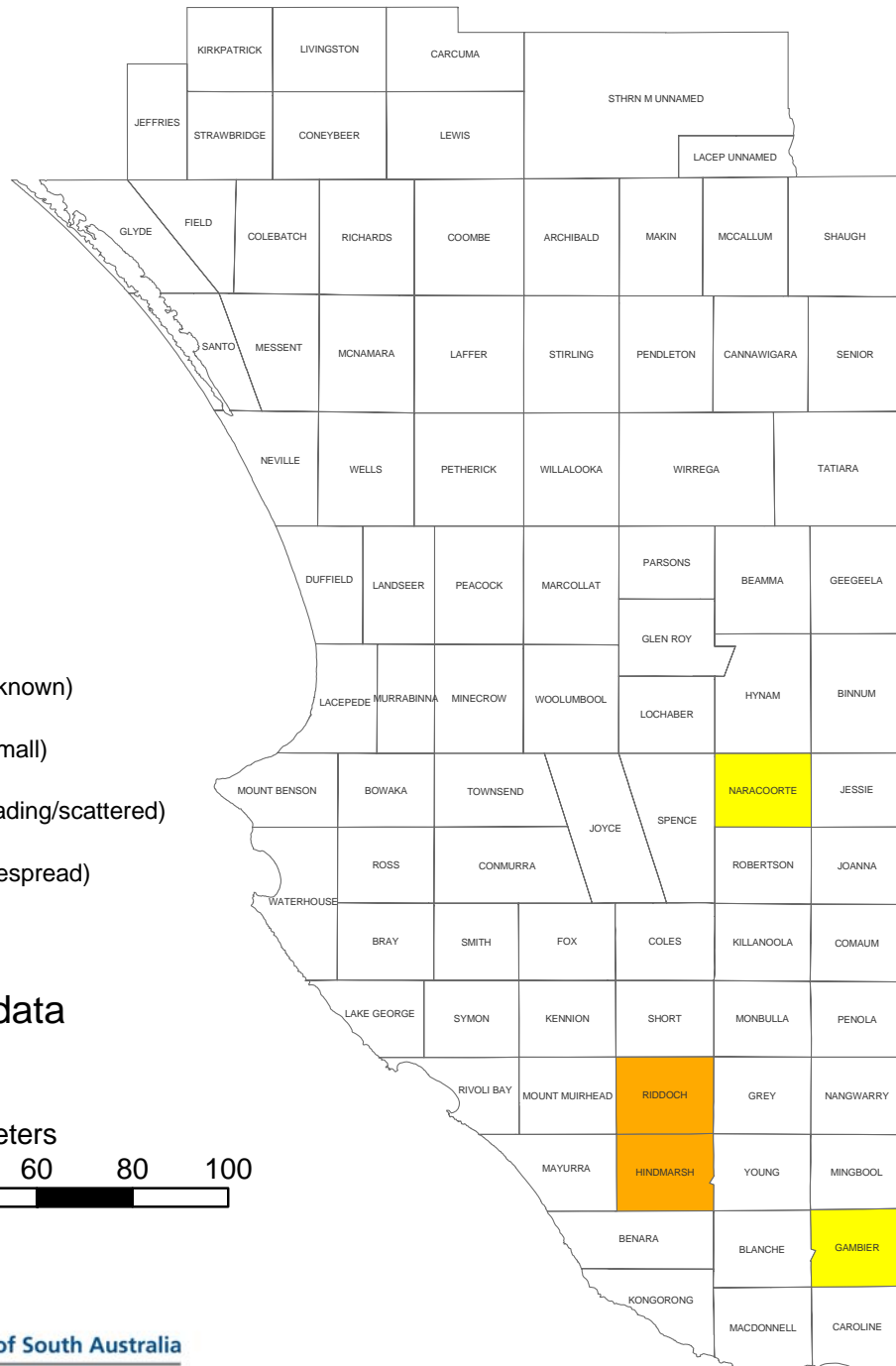
- Plants can be hand pulled or dug out but ensure all roots are removed to prevent regrowth.
- Cut and swab or spraying is an effective method for larger plants during spring and autumn.
- Where plants are growing among native vegetation, stems can be cut off at the base and destroyed, then the regrowth which will form from the base can be treated later.

### **Current management programs**

- Bluebell creeper is not a Proclaimed Plant.
- There is currently no coordinated regional program.
- Site specific control works occur in some conservation areas.
- This weed is a major issue for native vegetation and forestry landuses.



# Current Distribution of *Sollya heterophylla* (BLUEBELL CREEPER) within Hundreds in the South-East of South Australia.\*



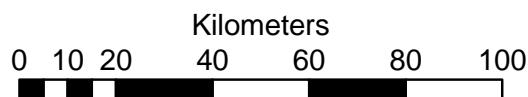
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2005 data



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## ***Boneseed - Chrysanthemoides monilifera***

**Origin** A perennial shrub introduced from South Africa as an ornamental garden plant.

### **Description**

- Boneseed is an erect perennial shrub to 2m, or much taller in sheltered sites, with a woody trunk and bright
- yellow, daisy-like flowers.
- Leaves are 3- 8 cm long, bright green, waxy with irregularly shallow-toothed edges.
- The fruits of boneseed are dry berries 6-8mm in diameter; they are green at first, turn black and then flake off to
- show the hard white inner coat.
- Each fruit holds one seed which is bone coloured and very hard.

### **Impacts**

- The hard seed coat allows seed to remain dormant in the soil for many years
- with only some germinating each year.
- A fire will stimulate all the seed to germinate at once.
- Birds are a major method of spread as they eat the fruit of boneseed and transport it to other locations. Rabbits, foxes, and cattle also eat the fruit and spread the seeds in their droppings
- Boneseed will establish most readily on disturbed sites such as cleared, cultivated or burnt areas. It is invasive due to its rapid rate of growth, large seed store in the soil and ability to regenerate after fire.
- Boneseed may have allelopathic properties that prevent some plants from growing near it.
- Dense stands of boneseed drastically alter the habitat of native birds and animals.

**Distribution** Boneseed is highly invasive and will establish in almost any situation. It prefers sandy soils and can tolerate saline coastal conditions.  
See map on facing page for current known distribution in the South East.

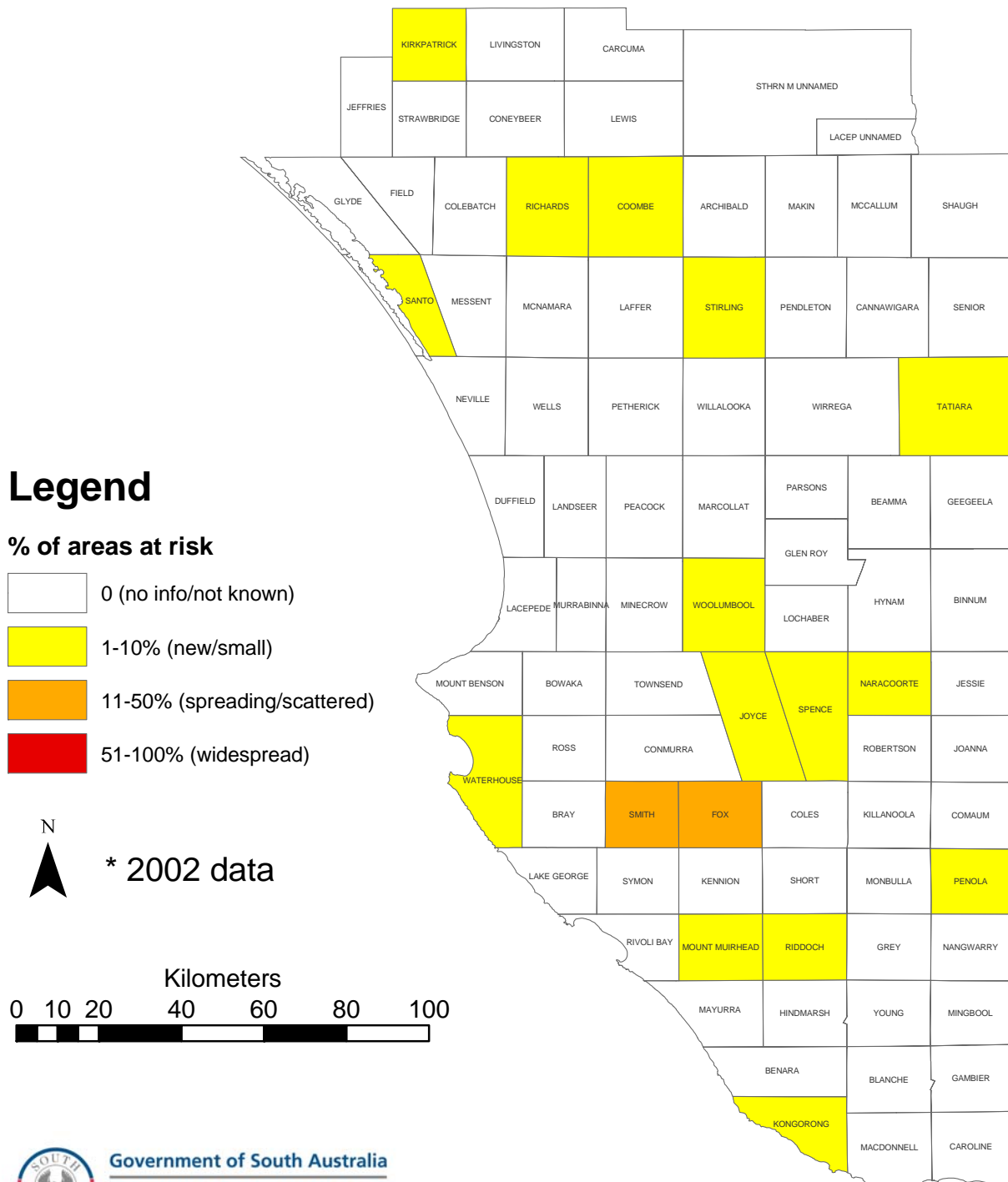
### **Control techniques**

- Physical removal of plants is the best method of control.
- The cut stump method is effective if soil disturbance needs to be avoided.
- Boneseed can be effectively treated with metsulfuron methyl.
- All control methods will require follow up measure to treat germination of seedlings.

### **Current management programs**

- Boneseed is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies.
- Site specific control works occur in some conservation areas.
- This weed is a major issue for vegetation and forestry landuses.

# Current Distribution of *Chrysanthemoides monilifera* (BONESEED) within Hundreds in the South-East of South Australia.\*



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## ***Bridal creeper (western cape form) – Asparagus asparagoides***

**Origin** A climbing perennial herb originating from South Africa

### **Description**

- A winter growing climbing herb to about 3m with glossy green leaves.
- Reproduces from tubers which form a dense mat under the ground
- Stems are slender and branching and twining. Leaves are broadly ovate but sharply pointed on the end, alternating along the stem.
- Flowers are greenish white which produce a red sticky berry. Bridal creeper also reproduces from seeds which are black, shiny and oval shaped.
- Plants become dormant and foliage dies off over summer.
- The western cape form has larger and darker leaves than the ordinary form and stems have a triangular cross section.

### **Impacts**

- Bridal creeper is capable of eliminating the entire under story of a natural ecosystem by shading other plants and strongly competing for moisture and nutrients.
- It tolerates heavy shade and can germinate and establish in dense natural bush.
- It can replace native species due to its rapid growth and ability to form a canopy over much taller plants.

### **Distribution**

A highly invasive weed of native vegetation, open woodlands and neglected areas.

The full distribution of the western cape form in the South East is not yet known.

See map on facing page for current known distribution in the South East.

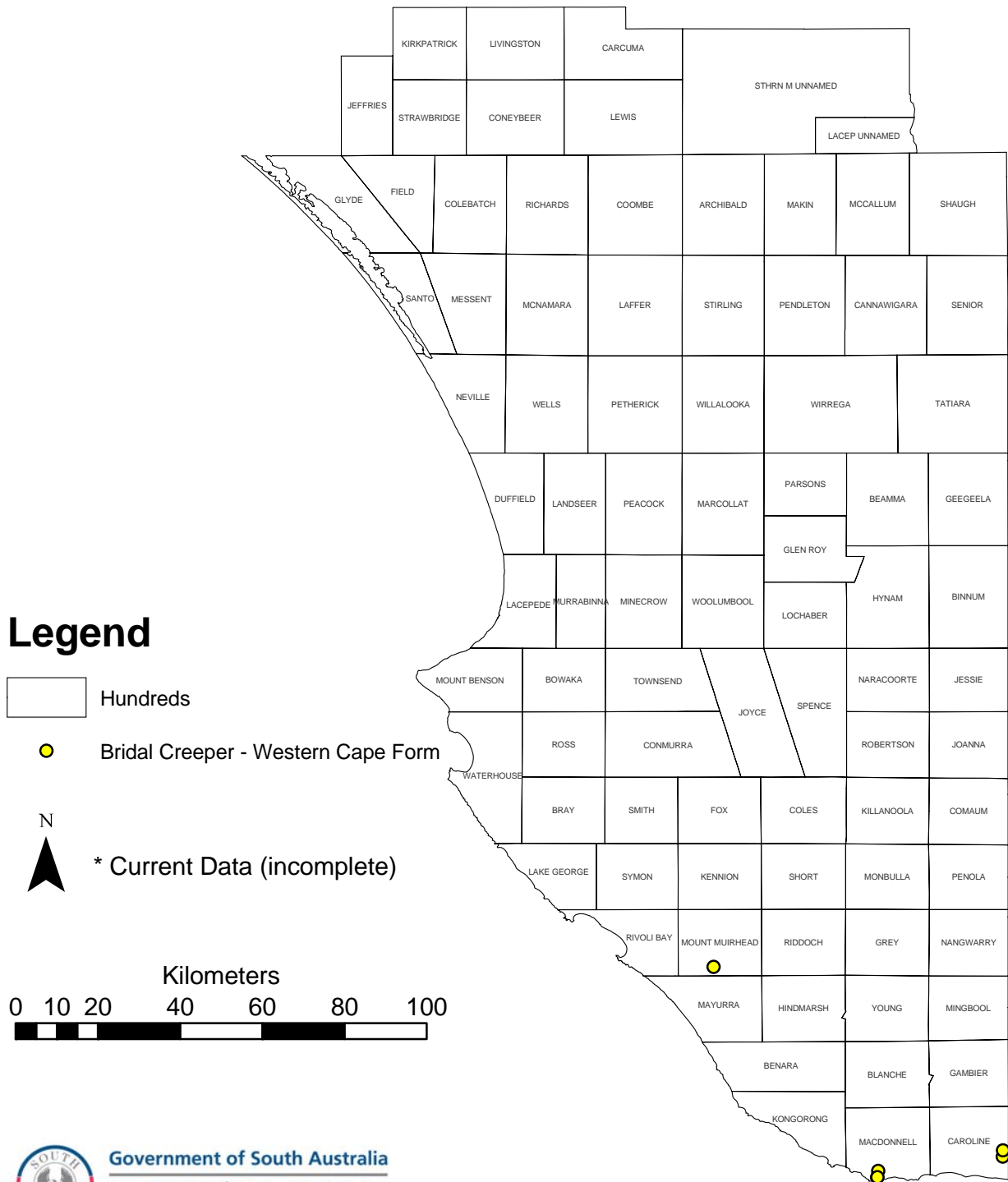
### **Control techniques**

- Western cape form of bridal creeper is resistant to the current biocontrol agents that are effective on the normal form.
- Rhizomes and tubers can be dug up and burnt.
- Bridal creeper can be sprayed while actively growing with metsulfuron methyl and penetrant.
- All sites will need to be monitored for regrowth.

### **Current management programs**

- Bridal creeper is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however a project is about to commence to determine the full extent of the distribution of the western cape form.
- This weed is a major issue for vegetation.

# Current Distribution of *Asparagus asparagoides* (BRIDAL CREEPER - WESTERN CAPE FORM) within Hundreds in the South-East of South Australia.\*



## ***Buckthorn – Rhamnus alaternus***

**Origin** A large, dense shrub originating from the Mediterranean

**Description**

- Buckthorn has leathery, dark green leaves with a paler underside that are roughly oval shaped. They have prominent veins and the margins are finely serrated.
- Stems are smooth with fine hairs when young and then becoming grey-brown with age.
- Flowers are yellow green in colour, have five petals and are star shaped. They form in small clusters over late winter and into spring.
- The fruit is a red berry which changes to black over summer.
- Buckthorn has a thick, branching taproot.

**Impacts**

- Buckthorn is an invasive weed of all natural environments.
- The dense shade produced by buckthorn can shade out the lower level plants in an ecosystem. The large form also crowds the growth of larger native plants and will eventually prevent regeneration.

**Distribution**

Buckthorn is highly adaptable and will establish in all shade conditions, a range of soil types and will tolerate seasonal dry spells. Plants are often found at the base of trees where birds have deposited the seeds.  
See map on facing page for current known distribution in the South East.

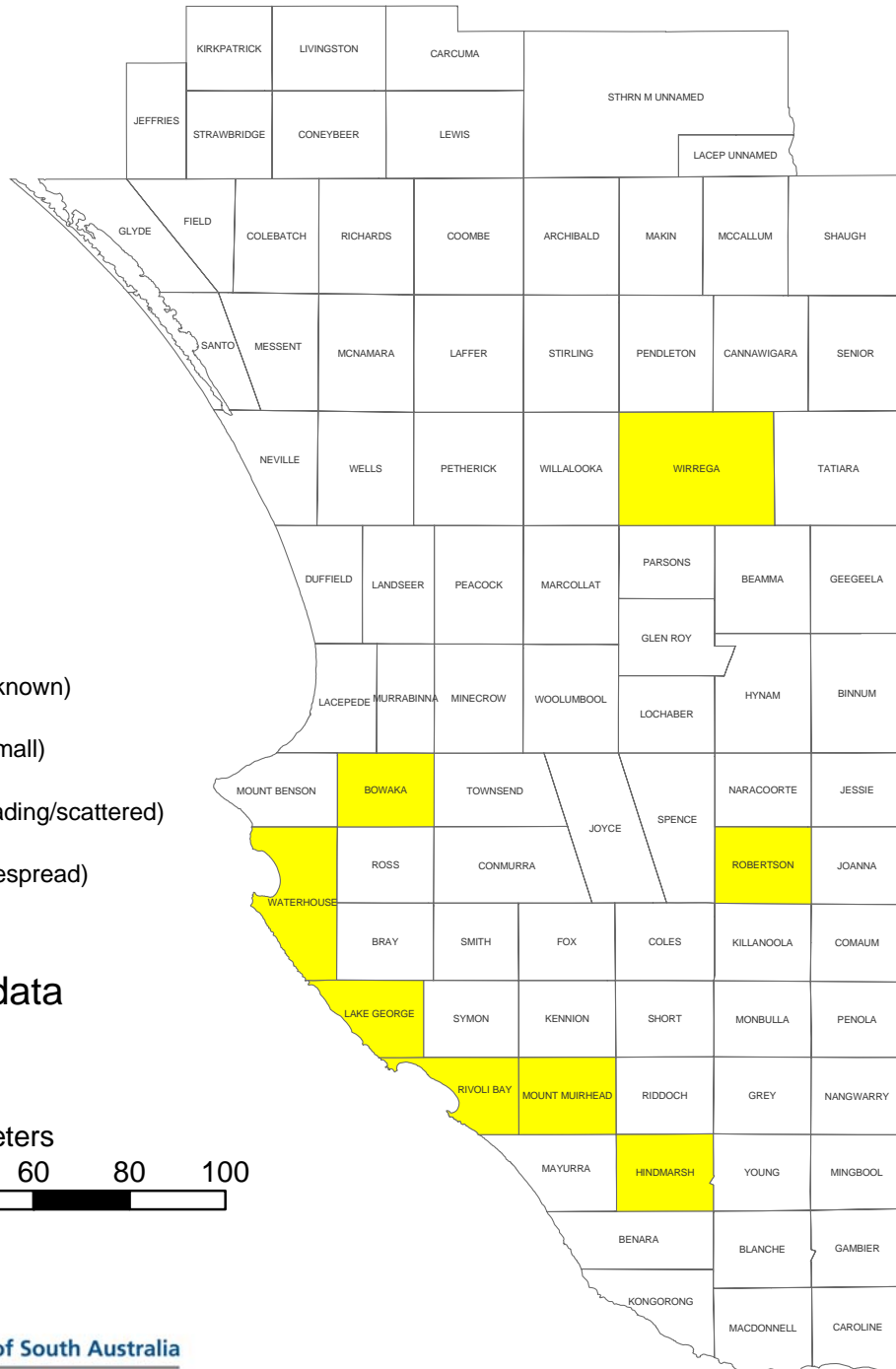
**Control techniques**

- Seedlings and small plants can be hand pulled.
- Mature plants can be cut and swabbed or sprayed.
- Monitoring will be required as buckthorn readily reshoots from the base.

**Current management programs**

- Buckthorn is not a Proclaimed Plant.
- There is currently no coordinated regional program.
- Site specific control works occur in some conservation areas.
- This weed is a major issue for native vegetation.

# Current Distribution of *Rhammus alaternus* (BUCKTHORN) within Hundreds in the South-East of South Australia.\*



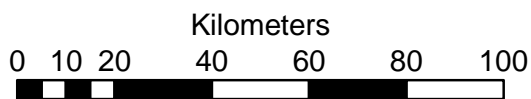
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2005 data



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## ***Caltrop - Tribulus terrestris***

**Origin** A summer growing weed introduced from southern Europe.

### **Description**

- Caltrop is a prostrate annual herb that reproduces from seed.
- Stems are green to red-brown and may be smooth or covered in fine hairs.
- The upper surfaces of the leaves are grey-green and the undersides are paler.
- Flowers are 8 to 15 mm in diameter with five bright yellow petals.
- The fruit is a woody burr about 1 cm diameter with sharp rigid spines, which can reach 6 mm long
- Seeds germinate after late spring and summer rains and the plant grows rapidly.

### **Impacts**

- Caltrop is mainly spread by seed, which are moved when the fruits attach to animals, humans and machinery.
- The burrs of caltrop can damage the feet of animals and injure humans.
- Burrs can also contaminate produce such as dried fruit and wool.
- Caltrop is toxic to stock and can cause nitrate poisoning, photosensitization and staggers.
- Caltrop may also chemically inhibit the growth of some other plants.

### **Distribution**

Caltrop is most abundant on light sandy soils but will grow on almost any soil type.

See map on facing page for current known distribution in the South East

### **Control techniques**

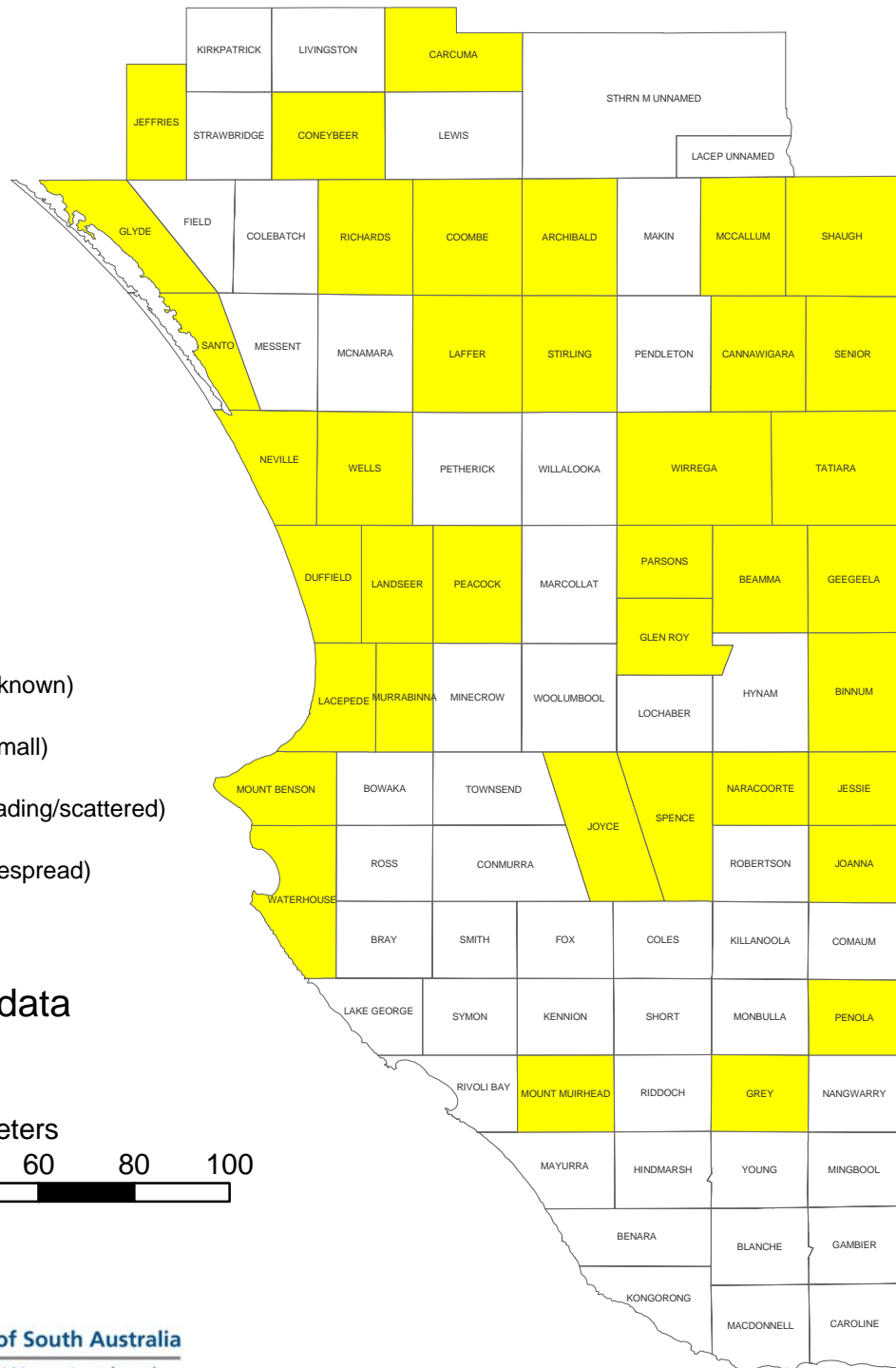
- The use of herbicides when small before flowering with glyphosate, 2 4, D or MCPA.
- Grubbing small infestations is highly effective before the plant sets seed

### **Current management programs**

- Caltrop is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for grazing, irrigated crops & pastures and perennial horticulture landuses.



# Current Distribution of *Tribulus terrestris* (CALTROP) within Hundreds in the South-East of South Australia.\*



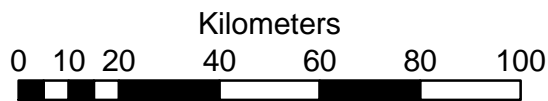
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2002 data



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## ***Cape broom - Genista monspessulana***

**Origin** A evergreen shrub introduced from the Mediterranean as an ornamental garden plant.

### **Description**

- An erect, evergreen shrub to 3m tall which reproduces by seed.
- There is normally one main stem with many branches which are finely hairy and later become woody.
- The leaves consist of three leaflets which are hairy on the underside and the middle one is longer than the others, up to 3cm.
- Flowers are bright yellow, 1.2 cm long and shaped like pea flowers.
- The fruit is a flat pod covered with silky hairs, containing 5-8 seeds, and black or brown when ripe.
- Cape broom has a branched taproot with many shallow lateral roots.

### **Impacts**

- Cape broom is an invasive species of native vegetation and its dense growth excludes desired plants, which reduces biodiversity while harbouring feral animals.
- It can also encroach into pasture paddocks resulting in lower carrying capacity.
- It is a major problem in forestry where its thickets increase the fire hazard along the edges of plantations.

**Distribution** Cape broom grows on a wide range of soils but does best on sandy soils. See map on facing page for current known distribution in the South East.

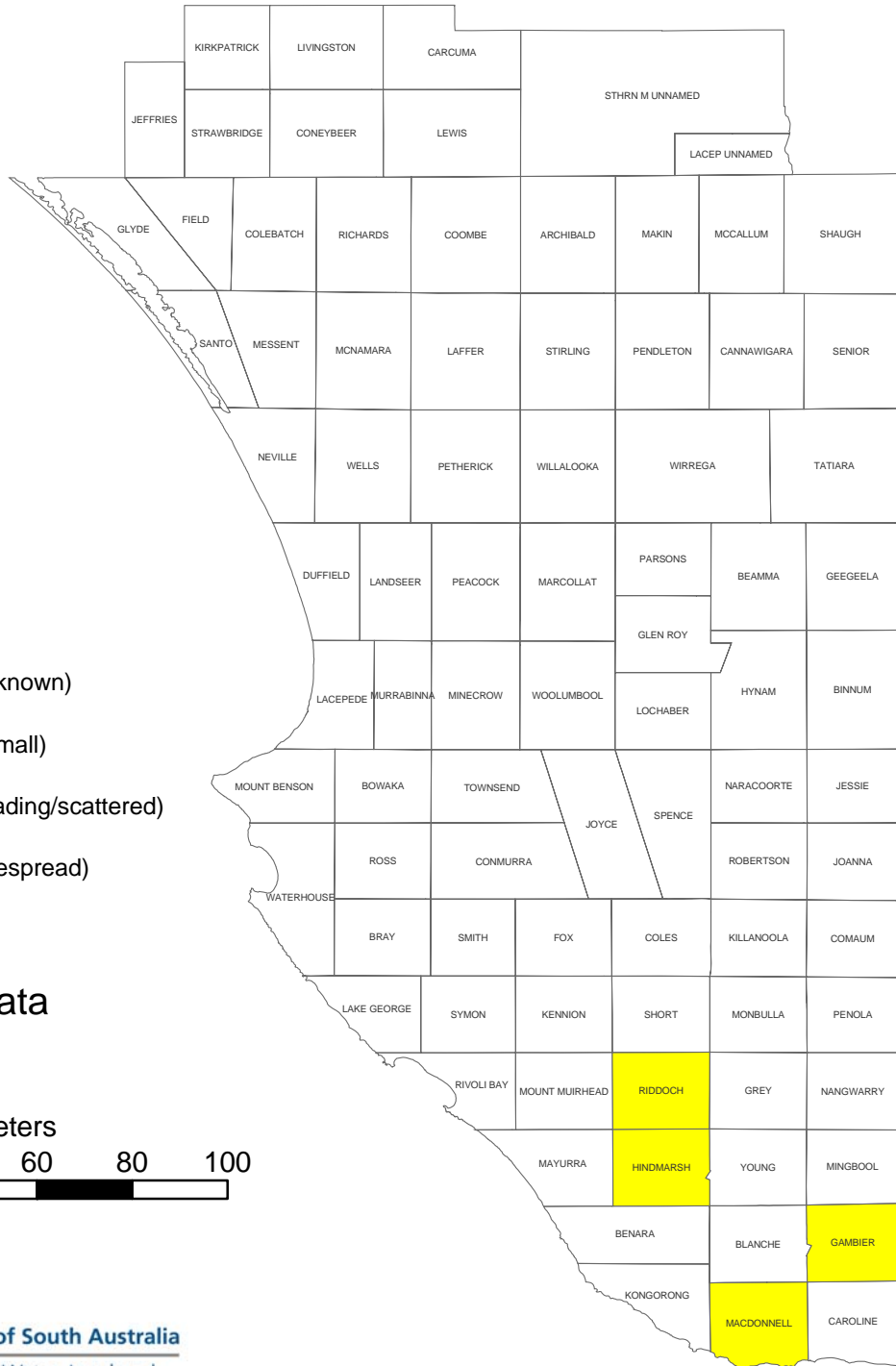
### **Control techniques**

- Seedlings and small plants are easily hand pulled
- Larger plants can be mechanically removed using heavy machinery
- Cut and swab using glyphosate

### **Current management programs**

- Cape broom is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies.
- This weed is a major issue for native vegetation and forestry landuses.

# Current Distribution of *Genista monspessulana* (CAPE BROOM) within Hundreds in the South-East of South Australia.\*



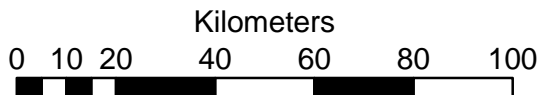
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2002 data



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## ***Coastal tea tree – Leptospermum laevigatum***

**Origin** Native to Victoria, Tasmania and New South Wales

### **Description**

- A large shrub or small tree to 4m. The trunk is short, thick and usually crooked.
- Leaves to 2cm long, broad, flat and blue-green to grey.
- Stems are aromatic, producing a smell like eucalyptus oil when crushed.
- Flowers are 15-20mm in diameter, with 5 white petals and numerous stamens. Flowering occurs from late winter to spring.
- Fruits are a flat-topped, cup-shaped capsule, 7-8mm across. They contain 8-12 valves that release lots of slender seeds when opened.

### **Impacts**

- Seral species stabilise coastal dunes. Within its original range, even slight disturbance such as changed fire regime can make the *L. laevigatum* community expand at the expense of the adjoining coastal heath, which represents a later stage of the sere.
- *L. laevigatum* behaves in the same way in South East SA where it has been introduced.
- Highly inflammable.
- Dense infestations replace indigenous communities and provide harbour for vermin.

### **Distribution**

Coastal tea tree prefers acid to neutral sandy soils and does not establish well in dense shade.  
See map on facing page for current known distribution in the South East.

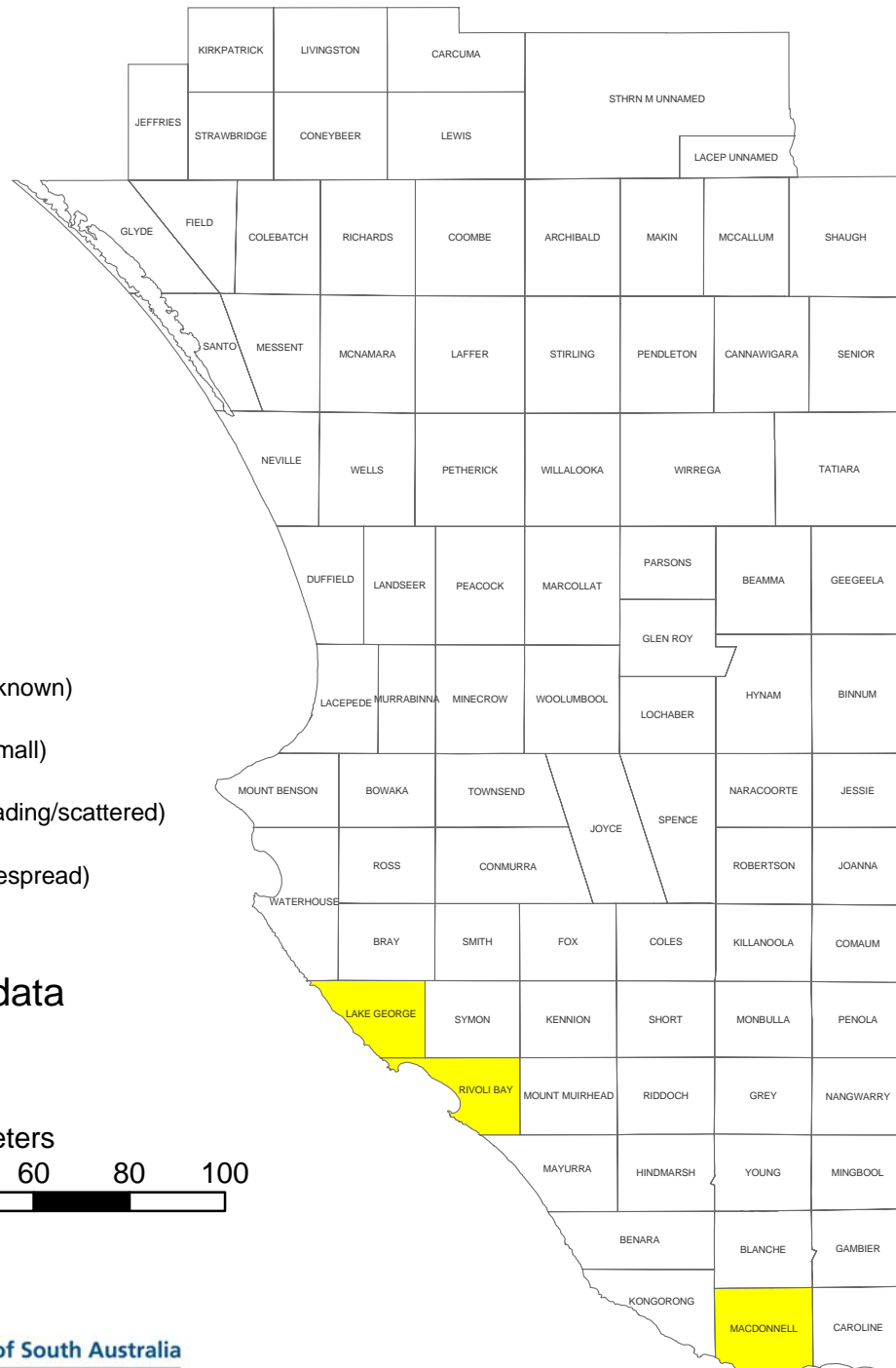
### **Control techniques**

- No herbicide treatments registered.
- Mechanical removal can be effective.

### **Current management programs**

- Coastal tea tree is not a Proclaimed Plant.
- There is currently no coordinated regional program.
- This weed is a major issue for native vegetation.

# Current Distribution of *Leptospermum laevigatum* (COASTAL TEA TREE) within Hundreds in the South-East of South Australia.\*



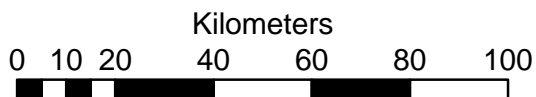
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2005 data



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## ***Dolichos pea – Dipogon lignosus***

**Origin** A woody perennial climber introduced from South Africa

### **Description**

- A woody, rope-like stem at maturity with thinner, dark coloured stems on new growth and young plants.
- Leaves appear alternately along stem and are darker on the top side than the underside. Each leaf has three leaflets which are longer than they are wider and taper to a sharp point at the end.
- Flowers are pink, purple or white and pea shaped. They form in clusters over spring.
- The fruit pod is 20-40mm long and 5-10mm wide, ripens in summer and contains 3 – 6 black seeds. It is a prolific seeder.

### **Impacts**

- Dolichos pea is a highly invasive climber capable of establishing in dense native vegetation.
- Infestations can smother all under story plants and climb over mature trees.
- The shading and competition caused by this weed can prevent regeneration of native species.
- It also fixes nitrogen which may affect the persistence of native species that may not tolerate higher soil nitrogen levels.

**Distribution** A highly vigorous weed that can tolerate a range of environments including coastal areas. Dolichos pea is spread by seed only.  
See map on facing page for current known distribution in the South East.

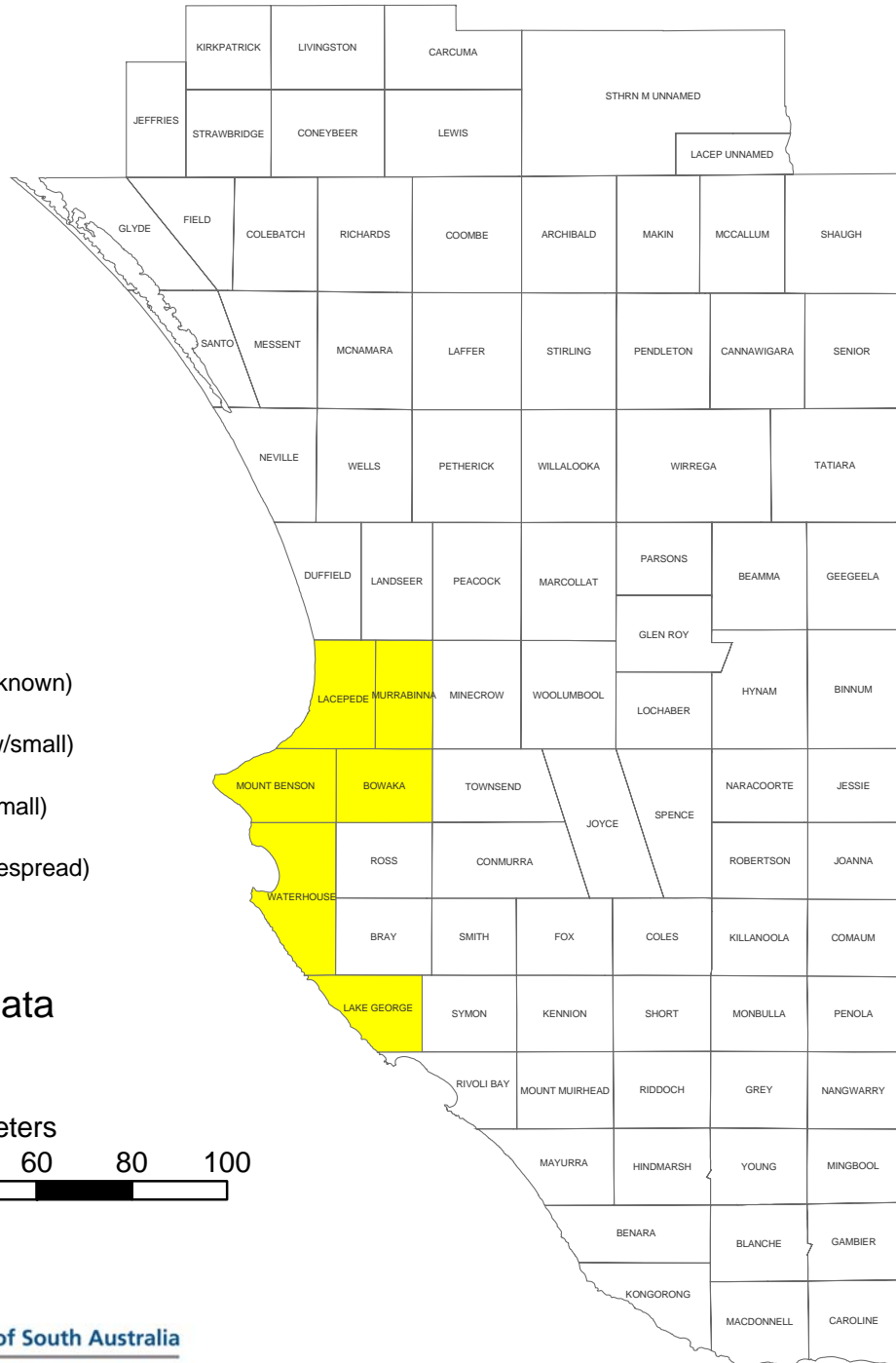
### **Control techniques**

- Plants can be hand pulled or dug out but ensure all roots are removed to prevent regrowth.
- Cut and swab or spraying is an effective method for larger plants during spring and autumn.
- Where plants are growing among native vegetation, stems can be cut off at the base and destroyed, then the regrowth which will form from the base can be treated later.

### **Current management programs**

- Dolichos pea is not a Proclaimed Plant.
- There is currently no coordinated regional program.
- This weed is a major issue for native vegetation.

# Current Distribution of *Dipogon lignosus* (DOLICHOS PEA) within Hundreds in the South-East of South Australia.\*



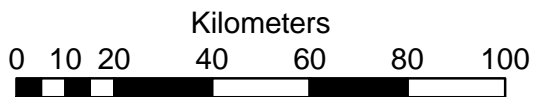
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1; 1-10% (new/small)
- 1-10% (new/small)
- 51-100% (widespread)



\* 2005 data



Government of South Australia

Department of Water, Land and Biodiversity Conservation

## **Gazania – *Gazania* spp**

**Origin** *Gazania linearis* and *G. rigens*, both introduced from South Africa.

### **Description**

- Perennial herbs with tough leaves present all year.
- Ground-cover plant with creeping stems (*G. rigens*); or forming tussocks (*G. linearis*).
- Leaves green above, whitish below.
- Yellow daisy-type flower heads which can also be orange or red in cultivars of *G. linearis*

### **Impacts**

- Spread into cleared vacant land and native vegetation from wind-blown seed
- Competitive impact on native species has not been assessed.
- Aesthetically objectionable due to their conspicuous flowerheads.
- Spreads readily from seeds and from deliberate planting in gardens

### **Distribution**

*Gazania* prefers sandy soils in open environments and is found in nearly all coastal towns in the South East  
See map on facing page for current known distribution in the South East.

### **Control techniques**

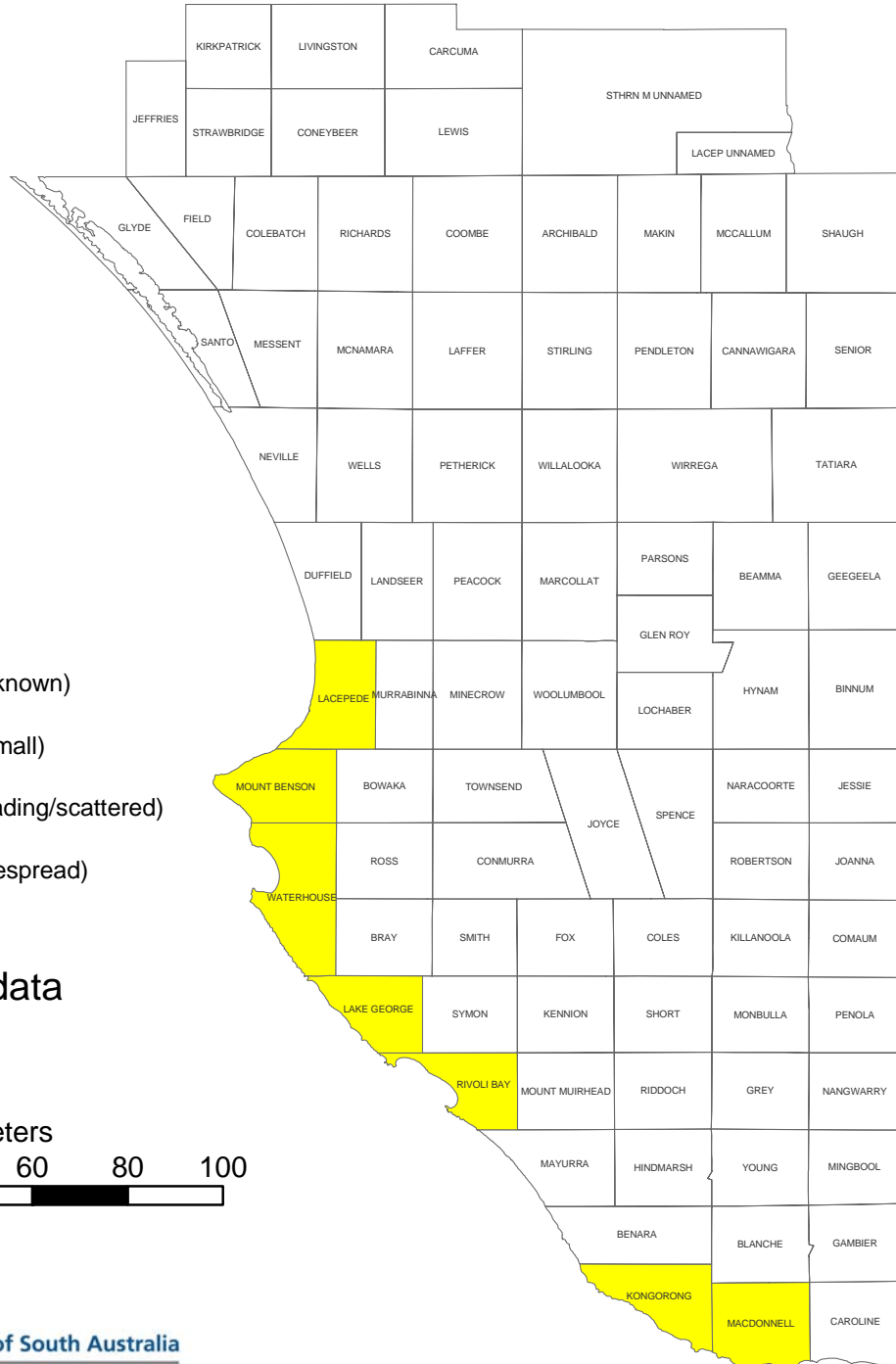
- No herbicide treatments registered.
- Individual plants may be hand pulled.

### **Current management programs**

- *Gazania* is not a Proclaimed Plant.
- There is currently no coordinated regional program.
- Site specific control works occur in some conservation areas.
- This weed is a major issue for native vegetation.



# Current Distribution of *Gazania* spp. (GAZANIA) within Hundreds in the South-East of South Australia.\*



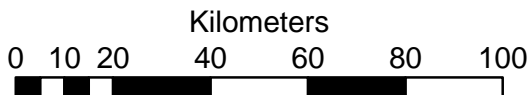
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2005 data



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Department of Water, Land and  
Biodiversity Conservation

## ***Golden dodder- Cuscuta campestris***

**Origin** Dodder is an annual summer growing parasitic weed introduced from the USA

### **Description**

- Golden dodder has yellow stems, which attach to host plants with small suckers which penetrate the leaves and stems of the host plant.
- Flowers are white, cream or pink, bell shaped.
- The fruits are the same size as the flowers, minus the petals and contain up to 4 seeds.
- The seeds can remain viable for up to 60 years in good conditions
- Twining stems grow rapidly over the host plant, flowering and seed set can begin in a matter of weeks and continue for months.

### **Impacts**

- Dispersal of dodder is mostly by seed which can contaminate harvested seed and then be sown elsewhere.
- Dodder seed can also be transported by animals and deposited in their droppings.
- Didders parasitise only broadleaf plants including lucerne, vegetables and weeds like Bathurst burr and wireweed. The dodder absorbs all its nutrients and water from the host plant and also shades the crop with its dense mass of stems. This reduces crop yields significantly. Infested areas may be quarantined, causing significant financial loss and inconvenience.

### **Distribution**

Golden dodder has two key requirements for distribution, it must have moisture over summer and the presence of suitable host plants.

Golden dodder is currently known in two isolated infestations in the Upper South East.

See map on facing page for current known distribution in the South East

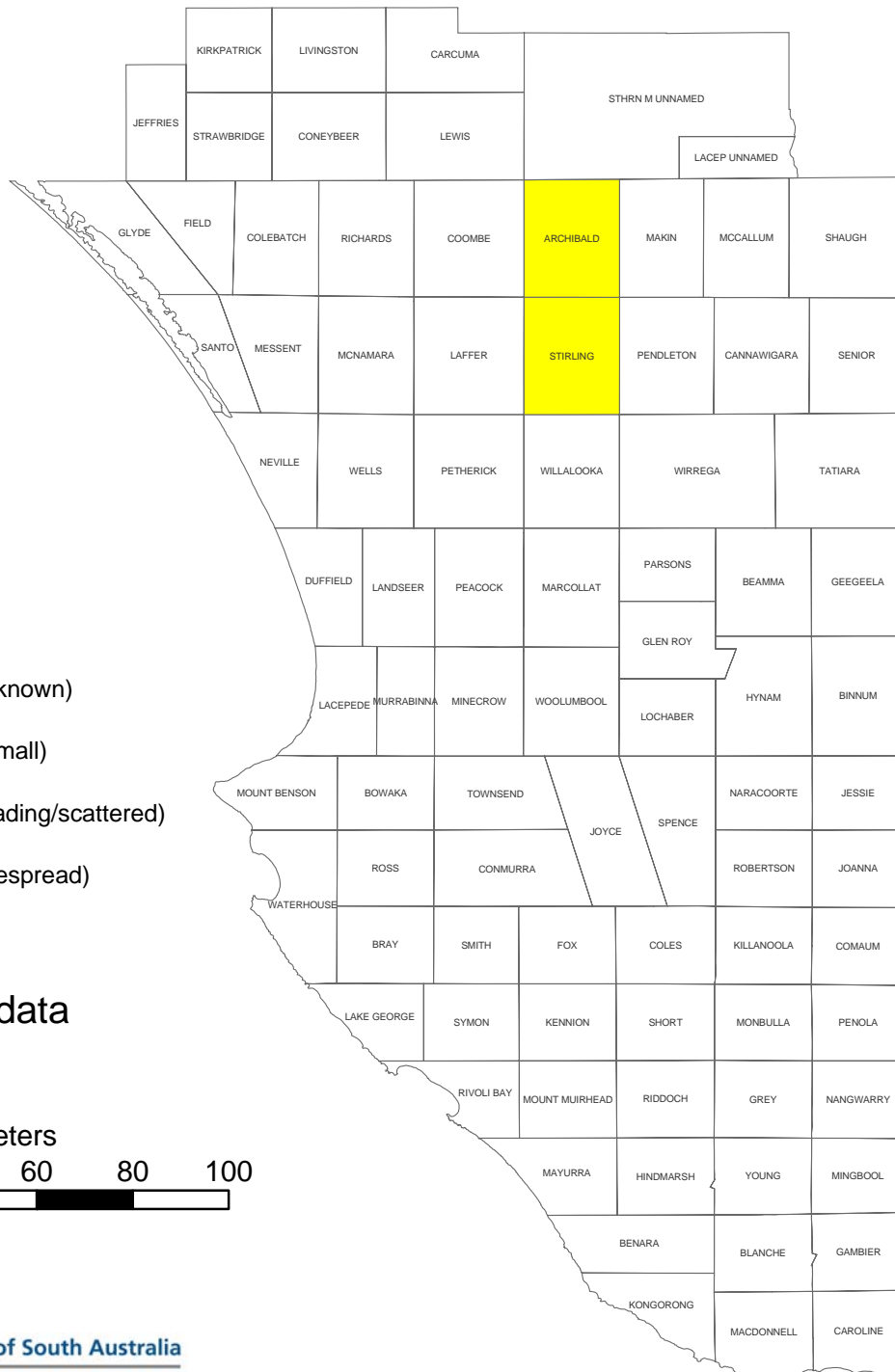
### **Control techniques**

- Herbicide treatments are effective but require the destruction of the host plant.
- Burning is also successful in destroying seed stores if the fire is hot enough.

### **Current management programs**

- Golden dodder is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however affected land managers are successfully controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for cropping and irrigated crops and pastures.

# Current Distribution of *Cuscuta campestris* (GOLDEN DODDER) within Hundreds in the South-East of South Australia.\*



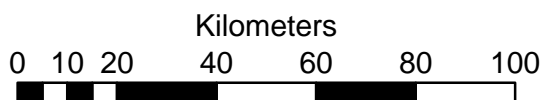
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2002 data



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## ***Golden wreath wattle – Acacia saligna***

**Origin** A large spreading shrub originating from Western Australia

### **Description**

- Stems are smooth and flat and orange – green in colour when young, becoming grey and roughened with age.
- Leaves are dark bluish green with a lighter mid vein. The shape and size varies but is generally long and thin and can be curved or wavy. Average size is 8-30cm long and 1-6cm wide.
- Flowers are dark yellow and form in ball shaped clusters. Appearing in spring.
- The fruit is a long (6-14cm) light brown pod containing 4 – 10 seeds. It is a prolific seeder.
- Roots grow quickly into a woody and branching system.

### **Impacts**

- Golden wreath wattle is highly invasive and can overtake entire ecosystems.
- It can fix nitrogen and therefore change soil fertility.
- Dense infestations will shade out other small plants and crowd the growth of larger native species.
- Regeneration can be severely reduced under thick infestations of Golden wreath wattle.

### **Distribution**

Golden wreath wattle has been planted extensively in gardens and tolerates a wide range of conditions.

See map on facing page for current known distribution in the South East.

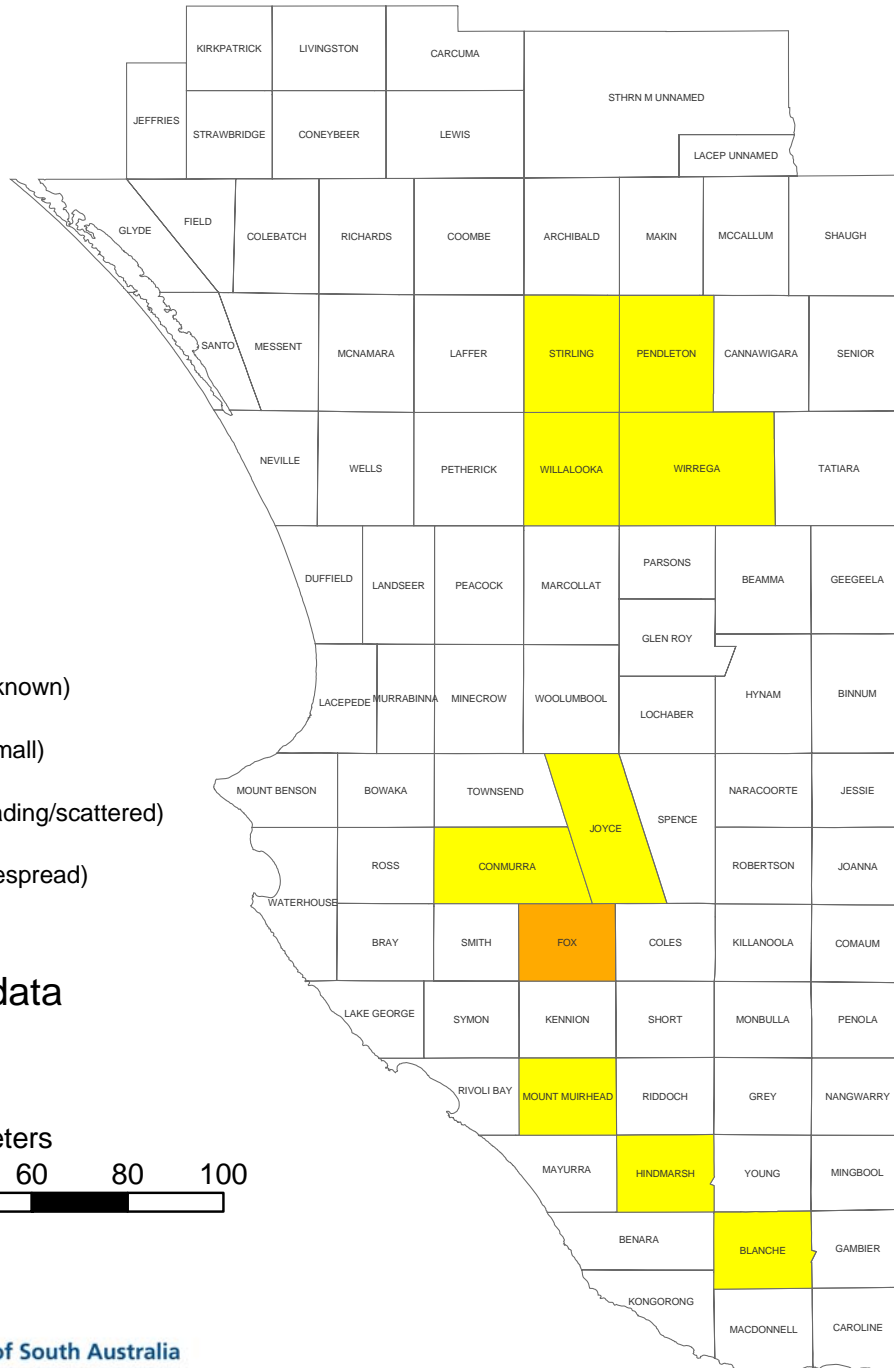
### **Control techniques**

- Seedlings and small plants can be effectively hand pulled
- Mature plants can be simply ring barked or cut down as they don't generally reshoot.
- Fire kills native plants but will stimulate germination

### **Current management programs**

- Golden wreath wattle is not a Proclaimed Plant.
- There is currently no coordinated regional program.
- Site-specific control works occur in some conservation areas.
- This weed is a major issue for native vegetation.

# Current Distribution of *Acacia saligna* (GOLDEN WREATH WATTLE) within Hundreds in the South-East of South Australia.\*



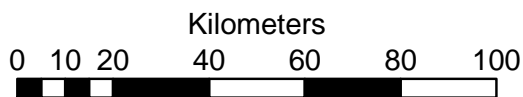
## Legend

% of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2005 data



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## ***Gorse - Ulex europaeus***

**Origin** A perennial spiny shrub introduced from Europe as a hedge plant.

### **Description**

- A shrub which can reach 4m tall and 3m across.
- Young growth is green and older shoots become brown and woody.
- Leaves are dark green, hairy, narrow, spine-like.
- Flowers are bright yellow, pea-shaped and about 2cm long.
- The fruit is a dark pod, covered in dense hair and containing 2-6 seeds.
- Seed can remain dormant but viable for 75 years or longer, building up a huge seed bank in the soil.

### **Impacts**

- Gorse is a major problem in native vegetation and forestry where plants compete strongly with young plants.
- It will also grow in pasture paddocks, resulting in lower carrying capacity and providing harbour for vermin.
- In the long term, soils under gorse become more acid and lose nutrients.

### **Distribution**

Gorse is not restricted to any particular soil type, but is most competitive on poor, alkaline soils. It requires at least 500 mm annual rainfall.  
See map on facing page for current known distribution in the South East.

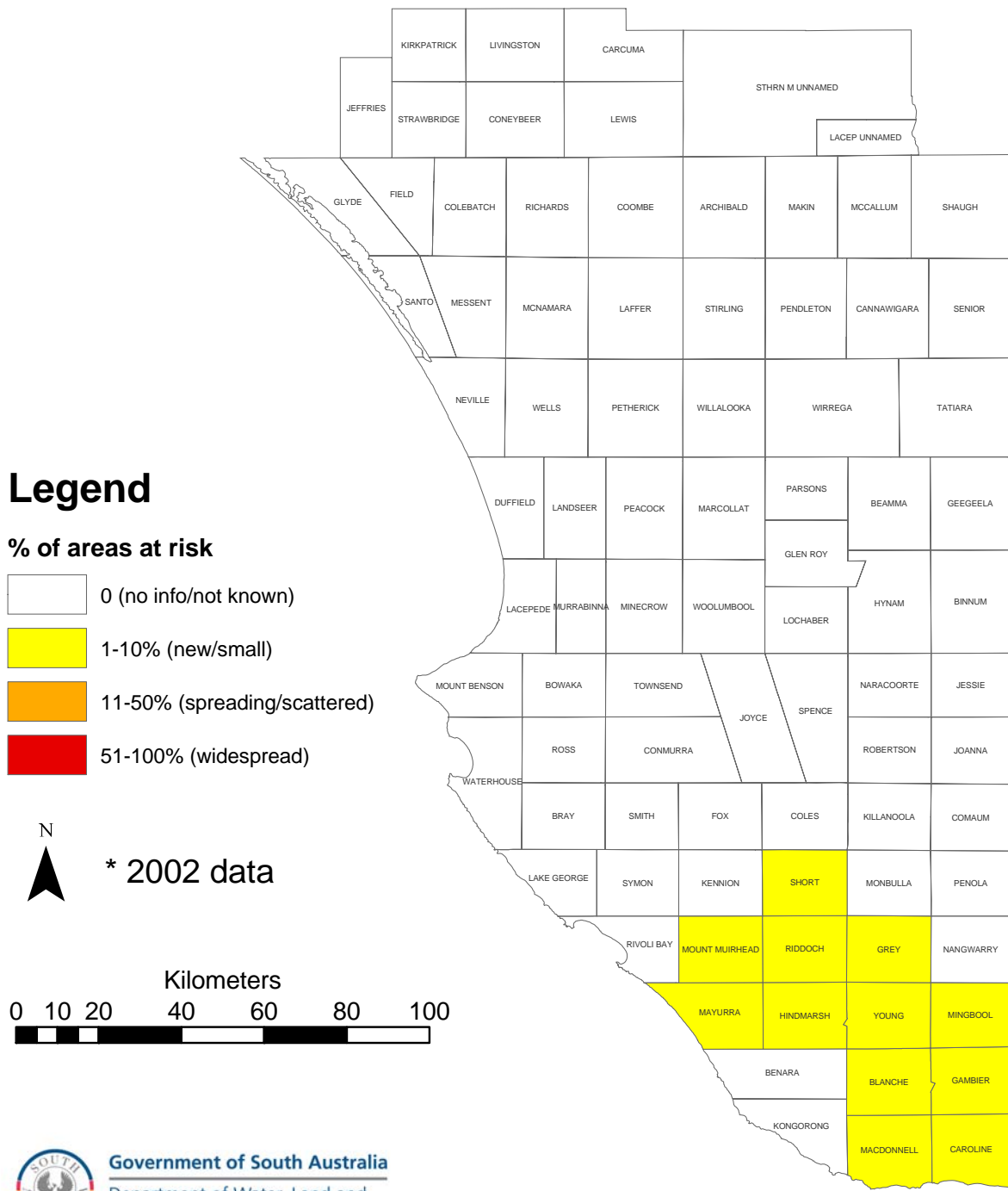
### **Control techniques**

- Physical removal of gorse is the best method.
- Herbicides such as glyphosate, triclopyr and metsulfuron methyl can be applied by hand spraying on actively growing plants.
- A mite biocontrol agent is present in the South East for gorse and is yet to show significant results.
- Burning is partially effective but will promote heavy germination.
- Follow up will always be required to treat regrowth and seedlings

### **Current management programs**

- Gorse is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for grazing and native vegetation landuses.

# Current Distribution of *Ulex europaeus* (GORSE) within Hundreds in the South-East of South Australia.\*



## ***Horehound – Marrubium vulgare***

**Origin** A perennial herb originated in southern and Western Europe, central and western Asia and North Africa

### **Description**

- A bushy perennial plant 30 to 80 cm high
- Sharply aromatic when crushed
- Leaves are wrinkled and blue-green colour and white woolly on the underside
- Flowers are white in clusters and dry to form burrs with hooked spines

### **Impacts**

- A widespread weed of pastures and waste lands
- Unpalatable to stock, it can taint the meat of animals
- The burrs contaminate wool and are spread by sheep

**Distribution** Horehound favours the alkaline limestone ridges of the South East but can grow in any soil and rainfall situation.  
See map on facing page for current known distribution in the South East.

### **Control techniques**

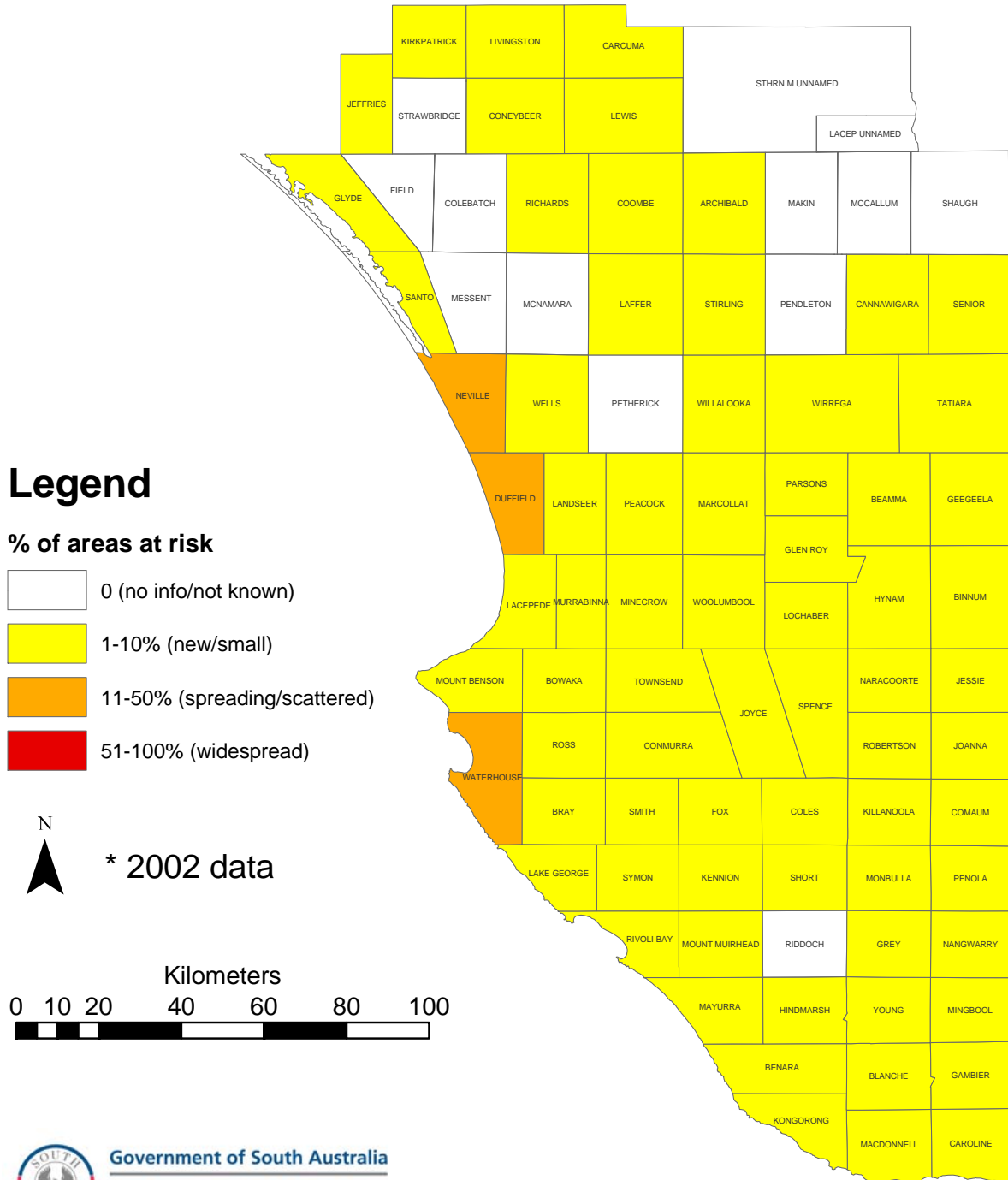
- Spray before flowering with metsulfuron methyl or 2,4-D amine or MCPA and metsulfuron methyl mix.
- The horehound plume moth is an effective biocontrol agent present in the region.

### **Current management programs**

- Horehound is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for grazing landuses.



# Current Distribution of *Marrubium vulgare* (HOREHOUND) within Hundreds in the South-East of South Australia.\*



## ***Innocent weed - Cenchrus incertus and Cenchrus longispinus***

**Origin** A summer-growing annual grass introduced from north and central America.

### **Description**

- Innocent weed is difficult to distinguish from other grasses until the burrs are formed.
- Leaves are flat, light green and 3-8 mm wide.
- The bases of the stems have a reddish colour and are bent.
- The flowering head at the end of an erect stem up to 80 cm tall produces up to 40 burrs, with microscopic barbs.
- Seeds germinate mainly in spring and early summer after rain but germination can also occur at other times of the year.

### **Impacts**

- The burrs of innocent weed contaminate wool, adding.
- Their needle-sharp spines also cause physical damage to livestock and people.
- The burrs can also contaminate crops and produce and are easily carried on clothing, packaging and vehicle tyres,
- The hooked spines on the burrs are well adapted for dispersal on animals by clinging to wool and fur.
- Contaminated hay and produce is a common method of spread for innocent weed.

### **Distribution**

Innocent weed grows well on disturbed sandy ground and under irrigation and will not establish well in managed pastures.

See map on facing page for current known distribution in the South East.

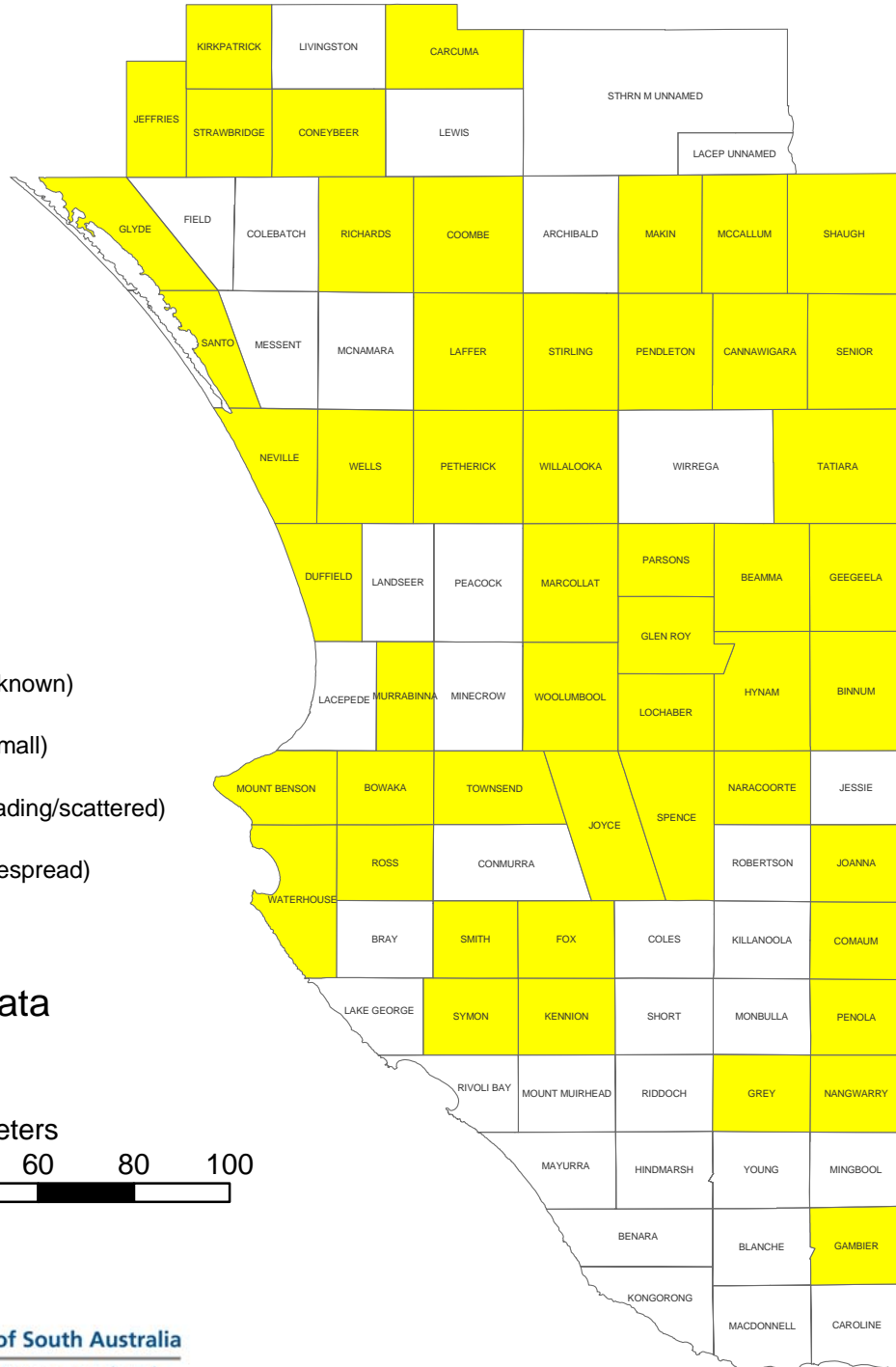
### **Control techniques**

- Herbicide treatments such as glyphosate and trifluralin are effective.
- Competitive pastures are a good way to prevent the establishment of innocent weed.
- Cultivation will kill plants but promote germination.

### **Current management programs**

- Innocent weed is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for irrigated crops and pastures, urban, grazing and perennial horticulture landuses.

# Current Distribution of *Cenchrus incertus* and *C. longispinus* (INNOCENT WEED) within Hundreds in the South-East of South Australia.\*



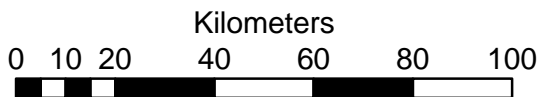
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2002 data



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## ***Khaki weed - Alternanthera pungens***

**Origin** A perennial groundcover herb introduced from South America.

### **Description**

- Khaki weed is a prostrate creeping herb that is normally perennial but may grow as an annual.
- Oval shaped green leaves are in pairs along the stem, ranging between 5 and 45 mm long. Flowers are very small, produced in clusters surrounded by spikey, straw-coloured bracts
- Seeds in the burrs are round, yellow and shiny, 1 to 2 mm long.
- Khaki weed can reproduce from seed, roots and by the stem nodes taking root.

### **Impacts**

- The burrs of khaki weed injure people and animals and contaminate wool.
- It can cause allergies in humans and may be poisonous to stock.
- It is a particular nuisance in amenity areas or lawns and to fruit pickers.

### **Distribution**

Khaki weed is a summer-growing perennial that prefers light soils, warm temperatures and plenty of moisture. It particularly favours areas like caravan parks that are watered in summer.

See map on facing page for current known distribution in the South East.

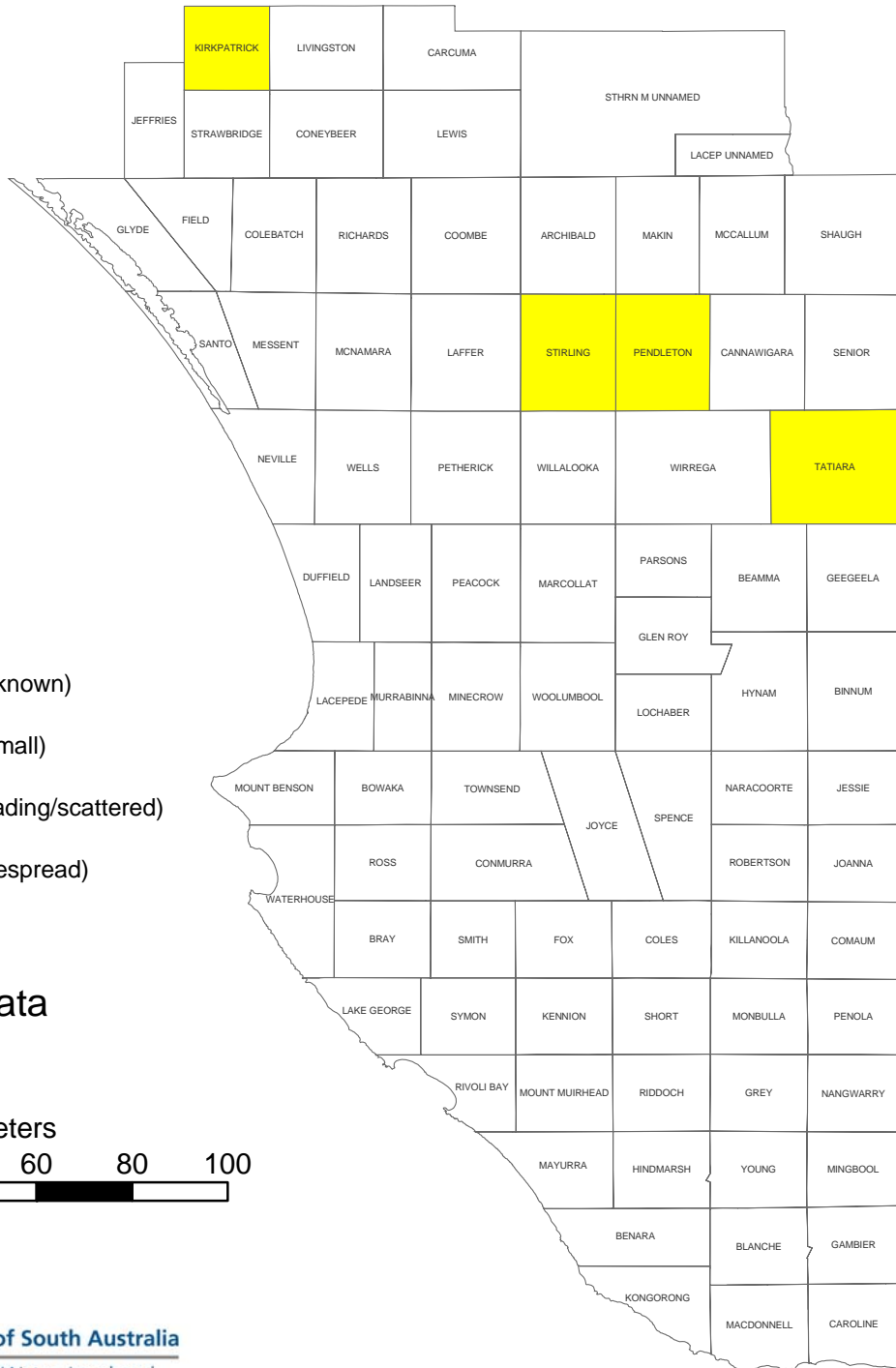
### **Control techniques**

- Handpulling of small infestations is most effective.
- 2,4-D, dicamba and amitrole are suitable herbicides to use on khaki weed.

### **Current management programs**

- Khaki weed is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for urban and irrigated crops and pastures landuses.

# Current Distribution of *Alternanthera pungens* (KHAKI WEED) within Hundreds in the South-East of South Australia.\*



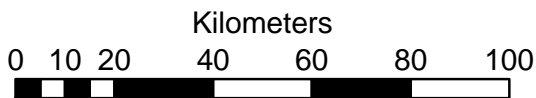
## Legend

### % of areas at risk

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- 51-100% (widespread)



\* 2002 data



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## ***Pampas grass – Cortaderia selloana***

**Origin** A perennial grass originated from South America

### **Description**

- A large tussock grass growing to a height of 2 – 6 metres
- Leaves are greyish with pale yellow base and rough serrated edges.
- Flowers in a dense panicle 25-100 cm on a stem to 3m
- Flower heads are feathery in appearance and are white to cream in colour.
- Has separate sexes. Female plants have spectacular white flowerheads and are widely planted in gardens. Male and hermaphrodite plants are less ornamental and are rarely grown.

### **Impacts**

- If a male or hermaphrodite plants are planted, all females in the area will start producing seed. This is spread by wind, and seedlings readily establish on bare ground.
- Can occupy pine plantations after harvesting and compete with the re-establishment of pine seedlings.
- Forming dense infestations changing the structure of the communities it invades.
- Provides nesting sites for European wasps and other pest animals.
- Leaves easily cut skin and cause skin irritation when handled.

### **Distribution**

A weed of most ecosystems, likes sunny places and disturbed places like roadsides.

See map on facing page for current known distribution in the South East.

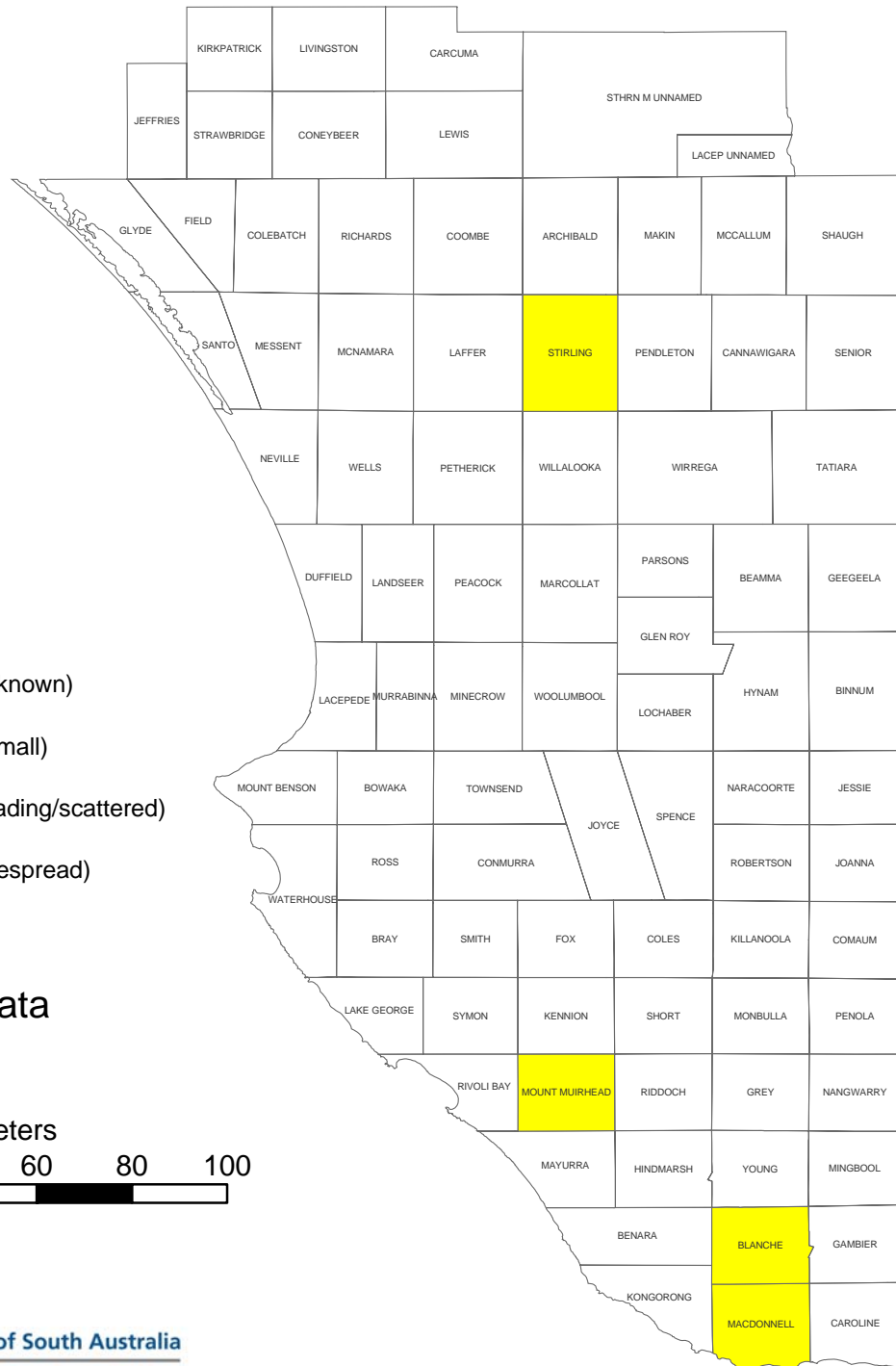
### **Control techniques**

- Remove any male or hermaphrodite plants if found. If solitary specimens in gardens, should be removed mechanically.
- Burning can be useful to remove mature growth and allow access to treat seedlings.
- Wild seedlings can be sprayed with 1:100 Roundup + Pulse when actively growing.

### **Current management programs**

- Pampas grass is not a Proclaimed Plant.
- There is currently no coordinated regional program.
- This weed is a major issue for forestry landuses.

# Current Distribution of *Cortaderia selloana* (PAMPAS GRASS) within Hundreds in the South-East of South Australia.\*



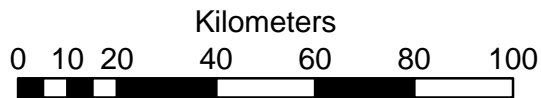
## Legend

### % of areas at risk

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- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2005 data



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## ***Radiata pine – Pinus radiata***

**Origin** An introduced tree from California and Mexico

**Description**

- An evergreen, resinous aromatic tree 25- 50m tall with extensive root system
- Thick, furrowed, grey-brown bark with whorled branches.
- A major source of softwood timber in Australia
- Produces cones 7.5-15cm in length, starting bright green and then maturing to grey-brown
- Reproduces from seed only
- Leaves are needles in bundles of 3, dark, glossy green in dense clusters

**Impacts**

- Invades native forests flanking softwood plantations
- Competes with native Eucalyptus ecosystems by shading and crowding
- Changes soil fertility and water cycles
- Produces thick leaf litter which prevents regeneration

**Distribution**

Radiata pine is widely planted in the South East as a forestry species. Radiata pine has escaped from many plantations into native vegetation and roadsides. The map provided on the facing page reflects where it is grown commercially and also where it is therefore likely to have invaded other landuses. See map on facing page for current known distribution in the South East.

**Control techniques**

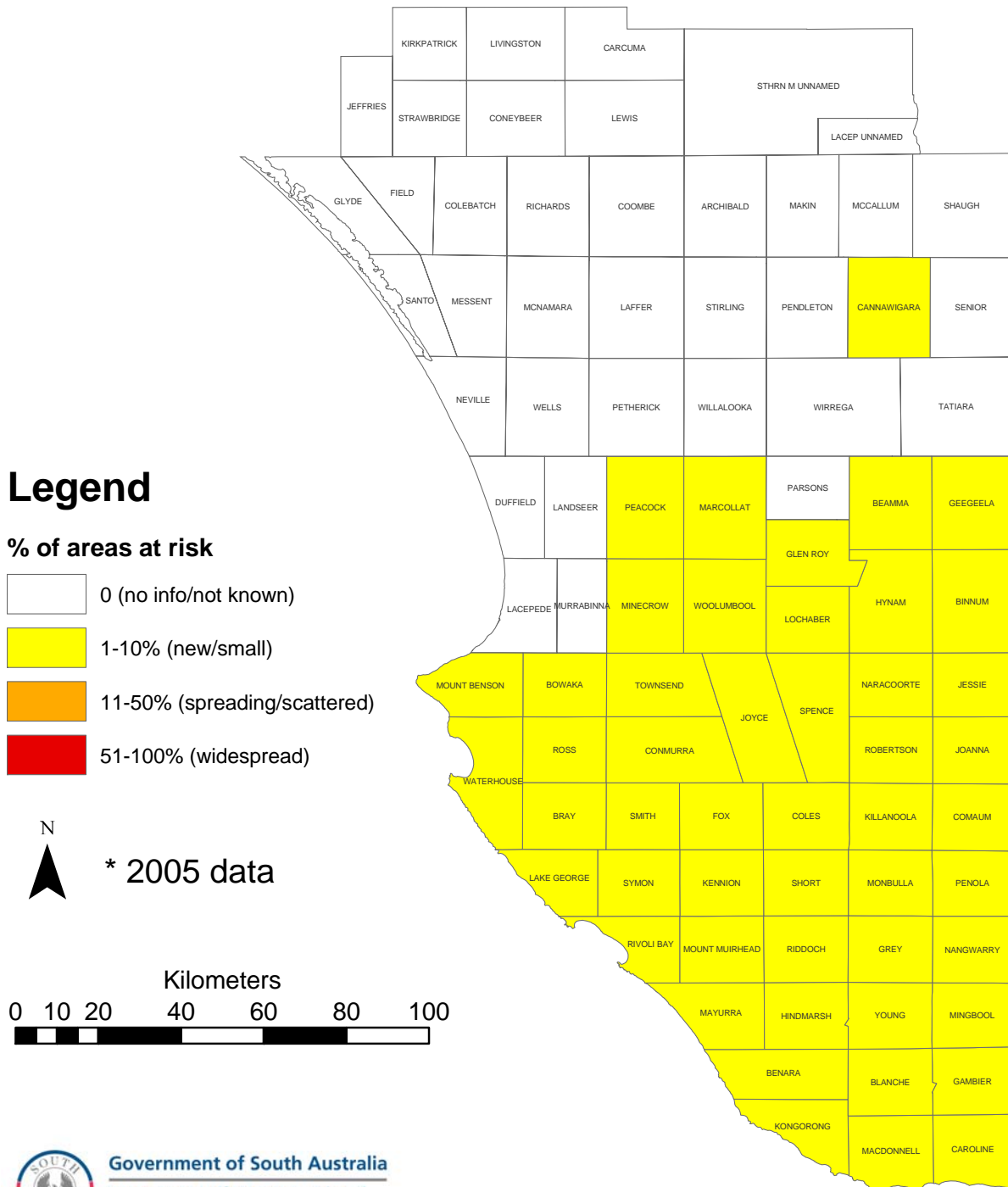
- Seedlings and small plants are easily hand pulled
- Mature trees are easily killed by cutting down – stumps do not require treatment.

**Current management programs**

- Radiata pine is not a Proclaimed Plant.
- There is currently no coordinated regional program. ForestrySA currently spends considerable effort controlling feral pines adjacent to their plantations.
- Site specific control works occur in some conservation areas.
- This weed is a major issue for native vegetation.



# Current Distribution of *Pinus radiata* (FERAL RADIATA PINE) within Hundreds in the South-East of South Australia.\*



## **Salvation Jane - *Echium plantagineum*,**

**Origin** A annual plant introduced from the Mediterranean as a garden ornamental.

### **Description**

- An erect annual plant reaching about 60cm high and covered in short bristly hairs.
- Leaves produced in autumn and winter are large, oblong in shape with a short stalk and they grow flat on the ground from a solid taproot to form a rosette.
- Leaves on the erect stems are stalkless, smaller and narrower.
- Flowers are attached along one side of the stem branches, with a blue to purple trumpet shaped

### **Impacts**

- Salvation Jane is highly competitive due the large amount of seed produced and the large, flat rosette that
- smothers emerging seedlings.
- Even though the weed is eaten by stock during its early stages of growth, its presence reduces the quality and quantity of useful fodder.
- Horses and pigs are susceptible to the alkaloids in salvation Jane and lose condition and appetite and die after
- a period of weeks feeding on the weed.
- The stiff bristles on salvation Jane cause irritation to the udders of dairy cows.
- It is also a source of hay fever and allergies in humans.

### **Distribution**

Salvation Jane prefers areas with high winter rainfall and is not restricted by soil type. It is a common weed of degraded pastures, roadsides and neglected areas.

See map on facing page for current known distribution in the South East.

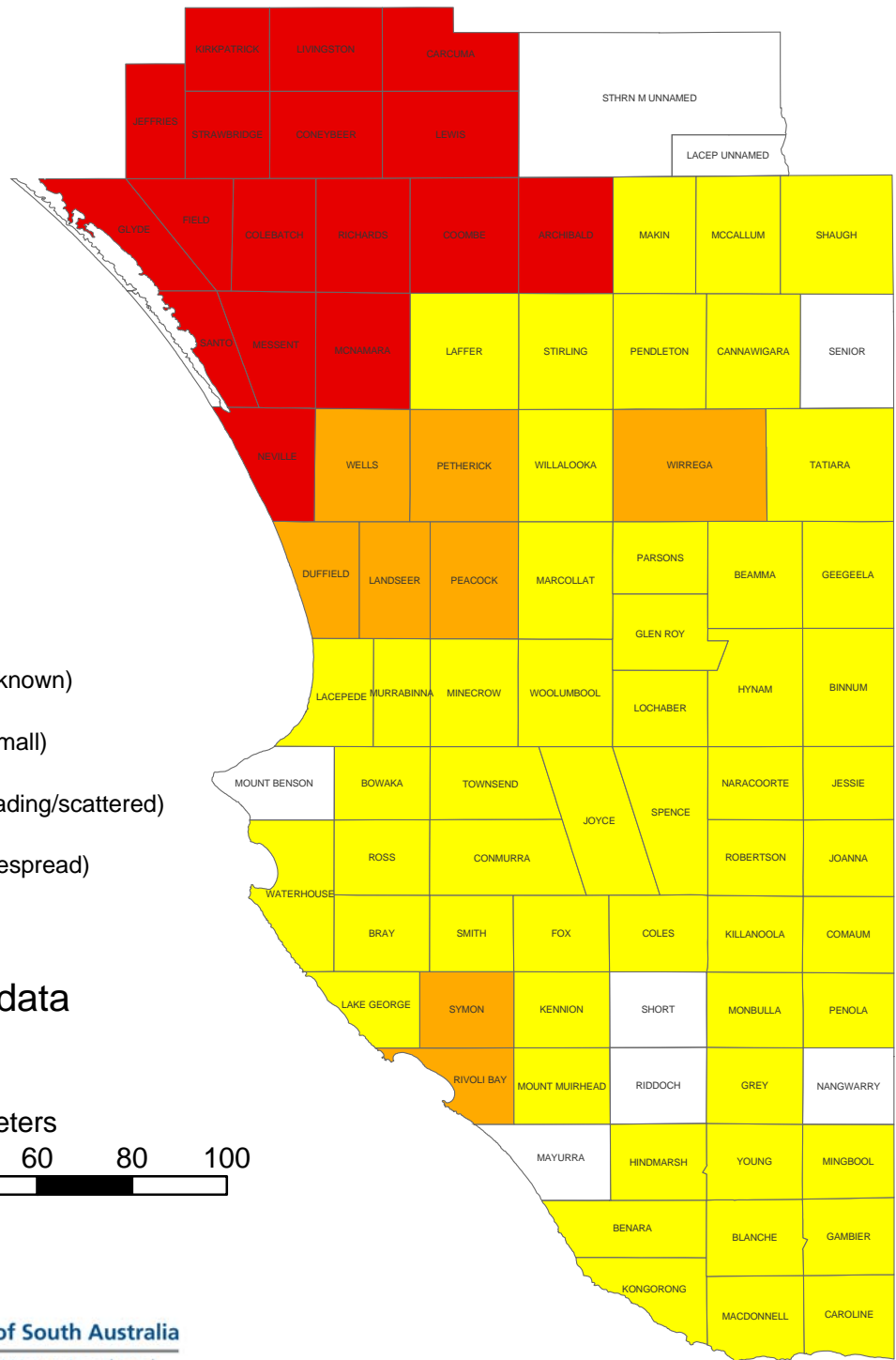
### **Control techniques**

- Salvation Jane is best treated as seedlings in late autumn. A wide range of herbicides is available.
- Several biocontrol agents are present in the South East and are proving to be very effective in suppressing salvation Jane.

### **Current management programs**

- Salvation Jane is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for grazing landuses.

# Current Distribution of *Echium plantagineum* (SALVATION JANE) within Hundreds in the South-East of South Australia.\*



## Legend

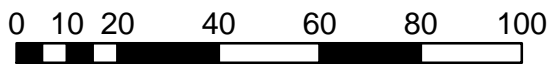
### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2002 data

Kilometers



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## **Sallow wattle – *Acacia longifolia* var *longifolia***

**Origin** A large spreading shrub originating from New South Wales and Victoria

### **Description**

- Stems are smooth and angular and reddish green in colour when young, becoming grey with age.
- Leaves are dark green with 2-3 parallel veins obvious. They are long and thin 5-20cm long and 1-3cm wide and tapering to a blunt end.
- Flowers are bright yellow and form in cylinder shaped spikes 2-5cm long in winter and spring.
- The fruit is a long (5-15cm) and straight pod containing 4 – 10 seeds. It is a prolific seeder.
- Roots form a shallow branching system.

### **Impacts**

- Sallow wattle is highly invasive and has invaded well beyond its natural range.
- It can fix nitrogen and therefore change soil fertility.
- Dense infestations will shade out other small plants and crowd the growth of larger native species.
- Regeneration can be severely reduced under thick infestations of sallow wattle.

### **Distribution**

Sallow wattle has been planted extensively in gardens and tolerates a wide range of conditions. It prefers high rainfall areas. See map on facing page for current known distribution in the South East.

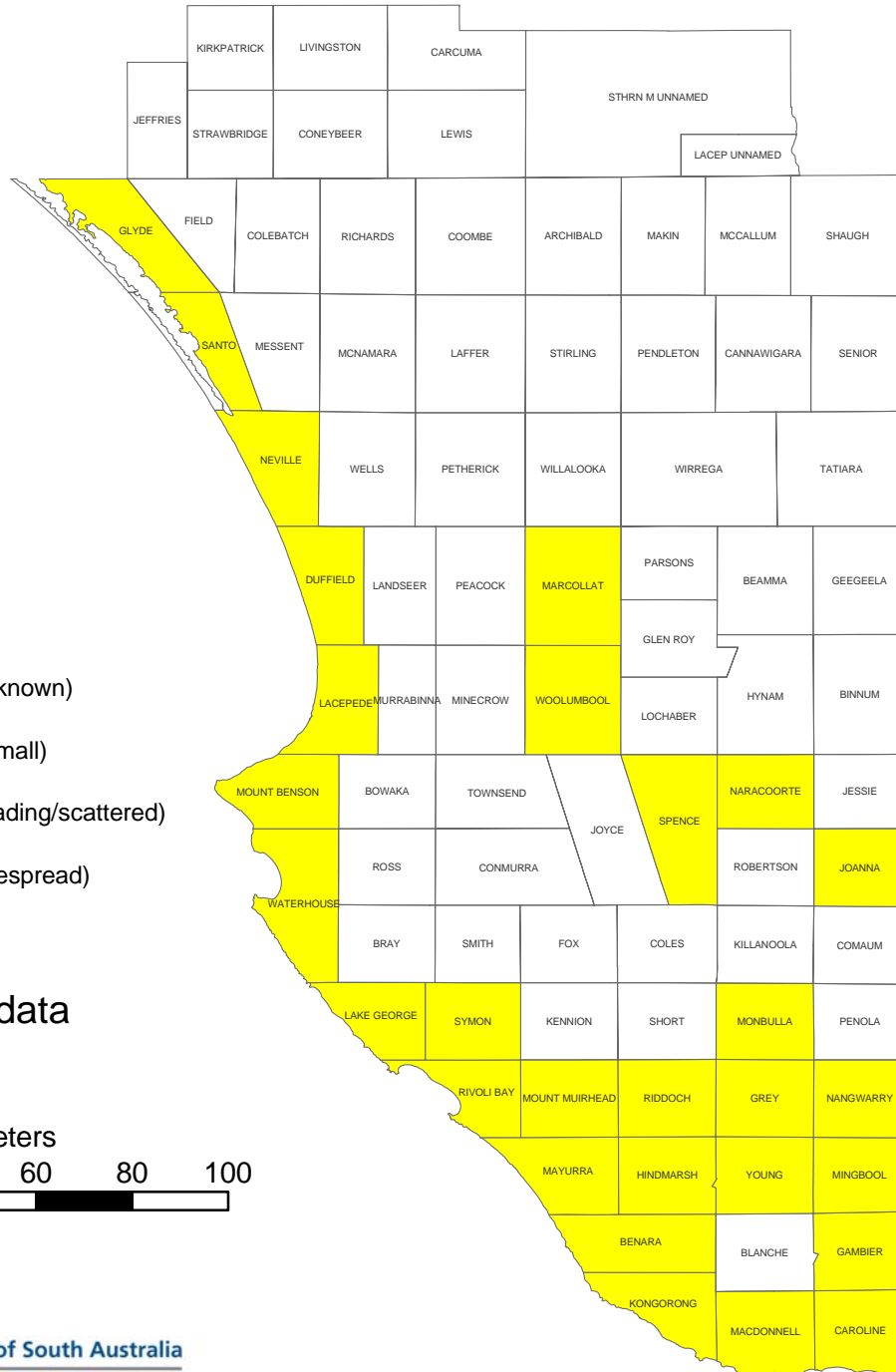
### **Control techniques**

- Seedlings and small plants can be effectively hand pulled.
- Mature plants can be simply ring barked or cut down as they don't generally reshoot.
- Fire kills native plants but will stimulate germination.

### **Current management programs**

- Sallow wattle is not a Proclaimed Plant.
- There is currently no coordinated regional program.
- Site specific control works occur in some conservation areas.
- This weed is a major issue for native vegetation.

# Current Distribution of *Acacia longifolia* var. *longifolia* (SALLOW WATTLE) within Hundreds in the South-East of South Australia.\*



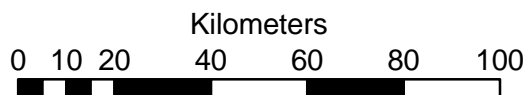
## Legend

### % of areas at risk

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- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2005 data



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## ***Shiny leaf coprosma – Coprosma repens***

**Origin** A medium sized shrub introduced from New Zealand

### **Description**

- Stems are smooth, light green to silver grey becoming roughened with age.
- Leaves are dark glossy green and oblong in shape with an indented mid vein. Underside of leaves is lighter.
- Flowers are less than 5mm long and form in clusters over spring and summer.
- Green berries form in summer and mature to orange-red over summer.
- Coprosma has a shallow branching root system.

### **Impacts**

- Impedes the growth and regeneration of native over-story species.
- Dense infestations will shade out other small plants and crowd the growth of larger native species.

**Distribution** Coprosma has been planted extensively in gardens and tolerates a wide range of conditions. It prefers high rainfall areas.  
See map on facing page for current known distribution in the South East.

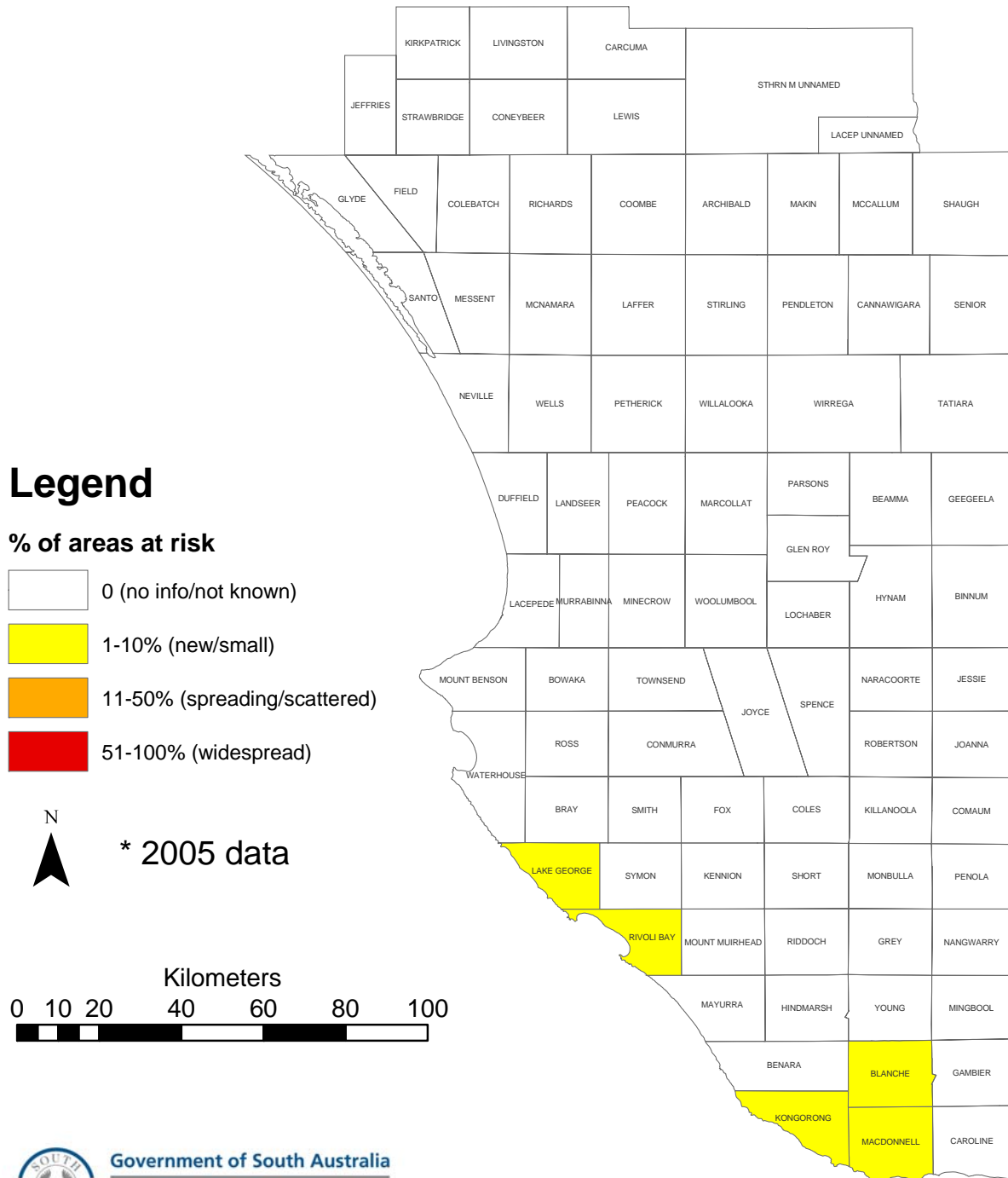
### **Control techniques**

- Seedlings and small plants can be effectively hand pulled.
- Plants can be effectively cut and swabbed or swabbed.
- Regrowth will need to be treated after initial control efforts.

### **Current management programs**

- Coprosma is not a Proclaimed Plant.
- There is currently no coordinated regional program.
- Site specific control works occur in some conservation areas.
- This weed is a major issue for native vegetation.

# Current Distribution of *Coprosma repens* (SHINY LEAF COPROSMA) within Hundreds in the South-East of South Australia.\*



## ***Silverleaf nightshade - Solanum elaeagnifolium***

**Origin** A deep-rooted perennial weed introduced from tropical America.

### **Description**

- Silverleaf nightshade is a shrubby perennial herb to 60 cm tall
- Oblong, silvery-green felted leaves and tiny scattered spines.
- The flowers produced in summer are shaped like a five pointed star up to 2.5 cm across, pale mauve with erect yellow stamens 7-8 mm long.
- The fruit is a globular golden-yellow berry about 1 cm diameter containing 20-100 seeds.
- The weed is semi-dormant in winter, grows during spring and summer using water reserves from deep in the soil.
- It can regenerate repeatedly from underground and survive drought

### **Impacts**

- Silverleaf nightshade competes with winter growing crops and pastures by taking water and nutrients from soil during the preceding summer.
- In pasture paddocks, silverleaf nightshade competes effectively with perennial grasses.
- Occasionally causes poisoning of stock.
- The berries are eaten by sheep, which can carry the seed in their gut for up to a month.
- Seed can also be carried by flood waters or as a contaminant in fodder and last over 10 years in the soil.
- Cultivation will spread it across a paddock as root fragments.

### **Distribution**

Silverleaf nightshade does not have a preference for soil type and can grow in a range of rainfall conditions.

See map on facing page for current known distribution in the South East.

### **Control techniques**

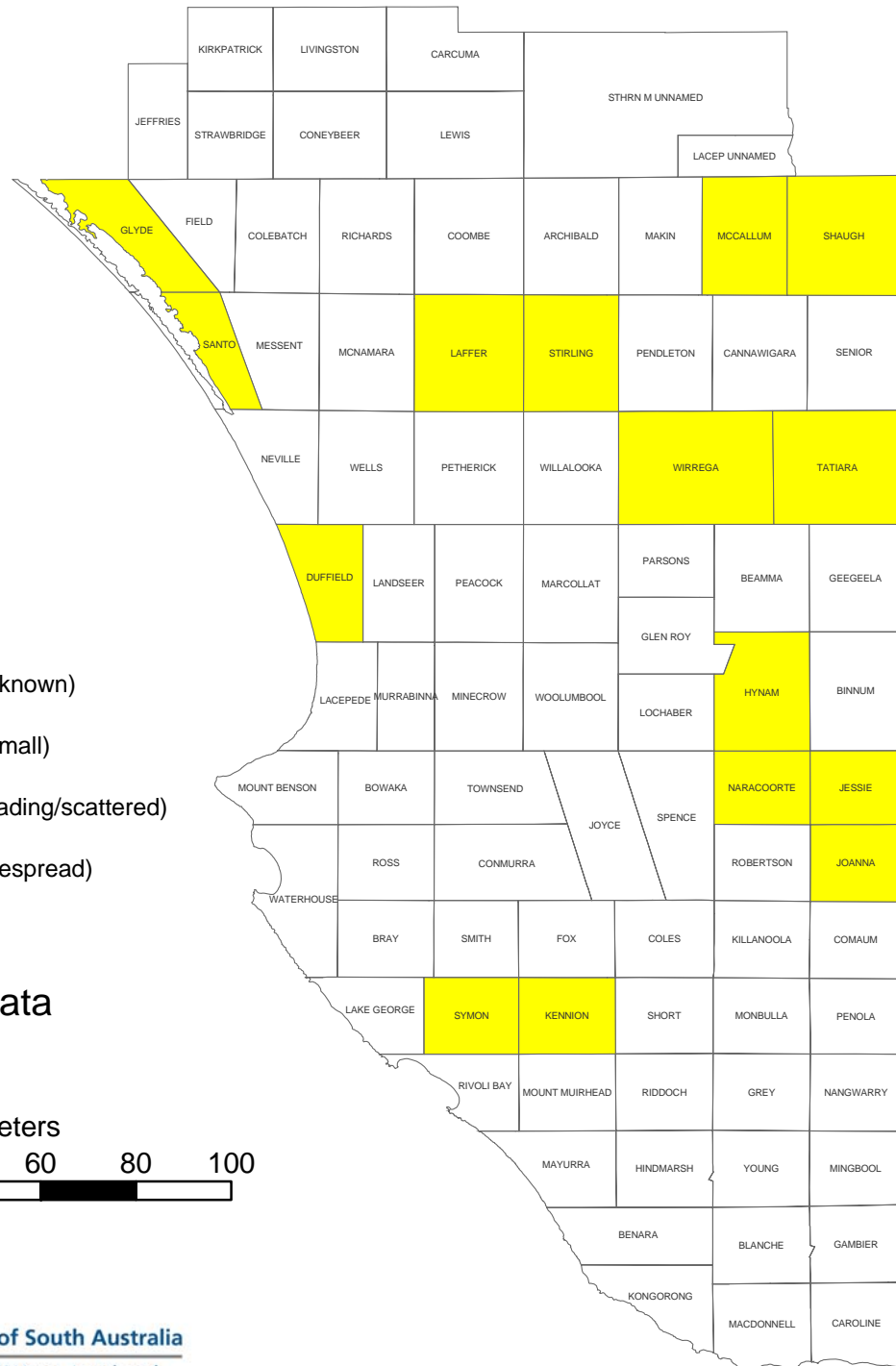
- Spot spraying with picloram is effective but picloram is a soil active herbicide so care is required.
- Slashing before flowering will temporarily suppress the weed.
- Do not cultivate silverleaf nightshade as this will spread the infestation

### **Current management programs**

- Silverleaf nightshade is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for cropping and grazing landuses.



# Current Distribution of *Solanum elaeagnifolium* (SILVER-LEAF NIGHTSHADE) within Hundreds in the South-East of South Australia.\*



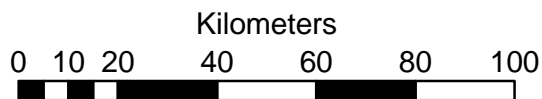
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2002 data



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## ***Spiny rush – Juncus acutus***

**Origin** A perennial tussock forming herb with a wide native range including Europe, the Americas and South Africa

### **Description**

- An erect tussock to 2m high reproducing from seed and rhizomes.
- Numerous straight, un-branched stems and leaves are filled with pith and finish in a sharp spine.
- The arrangements of stems and leaves creates a spherical shape to the plant.
- A cluster of reddish brown flowers form several centimetres from the end of the stems. A brownish fruit capsule is oval on shape and pointed at the end.
- Root system is shallow and fibrous with short rhizomes.

### **Impacts**

- Not palatable to stock, possibly toxic.
- It can completely cover an entire area, eliminating all other vegetation.
- Thick infestations become impenetrable due to the sharp spines.
- Provides harbour for rabbits.
- Can restrict flow of water courses.

### **Distribution**

Prefers degraded areas with poor soil fertility and disturbance. Favours moist areas and will tolerate saline conditions.  
See map on facing page for current known distribution in the South East.

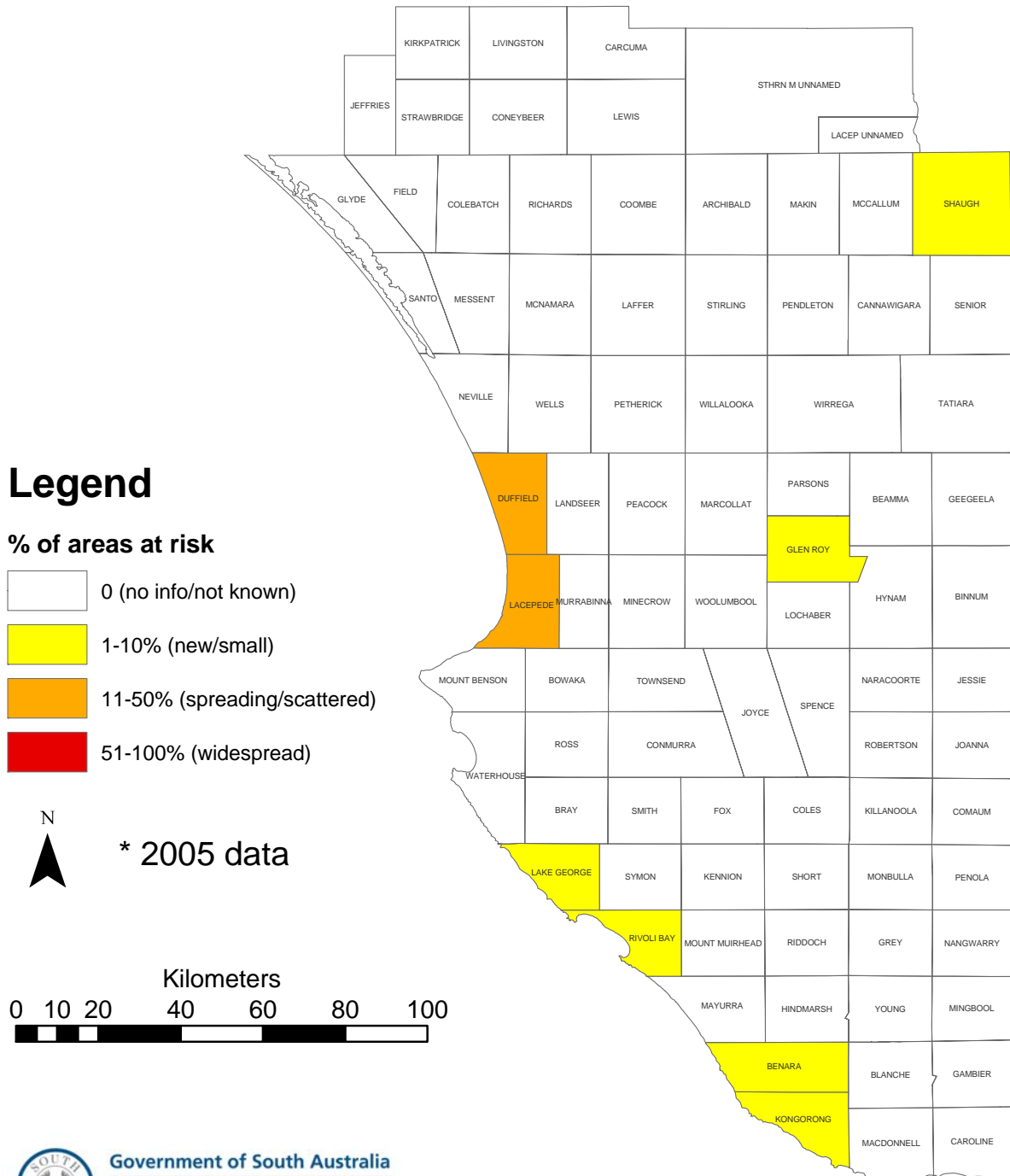
### **Control techniques**

- Habitat alteration is effective in the control of spiny rush. Improving drainage and fertility may assist in reducing the density of infestations.
- Mechanical removal is difficult and requires heavy machinery.
- Chemical control is also variable in its success.
- Seedlings and regrowth will require further treatment.

### **Current management programs**

- Spiny rush is not a Proclaimed Plant.
- There is currently no coordinated regional program.
- Site specific control works occur in some conservation areas.
- This weed is a major issue for native vegetation.

# Current Distribution of *Juncus acutus* (SPINY RUSH) within Hundreds in the South-East of South Australia.\*



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## ***Three corner jack – Emex australis***

**Origin** A annual prostrate herb from South Africa

**Description**

- Semi prostrate in grow up to 50cm long
- Leave are oval and glabrous
- Male and female flowers separate on the same plant.
- Fruit changing from green to brown as it ripens, hard to woody, 7 to 11mm long
- Seed brown, roughly triangular, 1 in each fruit
- Deep fleshy taproot

**Impacts**

- Fruit is well equipped for dispersal attaching it to almost anything particularly shoes, car tyres, feet of animals or containers of produce.
- Contamination of fodder, particularly Lucerne hay, is an important method of spread
- Can cause poisoning in stock

**Distribution**

Three corner jack prefers sandy loam soil and establishes well in disturbed sites such as cropping, sale yards and neglected areas.  
See map on facing page for current known distribution in the South East.

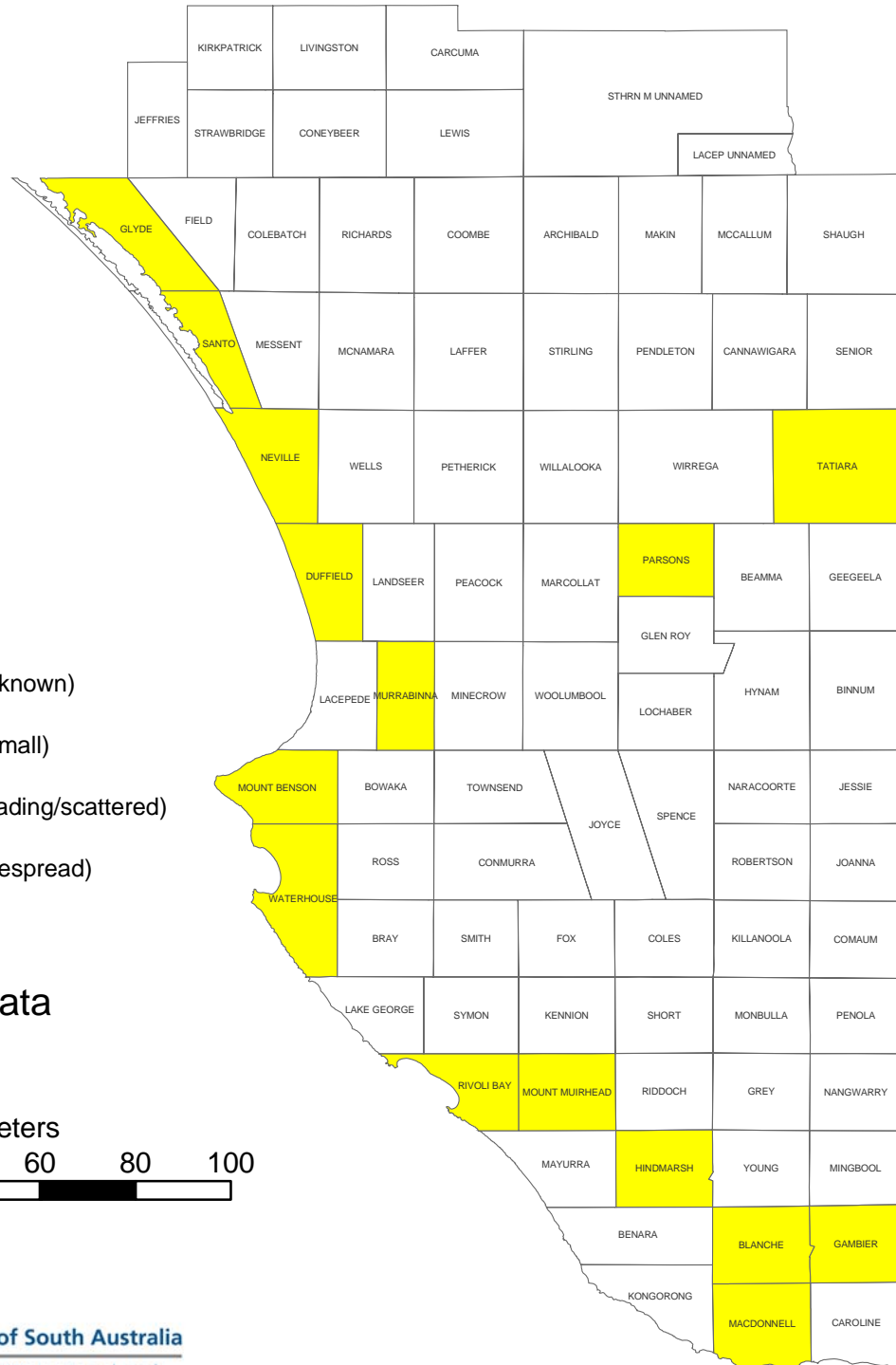
**Control techniques**

- Spray with glyphosate or metsulfuron methyl before flowering

**Current management programs**

- Three corner jack is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for grazing and irrigated crops and pastures landuses.

# Current Distribution of *Emex* spp. (THREE CORNER JACK) within Hundreds in the South-East of South Australia.\*



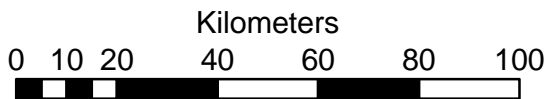
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2002 data



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## ***Three horned bedstraw – Galium tricornutum***

**Origin** Native to Europe to central Asia

### **Description**

- Sprawling, stems up to 50cm long.
- Leaves arranged in whorles and pointed
- Stems square with downwardly pointing prickles
- Flowers small and white with four petals
- Fruit is round and attached to the plant by a hooked stem

### **Impacts**

- A significant weed in crops found in paddocks that have been cropped for a number of years.
- Appears worse in area that have pulse crops incorporated into the rotation
- Can cause problems in harvesting and contaminate products

### **Distribution**

Principally occurring on heavy alkaline soils with annual rainfall from 300-550mm.  
See map on facing page for current known distribution in the South East.

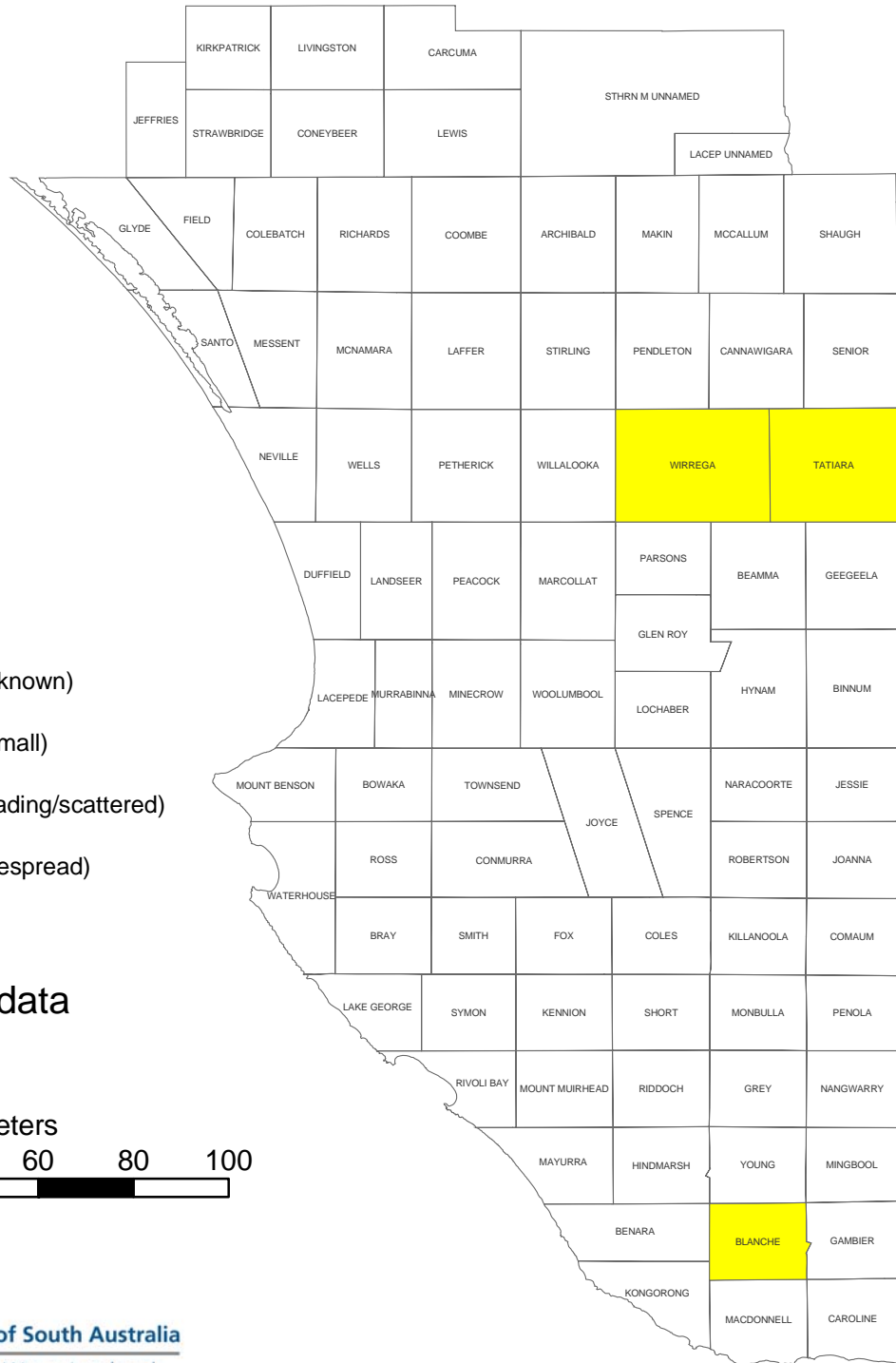
### **Control techniques**

- Spray with a broadleaf herbicide or glyphosate.

### **Current management programs**

- Three horned bedstraw is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for cropping landuses.

# Current Distribution of *Galium tricornutum* (THREE HORNED BEDSTRAW) within Hundreds in the South-East of South Australia.\*



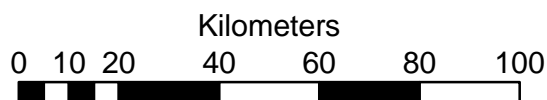
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2005 data



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Department of Water, Land and  
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## ***Variegated thistle - Silybum marianum***

**Origin** An annual herb native to the Mediterranean region

### **Description**

- Variegated thistle is an erect annual or biennial herb to 2.5 m tall with a thick taproot.
- Stems are branched from the base, thick but hollow, ribbed with small spines
- Leaves have a shiny, mottled dark green/light green (variegated) upper surface and a slightly hairy lower surface.
- Lower leaves are 20 -50 cm long, forming a rosette at ground level
- Flowering heads are round and 4 - 8 cm in diameter, packed with 50 - 200 purple florets.
- Variegated thistle reproduces only by seeds, which germinate after autumn rain but can remain viable in the soil for up to 9 years.
- Flowering starts in October and continues into early summer.

### **Impacts**

- Once established, variegated thistle will eliminate most plants by shading and competition for moisture and nutrients.
- It is unpalatable and not readily grazed by stock unless sprayed or cut.
- It is of little nutritional value and becomes poisonous by accumulating nitrates under certain conditions.
- The spines of the plant can cause physical injury, and restrict stock movement.
- Dense stands of variegated thistle may also harbour vermin.

### **Distribution**

Variegated thistle prefers heavy, fertile soils with high nitrogen and also needs bare or disturbed ground to germinate. A dry summer followed by a wet autumn appears to provide the most suitable conditions for germination and establishment.

See map on facing page for current known distribution in the South East.

### **Control techniques**

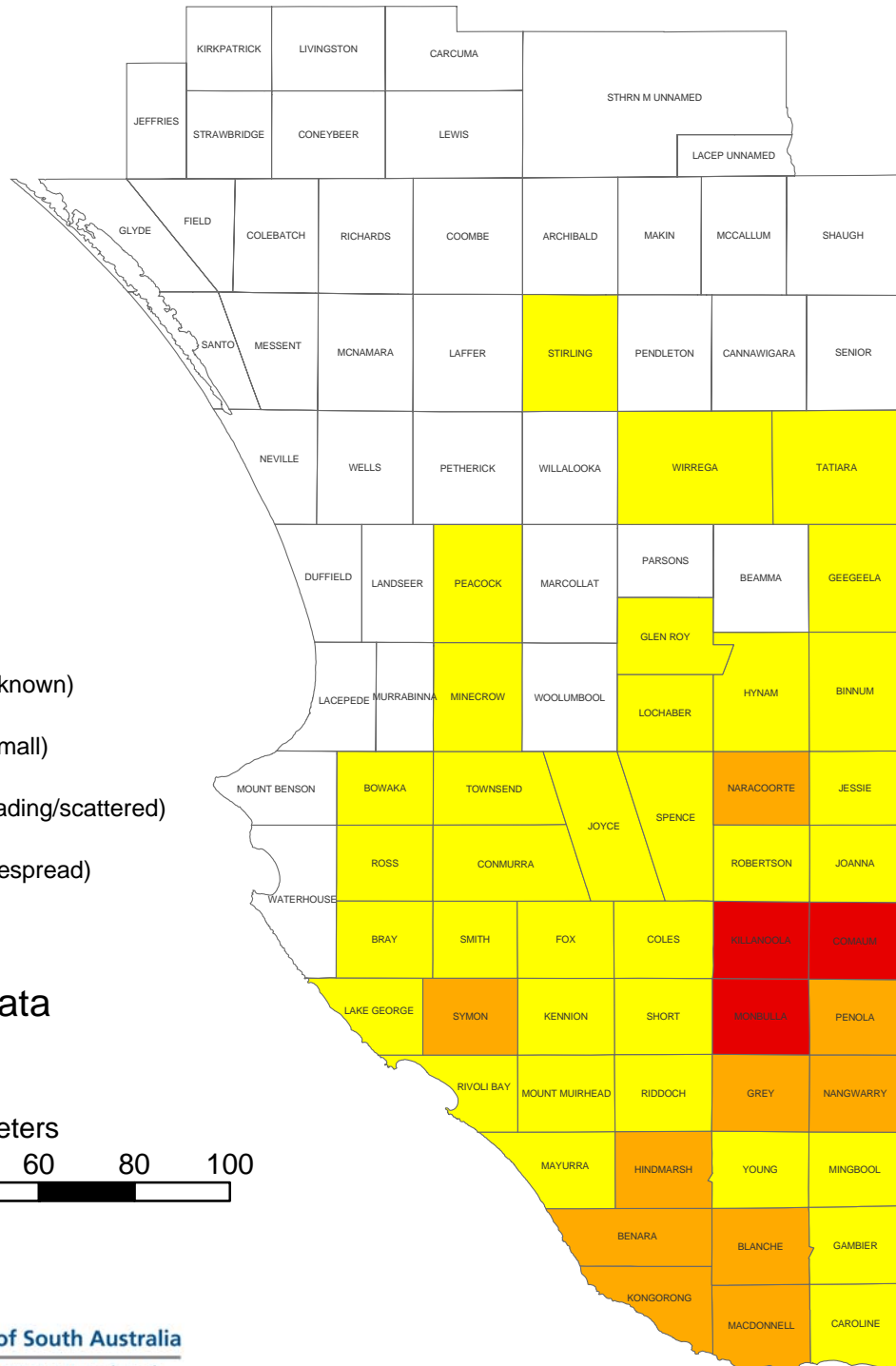
- Variegated thistle can be spot sprayed, boom sprayed or spray grazed.
- Hand pulling small infestations and cultivation of seedlings are effective control methods

### **Current management programs**

- Variegated thistle is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for cropping, grazing, irrigated crops and pastures landuses.



# Current Distribution of *Silybum marianum* (VARIEGATED THISTLE) within Hundreds in the South-East of South Australia.\*



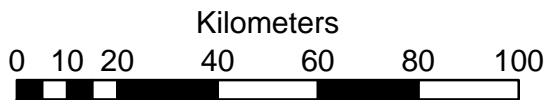
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2002 data



Government of South Australia  
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## ***Yellow burrweed - Amsinckia spp***

**Origin** An annual herb introduced from America

### **Description**

- Yellow burrweed is an erect annual herb between 20 and 70cm high.
- Stems may be branched and are covered with short stiff hairs.
- The leaves have similar tiny hairs; the leaves at ground level are up to 20 cm long and form a rosette, with smaller leaves arranged alternately along the stem.
- Flowers are bright yellow with five petals fused into a trumpet shaped tube 5mm long.
- Yellow burrweed has a stout taproot with many lateral roots.

### **Impacts**

- Yellow burrweed is a highly competitive weed in cereal crops and can drastically reduce crop yield.
- Its seeds also contaminate grain, and bristly fragments of the plant cause vegetable fault in wool.
- It may be poisonous to stock, containing similar alkaloids to salvation Jane, but no deaths have been recorded in Australia.
- The staggered germination of yellow burrweed seeds makes control of infestations difficult.

### **Distribution**

Yellow burrweed is not restricted by soil type but favours disturbed areas. It reproduces only by seeds, which are spread by stock and other animals, contaminated machinery and produce. They germinate in large numbers after the autumn break and may also have staggered germinations after later rains. See map on facing page for current known distribution in the South East.

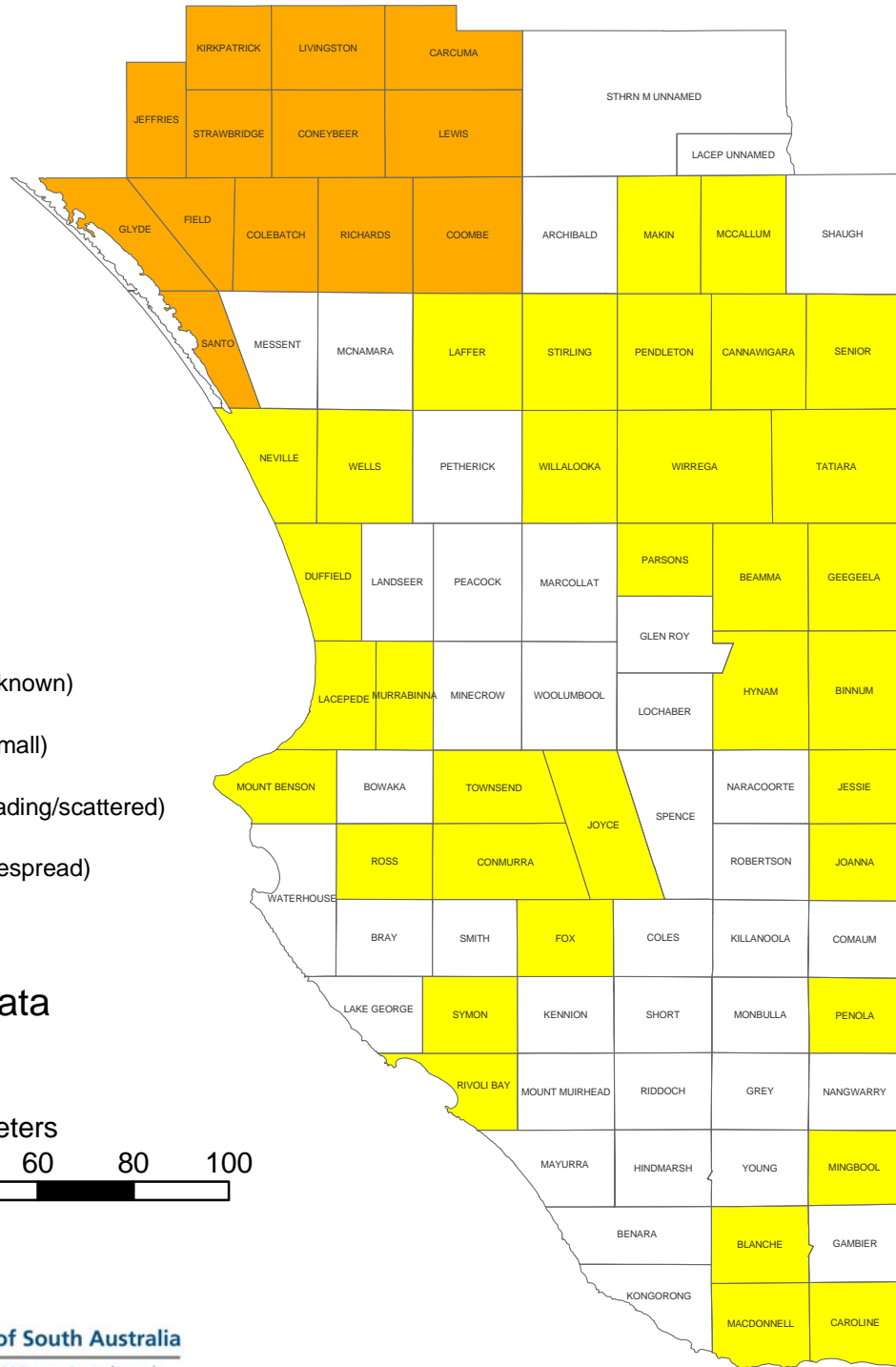
### **Control techniques**

- Cultivation and hand hoeing are successful control measures for yellow burrweed
- A wide of chemicals is available for use on yellow burrweed in crop and pasture situations. 2,4-D can be used for spray grazing, glyphosate is effective in spot spraying and bromoxynil/MCPA can be applied with a boomspray.

### **Current management programs**

- Yellow burrweed is a Proclaimed Plant under the Animal and Plant Control (agriculture and other purposes) Act.
- There is currently no coordinated regional program, however land managers are controlling the weed according to local APCB policies. The general cooperation for the control of this plant is high among land managers within the region.
- This weed is a major issue for grazing landuses.

# Current Distribution of *Amsinckia* spp. (YELLOW BURR WEED) within Hundreds in the South-East of South Australia.\*



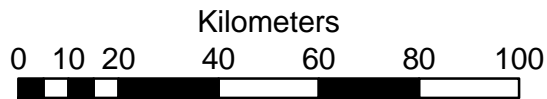
## Legend

### % of areas at risk

- 0 (no info/not known)
- 1-10% (new/small)
- 11-50% (spreading/scattered)
- 51-100% (widespread)



\* 2002 data



Government of South Australia  
Department of Water, Land and Biodiversity Conservation

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Animal and Plant Control Commission Weed ID Notes

Animal and Plant Control Commission Weed Control Notes

Parsons, W.T. and Cuthbertson, E.G. (1992) Noxious Weeds of Australia. Inkata Press, Melbourne

Muyt, A. (2001) Bush Invaders of South East Australia. RG and FJ Richardson, Victoria



## **APPENDICES**

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Appendix 1: Original South East Weed List

Appendix 2: Alum Classifications

Appendix 3: SA Weed Risk Management System Guide

**Appendix 1: ORIGINAL SOUTH EAST WEED LIST**



## APPENDIX 1 : ORIGINAL WEED LIST

Common Name	Botanical Name	Present	Pro. Plant	Aquatic	Crop/ Pasture	Forestry	Grazing	Irrigated	Native Veg.	Perennial Hort	Urban
African Boxthorn	<i>Lycium ferocissimum</i>	Y	P				X		X		X
African feathergrass	<i>Pennisetum macrourum</i>	Y	P			X	X		X		
African lovegrass	<i>Eragrostis curvula</i>	Y	P				X		X		
African rue	<i>Peganum harmala</i>	N	P								
Alkali sida	<i>Malvella leprosa</i>	N	P								
Allepo pine	<i>Pinus halepensis</i>	Y	P						X		X
Alligator weed	<i>Alternanthera philoxeroides</i>	N	P	X							
Annual ryegrass	<i>Lolium rigidum</i>	Y			X		X				
Apple of sodom	<i>Solanum hermarii</i>	Y					X		X		X
Arrowhead	<i>Sagittaria montevidensis</i>	Y	P	X							
Athel pine	<i>Tamarix aphylla</i>	Y	P						X		X
Azzarola	<i>Crataegus sinaica</i>	N	P								
Bamboo	<i>Arundo donax</i>	Y							X		
Barleria	<i>Barleria prionitis</i>										
Bathurst burr	<i>Xanthium spinosum</i>	Y	P		X	X	X	X		X	
Bedstraw	<i>Galium sp.</i>	Y			X						
Bifora	<i>Bifora testiculata</i>	?	P								
Blackberry	<i>Rubus fruticosus</i>	Y	P			X	X	X	X		X
Blackberry nightshade	<i>Solanum nigrum</i>	Y						X	X		
Bladder campion	<i>Silene vulgaris</i>	Y	P		X		X	X			
Blue hound's tongue	<i>Cynoglossum creticum</i>										
Blue mustard	<i>Chorispora tenella</i>	N			X						
Bluebell creeper	<i>Sollya hetrophulla</i>	Y							X		
Bluebell creeper	<i>Sollya heterophylla</i>	Y				X			X		
Boneseed	<i>Chrysanthemoides monilifera</i>	Y	P			X			X		
Bracken fern	<i>Pteridium esculentum</i>	Y				X	X				
Bridal creeper	<i>Asparagus asparagoides</i>	Y	P			X			X		X
Bridal veil	<i>Asparagus declinatus</i>	?							X		
Broad-kernel espartillo	<i>Achnatherum caudatum</i>	?	P								
Broomrapes	<i>Orobancha spp.</i>	N	P		X			X			
Buchan weed	<i>Hirschfeldia incana</i>	Y			X			X			
Buckthorn	<i>Rhamnus alaternus</i>	Y							X		
Bulbil watsonia	<i>Watsonia meriana var.</i>	Y	P						X		

Common Name	Botanical Name	Present	Pro. Plant	Aquatic	Crop/Pasture	Forestry	Grazing	Irrigated	Native Veg.	Perennial Hort	Urban
	<i>bulbillifera</i>										
Cabomba	<i>Cabomba caroliniana</i>	N	P	X							
Calomba daisy	<i>Oncosiphon suffruticosum</i>	N	P								
Caltrop	<i>Tribulus terrestris</i>	Y	P		X		X	X		X	X
Cane needlegrass	<i>Nassella hyalina</i>	N	P								
Cane needlegrass	<i>Nassella hyalina</i>										
Cape broom	<i>Genista monspessulana</i>	Y	P			X			X		
Capeweed	<i>Arctotheca calendula</i>	Y			X		X	X			
Carrot	<i>Daucus carota</i>	Y	P						X		
Chilean needlegrass	<i>Nassella neesiana</i>	Y	P				X		X		
Chinese rain tree / Golden rain tree	<i>Koelreuteria elegans</i>										
Chinese violet	<i>Asystasia gangetica</i> spp. <i>Micrantha</i>										
Coastal tea tree	<i>Leptospermum laevigatum</i>	Y							X		
Coastal wattle	<i>Acacia sophorae</i>	Y							X		
Common lantana	<i>Lantana camara</i>	N	P						X		
Coolatai grass	<i>Hyparrhenia hirta</i>	N					X		X		
Cootamundra wattle	<i>Acacia baileyana</i>	Y									
Cotoneaster	<i>Cotoneaster</i> spp.	Y							X		
Couch	<i>Cynodon dactylon</i>	Y			X	X		X		X	X
Creeping knapweed	<i>Acroptilon repens</i>	Y	P		X			X			
Cutch tree	<i>Acacia catechu</i> var <i>sundra</i>										
Cutleaf mignonette	<i>Reseda lutea</i>	Y	P		X						
Cyperus	<i>Cyperus teneristolon</i>										
Desert Ash	<i>Fraxinus angustifolia</i>	Y		X					X		
Dock	<i>Rumex crispus</i>	Y			X	X	X	X			
Dodder red & chilean	<i>Cuscuta</i> spp	Y	P		X			X	X		
Dog rose	<i>Rosa canina</i>	Y	P						X		
Dolichos pea	<i>Dipogon lignosus</i>	Y							X		
Elodea	<i>Elodea canadensis</i>	N	P	X							
Engilsh broom	<i>Cytisus scoparius</i>	Y	P								
Erica	<i>Erica arborea</i>	Y							X		
Eurasian water milfoil	<i>Myriophyllum spicatum</i>	N	P								
Evening primrose	<i>Oenothera stricta</i>	Y							X		

Common Name	Botanical Name	Present	Pro. Plant	Aquatic	Crop/ Pasture	Forestry	Grazing	Irrigated	Native Veg.	Perennial Hort	Urban
False caper	<i>Euphorbia terracina</i>	Y	P				X	X	X		X
False yellowhead	<i>Dittrichia viscosa</i>										
Fat hen	<i>Chenopodium album</i>	Y						X		X	
Field bindweed	<i>Convolvulus arvensis</i>	Y	P		X			X		X	
Field garlic	<i>Allium vineale</i>	Y	P		X						
Fleabane	<i>Conyza spp.</i>	Y			X	X		X		X	
Freesia	<i>Freesia hybrids</i>	Y							X		
Galvanised burr	<i>Sclerolanena birchii</i>	N	P								
Garden geranium	<i>Pelargonium alchemilloides</i>										
Gazania spp.	<i>Gazania spp.</i>	Y							X		X
Golden dodder	<i>Cuscuta campestris</i>	Y									
Golden wreath wattle	<i>Acacia saligna</i>	Y							X		
Gorse/ Furze	<i>Ulex europaeus</i>	Y	P			X	X		X		
Hawthorn/ May	<i>Crataegus monogyna</i>	Y	P						X		
Heather	<i>Calluna vulgaris</i>										
Hoary cress	<i>Cardaria draba</i>	Y	P		X						
Holly leaved senecio	<i>Senecio glastifolius</i>										
Horehound	<i>Marrubium vulgare</i>	Y	P		X		X		X		
Horsetail	<i>Equisetum spp.</i>	N	P								
Horsetail	<i>Equisetum spp.</i>										
Hydrocotyle	<i>Hydrocotyle ranunculoides</i>	N	P	X							
Hymenachne	<i>Hymenachne amplexicaulis</i>	N	P								
Innocent weed	<i>Cenchrus incertus/longispinus</i>	Y	P		X	X	X	X		X	X
Karoo thorn	<i>Acacia karroo</i>										
Khaki weed	<i>Alternanthera pungens</i>	Y						X			X
Kikuyu	<i>Pennisetum clandestinum</i>	Y				X			X		X
Kochia	<i>Kochia scoparia</i> (weedy form)	N	P								
Lagarosiphon	<i>Lagarosiphon major</i>										
Largarosiphon	<i>Lagarosiphon major</i>	?	P	X							
Laurel clock vine	<i>Thunbergia laurifolia</i>										
Leaf cactus	<i>Pereskia aculeata</i>										
Leafy elodea	<i>Egeria densa</i>	?	P	X							
Lesser loosestrife	<i>Lythrum hyssopifolia</i>	Y			X						
Lincoln weed	<i>Diplotaxis tenuifolia</i>	Y	P		X		X	X			
Lobed needlegrass	<i>Nassella charruana</i>										

Common Name	Botanical Name	Present	Pro. Plant	Aquatic	Crop/Pasture	Forestry	Grazing	Irrigated	Native Veg.	Perennial Hort	Urban
Mallow	<i>Malva parviflora</i>	Y								X	
Marguerite daisy	<i>Argyranthemum frutescens</i>	Y							X		
Marram grass	<i>Ammophila arenaria</i>	Y							X		
Mesquite	<i>Prosopis</i> spp.	N	P								
Mexican feathergrass	<i>Nassella tenuissima</i>	N	P				X				
Mimosa	<i>Mimosa pigra</i>	N	P								
Muskweed	<i>Myagrum perfoliatum</i>	N	P								
Myrtle-leaved milkwort	<i>Polygala myrtifolia</i>	Y							X		
Nightstock	<i>Matthiola longipetala</i>	Y	P		X						
Noogoora burr complex	<i>Xanthium strumarium</i> sp. agg.	Y	P				X	X			
Nutgrass	<i>Cyperus rotundus</i>	Y	P								
Olive	<i>Olea europaea</i>	Y	P						X		
One-leaf Cape tulip	<i>Moraea flaccida</i>	Y	P				X				
Onion grass	<i>Romulea rosea</i> var. <i>australis</i>	Y					X				
Onion weed	<i>Asphodelus fistulosus</i>	Y	P				X				
Orange hawkweed	<i>Hieracium aurantiacum</i>										
Ox tongue	<i>Picris echioides</i>	Y						X			
Pampas/ pink grass	<i>Cortaderia</i> spp.	Y				X			X		
Paramatta grass	<i>Sporobolus africanus</i>	Y					X	X			
Parkinsonia	<i>Parkinsonia aculeata</i>	N	P								
Parthenium weed	<i>Parthenium hysterphorus</i>	N	P								
Perennial ragweed	<i>Ambrosia</i> spp.	N	P								
Perennial thistle	<i>Cirsium arvense</i>	Y					X				
Phalaris	<i>Phalaris aquatica</i>	Y				X			X		
Pheasant's eye	<i>Adonis microcarpa</i>	Y	P		X						
Pin cushion daisy	<i>Scabiosa atropurpurea</i>	Y							X		X
Plumerillo	<i>Jarava plumosa</i>	N	P								
Poa grass	<i>Poa annua</i>	Y						X			X
Poison buttercup	<i>Ranunculus sceleratus</i>	N									
Poison ivy	<i>Toxicodendron radicans</i>	N	P								
Pond apple	<i>Anona glabra</i>	N	P								
Poplars	<i>Populus</i> spp.	Y							X		
Praxelis	<i>Praxelis clematidea</i>										
Prickly acacia	<i>Acacia nilotica</i> subsp. <i>Indica</i>	N	P			X					
Prickly pear	<i>Opuntia</i> spp.	Y	P								

Common Name	Botanical Name	Present	Pro. Plant	Aquatic	Crop/Pasture	Forestry	Grazing	Irrigated	Native Veg.	Perennial Hort	Urban
Primrose willow	<i>Ludwigia peruviana</i>	N	P								
Radiata pine	<i>Pinus radiata</i>	Y							X		
Ragwort	<i>Senecio jacobaea</i>	N	P								
Rampion mignonette	<i>Reseda phyteuma</i>	N	P								
Red gum euc.	<i>Eucalyptus camaldulensis</i>	Y				X				X	
Rhus tree	<i>Toxicodendron succedaneum</i>	N	P								
Rosewood	<i>Tipuana tipu</i>										
Rubber vine	<i>Cryptostegia grandifolia</i>	N	P								
Sagittaria	<i>Sagittaria graminea</i>	N	P	X							
Sallow wattle	<i>Acacia longifolia</i>	Y				X			X		
Salvation Jane	<i>Echium plantagineum</i>	Y	P		X		X	X			
Salvinia	<i>Salvinia molesta</i>	N	P	X							
Sea spurge	<i>Euphorbia paralias</i>	Y									
Senegal tea plant	<i>Gymnocoronis spilanthoides</i>	?	P	X							
Serrated tussock	<i>Nassella trichotoma</i>	?	P				X				
Shiny leaf Coprosma	<i>Coprosma repens</i>	Y							X		
Siam weed	<i>Chromolaena odorata</i>										
Silver grass	<i>Vulpia bromoides</i>	Y					X				
Skeleton weed	<i>Chondrilla juncea</i>	Y	P		X						
Slender thistle	<i>Carduus tenuiflorus</i>	Y	P				X	X			
Sliverleaf nightshade	<i>Solanum elaeagnifolium</i>	Y	P		X		X	X			
Soldier thistle	<i>Picnomon acarna</i>	Y	P				X				
Sorrel	<i>Rumex acetosella</i>	Y					X	X			
Soursob	<i>Oxalis pes-caprae</i>	Y	P		X		X			X	X
South Afrian Weed Orchid	<i>Disa bracteata</i>	Y				X			X		
Spear thistle	<i>Cirsium vulgare</i>	Y	P				X	X			
Spiny rush	<i>Juncus acutus</i>	Y							X		
Subterranean Cape sedge	<i>Trianoptiles solitaria</i>										
Sweet briar	<i>Rosa rubiginosa</i>	Y	P						X		
Sweet pittosporum	<i>Pittosporum undulatum</i>	Y							X		
Tagasaste	<i>Chamaecytisus palmensis</i>	Y							X		
Tall Wheat Grass	<i>Thinopyrum ponticum</i>	Y			X				X		
Texas needlegrass	<i>Nassella leucotricha</i>	N									

Common Name	Botanical Name	Present	Pro. Plant	Aquatic	Crop/Pasture	Forestry	Grazing	Irrigated	Native Veg.	Perennial Hort	Urban
Three corner garlic	<i>Allium triquetrum</i>	Y	P								
Three corner jack	<i>Emex spp.</i>	Y	P				X	X			
Three horned bedstraw	<i>Galium tricornutum</i>	Y	P		X						
Tree of heaven	<i>Ailanthus altissima</i>	Y									X
Two-leaf Cape tulip	<i>Moraea miniata</i>	Y	P				X				
Uruguayan rice grass	<i>Piptochaetium montevidense</i>										
Variegated thistle	<i>Silybum marianum</i>	Y	P		X		X	X			
Veldt grass	<i>Ehrharta calycina</i>	Y							X		
Water caltrop	<i>Trapa natans</i>	N	P	X							
Water hyacinth	<i>Eichhornia crassipes</i>	N	P	X							
Water soldier	<i>Stratiotes aloides</i>	N	P	X							
Water-dropwort	<i>Oenanthe pimpinelloides</i>	N	P								
White arctotis	<i>Arctotis stoechadifolia</i>	Y							X		
White Spanish broom	<i>Cytisus multiflora</i>										
White weeping broom	<i>Retama raetam</i>								X		
Wild artichoke	<i>Cynara cardunculus</i>	Y	P								
Wild oats	<i>Avena fatua</i>	Y			X				X		
Wild radish	<i>Raphanus raphanistrum</i>	Y			X			X			
Williams Grass	<i>Festuca arundinacea</i>	Y							X		
Willow herb	<i>Epilobium billardieranum</i>	Y						X			
Willow spp.	<i>Salix spp.</i>	Y	P	X							
Wireweed	<i>Polygonum aviculare</i>	Y						X		X	
Witch grass	<i>Panicum hillmanii</i>	Y								X	
Yellow burrweed	<i>Amsinckia spp.</i>	Y	P		X		X	X			
Yellow soldier	<i>Lachenalia reflexa</i>										

# Appendix 2: ALUM CLASSIFICATIONS

## APPENDIX 2 : ALUM Classifications

The eight landuse types identified in this project were mapped using the Australian Land Use Management (ALUM) classification system. This system is based on nationally agreed landuse mapping principles. The table below shows how each of the ALUM classes were allocated to one of the eight landuse types used in the assessment procedure.

ALUM Classifications							
Aquatic	Native Vegetation	Urban	Cropping/ Pasture	Irrigated	Grazing	Forestry	Perennial Horticulture
6.1.0	1.1.0	5.3.0	3.3.0	4.3.0	2.1.0	3.1.0.	3.4.0
6.1.1	1.1.1	5.4.0	3.3.1	4.3.1	3.2.0	3.1.1.	3.4.1.
6.1.2	1.1.2.	5.4.1	3.3.2	4.3.2	3.2.1	3.1.2	3.4.2
6.1.3	1.1.3.	5.4.2	3.3.3	4.3.3	3.2.3	3.1.3	3.4.3
6.2.0	1.1.4	5.5.0	3.3.4	4.3.4	3.2.4	4.1.0	3.4.4
6.2.1	1.1.5.	5.5.1	3.3.5	4.3.5	3.2.5		3.4.5
6.2.2	1.1.6	5.5.2	3.3.6	4.3.6			4.4.0
6.2.3	1.1.7	5.5.3	3.3.7	4.3.7			4.4.1.
6.2.4	1.2.0	5.5.4	3.3.8	4.3.8			4.4.2
6.3.0	1.2.1	5.5.5		4.2.0			4.4.3
6.3.1.	1.2.2	5.6.0		4.2.1			4.4.4
6.3.2	1.2.3	5.6.1		4.2.2			4.4.5
6.3.3	1.2.4.	5.6.2		4.2.3			
6.4.0	1.2.5	5.7.0		4.2.4			
6.4.1	1.3.0	5.7.1		4.5.0			
6.4.2	1.3.1	5.7.2		4.5.0			
6.5.0	1.3.2	5.7.3		4.5.1			
6.5.1	1.3.3	5.7.4		4.5.2			
6.5.2	1.3.4	5.7.5		4.5.3			
6.5.3	2.2.0	5.8.0		4.5.4			
6.6.0	2.2.1	5.8.1		3.5.0			
6.6.1	2.2.2	5.8.2		3.5.1			
6.6.2	3.1.4	5.8.3		3.5.2			
6.6.3		5.9.0		3.5.3			
		5.9.1		3.5.4			
		5.9.2		5.2.1			
		5.9.3		3.4.6			
		5.9.4		3.4.7			
		5.9.5		4.4.6			
		5.1.0		4.4.7			
		5.1.1					
		5.1.2					
		5.1.3					



# **Appendix 3: SA WEED RISK MANAGEMENT SYSTEM GUIDE**

# SA WEED RISK MANAGEMENT GUIDE – July 2004

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## INTRODUCTION

This guide for the SA Weed Risk Management System has been developed by the Animal and Plant Control Commission in cooperation with Animal and Plant Control Boards, to help in prioritising weeds for control programs. A series of questions are answered to compare the relative risk and feasibility of control of different weeds. Weeds are assessed separately for various **landuses**, so that the most important weeds of different landuses can be identified.

Use this guide when filling out the accompanying scoresheet. The questions can apply to any type of weed in any landuse. There may be **questions where you don't know the answer** for a certain weed, especially if it is not present in your area. In such cases choose the "don't know" option, and seek opinions from others (e.g. landholders, advisers, other Boards, researchers). "Don't know" is treated as a "0" for the Comparative Weed Risk scoring and gets a maximum score for the Feasibility of Containment scoring. This avoids bias against weeds which have a score for all questions. However, weeds which have one or more questions answered as "don't know" are indicated as such at their final score. Sharing information and scores is the key to building up knowledge and getting the most out of the SA Weed Risk Management System. Answering questions as a group is better than individually. It's particularly important to get consensus on assumptions about typical weed control in the landuse.

This scoring system is a tool to help in making standard, informed decisions on weed control priorities. Comments on the system are welcome for future improvements in its accuracy and ease of use.

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For an example use of the Comparative Weed Risk spreadsheet see the following reference:

Virtue, J. G. and Melland, R. L. (2003). The Environmental Weed Risk of Revegetation and Forestry Plants. DWLBC Report 2003/02. The Department of Water, Land and Biodiversity Conservation.

The report can be downloaded from [www.dwlbc.sa.gov.au](http://www.dwlbc.sa.gov.au)



**ANIMAL AND PLANT  
CONTROL COMMISSION**  
SOUTH AUSTRALIA



**The Department of  
Water, Land and  
Biodiversity  
Conservation**

## LANDUSES

Different types of weeds are important in different landuses. For example, annual weeds are problems in grain crops, and woody weeds are problems in native vegetation. If you were to compare the risk of weeds of different landuses, then you would also need to compare the importance of the landuses themselves. This is too difficult to do (i.e. you need \$/ha values for each landuse). An easier approach is to compare weeds within landuses only. Animal and Plant Control Boards can then decide for themselves the amount of time devoted to protecting each landuse.

The following landuses are suggested:

1. **Aquatic** (Permanent water bodies. e.g. rivers, swamps, canals, lakes, estuaries)
2. **Crop/Pasture rotation** (e.g. dryland cereals, pulses, oilseeds, legume pastures, hay)
3. **Forestry** (e.g. pines, blue gums)
4. **Irrigated crops and pastures** (e.g. vegetables, lucerne. Prone to summer weeds.)
5. **Native vegetation** (For nature conservation purposes. Public and private reserves.)
6. **Non-arable grazing** (Includes permanent pastures and rangelands.)
7. **Perennial horticulture** (e.g. vineyards, citrus, stonefruits)
8. **Urban** (e.g. sports fields, parks, footpaths)

Within each Board, landuses will vary in terms of what is grown and how crops/pastures/vegetation are managed. However, to keep the scoring system relatively simple and to answer at a Board or regional level, it is necessary to **think in averages**. There are two main aspects to keep in mind:

- (i) **Where a weed is only prevalent at certain phases in a landuse.** For example, the typical *crop/pasture rotation* landuse in a Board may have cereals, canola, pulses and pasture phases. In answering questions, average the *invasiveness* and *impacts* of a weed amongst these four vegetation types. Thus a weed which is only a problem in cereals will score less than a similar weed which is a problem in all crops and pasture. In the *potential distribution* section these two weeds will get the same score, as they will occupy the same area.
- (ii) **Where a weed only occurs in certain parts of a landuse.** For example, the *perennial horticulture* landuse in a Board may contain citrus, stonefruit, olives and vines. For a weed which only occurs in citrus and vines, average the *invasiveness* and *impacts* of a weed amongst these two vegetation types only. Then in the *potential distribution* section, the weed's score may be reduced because it is not a problem in all perennial horticulture crops in the Board area.

Decide which landuses apply to your Board. Then decide which weeds cause problems in which landuses. There is no need (and it makes little sense) to assess every weed in every landuse. The idea is simply to determine the important weeds of each landuse.

Assumptions about a landuse can be recorded on the scoresheets.

## 1) COMPARATIVE WEED RISK

The weed risk questions are divided into three main criteria; invasiveness, impacts and potential distribution. **Invasiveness** looks at the weed's rate of spread, faster spreading weeds being a higher priority for control. **Impacts** are the economic, environmental and social effects the weed has. **Potential distribution** indicates what total area the weed could spread to. Scores for each of these criteria are multiplied (each ranging between 0 and 10), to give a weed risk score out of 1000.

### INVASIVENESS

This section indicates how fast the weed can spread within a particular landuse. It takes account of how well the weed can establish, reproduce and disperse. Answer all questions with the landuse in mind, except for question 5(a).

1. What is the weed's ability to establish amongst existing plants?		SCORE
<input type="checkbox"/> very high	"Seedlings" readily establish within dense vegetation, or amongst thick infestations of other weeds.	3
<input type="checkbox"/> high	"Seedlings" readily establish within more open vegetation, or amongst average infestations of other weeds.	2
<input type="checkbox"/> medium	"Seedlings" mainly establish when there has been moderate disturbance to existing vegetation, which substantially reduces competition. This could include intensive grazing, mowing, raking, clearing of trees, temporary floods or summer droughts.	1
<input type="checkbox"/> low	"Seedlings" mainly need bare ground to establish, including removal of stubble/leaf litter. This will occur after major disturbances such as cultivation, overgrazing, hot fires, grading, long-term floods or long droughts.	0
<input type="checkbox"/> don't know		?

Ignore any weed control practices for this question. Depending on the landuse, "vegetation" may be crops, pastures, lawns and/or native vegetation. Weeds that invade well-managed landuses (where a dense vegetative cover over soil is maintained) are assumed to be more important. High scoring weeds would include wild radish, bridal creeper and dodder.

Assume the plant has just arrived. "Seedlings" includes growth from dispersed vegetative propagules (e.g. broken fragments of couchgrass stems or silverleaf nightshade roots) and spores, in addition to seeds. "Seedlings" does not include new vegetative growth whilst still attached to the parent plant (e.g. by stolons, rhizomes or lateral roots). This feature is accounted for in question 3(c).

Features which can help a weed establish amongst existing plants include:

- the ability to germinate under the canopy of other plants (e.g. weeds that have staggered germination in crops)
- large seeds or vegetative propagules (e.g. bulbs, root fragments, tubers) provide more reserves to help the weed establish in competition with other plants
- the ability to tolerate or avoid competitive stresses (e.g. by rapid root growth, fixing own nitrogen, or rapid vertical shoot growth)

2. What is the weed's tolerance to average weed management practices in the landuse?		SCORE
<input type="checkbox"/> very high	Over 95% of weeds survive commonly used weed management practices.	3
<input type="checkbox"/> high	More than 50% of weeds survive.	2
<input type="checkbox"/> medium	Less than 50% of weeds survive.	1
<input type="checkbox"/> low	Less than 5% of weeds survive.	0
<input type="checkbox"/> don't know		?

Assume the weed is new to an area. This question looks at whether the new weed is killed by the weed management practices which are commonly used across the landuse. If most are killed then there will be few plants to reproduce and spread. If few are killed then changes to weed management practices will eventually be needed. Weed management practices include herbicides, cultivation, cutting/slashing, grazing, and fire. The types and timing of these practices may vary within landuses (e.g. for cereals and broadleaf crops, or vineyards and citrus), but average these. If a weed grows and seeds when there is normally no weed management (e.g. summer) then it is highly tolerant of the common weed management practices. Weeds with high tolerance to routine weed management would include silverleaf nightshade (difficult to kill), caltrop (quick to seed), and broomrape. In native vegetation there may be no commonly used weed management practices at a regional level - if so then include this in your assumptions about the landuse.

3. What is the reproductive ability of the weed in the landuse?				Total (a+b+c)	SCORE	
<b>(a) Time to seeding</b>	<b>(b) Seed set</b>	<b>(c) Vegetative reproduction</b>		<input type="checkbox"/> high	5 or 6	3
<input type="checkbox"/> 1 year	<input type="checkbox"/> high	<input type="checkbox"/> fast	<input type="checkbox"/> high	<input type="checkbox"/> medium-high	3 or 4	2
<input type="checkbox"/> 2-3 yrs	<input type="checkbox"/> low	<input type="checkbox"/> slow	<input type="checkbox"/> low	<input type="checkbox"/> medium-low	1 or 2	1
<input type="checkbox"/> >3 yrs/never	<input type="checkbox"/> none	<input type="checkbox"/> none	<input type="checkbox"/> none	<input type="checkbox"/> low	0	0
<input type="checkbox"/> don't know	<input type="checkbox"/> don't know	<input type="checkbox"/> don't know	<input type="checkbox"/> don't know	<input type="checkbox"/> don't know		?

This question looks at how well the weed can reproduce, to rapidly build up its numbers at a site, and to spread quickly to other sites. If a weed never gets to reproduce in a landuse then it will score 0. Three factors are considered in scoring the weed:

- Time to seeding is the time from establishment (from seed or vegetative propagule) to seed production.
- Consider seed set as the average number of viable seed produced per square metre of ground per year, in a patch of the weed. This may be from one large weed (e.g. a tree) or many small weeds (e.g. grasses). High would be >1000 seeds per m<sup>2</sup>. Your answer to question 2 may influence seed set.
- Consider vegetative reproduction as the average number of new plants produced each year by such means as bulbs, bulbils, corms, tubers, rhizomes, stolons, root suckers, root fragments and shoot fragments. High would be >10 new plants per year from a mature parent plant. In certain landuses cultivation may increase vegetative reproduction (e.g. Lincoln weed). "New plants" are defined as shoots with their own root system. There may still be some connection to the parent plant (e.g. couchgrass).

4. How likely is long-distance dispersal (>100m) by natural means?				Total (a+b+c+d)	SCORE
<b>(a) Flying birds</b>		<b>(b) Other wild animals</b>		6, 7 or 8	3
<input type="checkbox"/> common	2	<input type="checkbox"/> common	2	3, 4 or 5	2
<input type="checkbox"/> occasional	1	<input type="checkbox"/> occasional	1	1 or 2	1
<input type="checkbox"/> unlikely	0	<input type="checkbox"/> unlikely	0	0	0
<input type="checkbox"/> don't know	?	<input type="checkbox"/> don't know	?		?
<b>(c) Water</b>		<b>(d) Wind</b>			
<input type="checkbox"/> common	2	<input type="checkbox"/> common	2		
<input type="checkbox"/> occasional	1	<input type="checkbox"/> occasional	1		
<input type="checkbox"/> unlikely	0	<input type="checkbox"/> unlikely	0		
<input type="checkbox"/> don't know	?	<input type="checkbox"/> don't know	?		

This question looks at how well the weed can spread its propagules (seed or vegetative) by natural means, to start new weed outbreaks a long distance from the original outbreak. Weeds which have more means of dispersal tend to spread faster. Consider if a weed is adapted for long-distance dispersal by any of the above means, and how regularly these means of dispersal occur. How often do you see new outbreaks starting at least 100 metres away from an original infestation?

Features favouring long-distance dispersal by flying birds and other wild animals (e.g. foxes, kangaroos, rabbits, emus) are:

- whole fruits are eaten, and viable seeds are then defecated or regurgitated (e.g. olives, sweet briar)
- propagules have hooks, barbs or sticky substances that attach to feathers, hairs or skin (e.g. horehound, brome grass)
- very small seeds which can lodge within feathers, hairs or feet (e.g. nutgrass)

Features favouring long-distance water dispersal are:

- propagules which float (consider wind-assisted movement as water dispersal)
- weeds located in or near to moving water
- frequent floods

Mainly aquatic weeds such as salvinia and seeding willows would be commonly dispersed over 100m by water movement.

Research has shown that seeds of most wind dispersed weeds actually land close to the parent plants. Long-distance dispersal is more likely to be common for tall trees with light seeds (with wings, plumes or hairs) which are subject to frequent strong winds, and for weeds which snap off after fruiting and roll across sparsely-vegetated ground (e.g. wild turnip, serrated tussock).

5. How likely is long-distance dispersal (>100m) by human means?				Total (a+b+c+d)	SCORE
<b>(a) Deliberate spread by people</b>		<b>(b) Accidentally by people and vehicles</b>		6, 7 or 8	3
<input type="checkbox"/> common	2	<input type="checkbox"/> common	2	3, 4 or 5	2
<input type="checkbox"/> occasional	1	<input type="checkbox"/> occasional	1	1 or 2	1
<input type="checkbox"/> unlikely	0	<input type="checkbox"/> unlikely	0	0	0
<input type="checkbox"/> don't know	?	<input type="checkbox"/> don't know	?		?
<b>(c) Contaminated produce</b>		<b>(d) Domestic/farm animals</b>			
<input type="checkbox"/> common	2	<input type="checkbox"/> common	2		
<input type="checkbox"/> occasional	1	<input type="checkbox"/> occasional	1		
<input type="checkbox"/> unlikely	0	<input type="checkbox"/> unlikely	0		
<input type="checkbox"/> don't know	?	<input type="checkbox"/> don't know	?		

This question looks at how well the weed can spread its propagules (seed or vegetative) by human-influenced means, to start new weed outbreaks a long distance from the original outbreak. Weeds which have more means of dispersal tend to spread faster. Consider if a weed is adapted for long-distance dispersal by any of the above means, and how regularly these means of dispersal occur. How often do you see new outbreaks starting at least 100 metres away from an original infestation?

Deliberate human spread includes weeds which are currently or have been historically planted for use in agriculture, forestry, horticulture, amenity, windbreaks and/or soil protection. **Ignore the landuse for this question.** Examples include olives, African lovegrass and Aleppo pine. Deliberate human spread also includes weeds with attractive flowers which are picked and then discarded (e.g. Calomba daisy, cape tulip). A weed may be legally restricted from sale, but is it still planted?

Features favouring accidental people and vehicle dispersal are:

- weeds which grow in heavily trafficked areas, such that transport by footwear, clothing or vehicles (including farm machinery and boats) may occur
- weeds which are dragged by farm machinery (e.g. silverleaf nightshade)
- propagules have hooks, barbs, or sticky substances to attach to objects (e.g. caltrop)
- very small propagules which can lodge in cracks in footwear, clothing or vehicles (e.g. Lincoln weed)

For contaminated produce consider crop seed, pasture seed, hay, soil, gravel, fertilisers, manures, and/or mulch. Examples of weeds which may be commonly spread by such means include bifora, salvation Jane, and soursob. Do not consider wool as this relates to the sale of farm animals between properties, which is covered in (d).

Features favouring dispersal by domestic/farm animals (e.g. sheep, cattle, horses, dogs) are:

- whole fruits are eaten, and viable seeds are then defecated or regurgitated (e.g. cutleaf mignonette, charlock)
- propagules have hooks, barbs or sticky substances that attach to feathers, hairs or skin (e.g. horehound, brome grass)
- very small seeds which can lodge within feathers, hairs or feet (e.g. nutgrass)

## IMPACTS

This section indicates the **potential impacts** the weed has. Each question is answered with a landuse in mind. Assume that the **weed has spread** across a whole paddock, orchard, plantation, nature reserve or water body, and that **commonly-used weed management practices have not been changed to specifically target the weed**. If the weed is well-controlled by these common practices then it will occur at a low density and will have minimal impacts. Alternatively, if the weed is poorly controlled by these common practices then it may get to a high density and have substantial impacts. If the weed has an effective biocontrol agent established which substantially reduces its growth then the weed's impacts will be reduced. **Decide if the weed is likely to reach a low, medium or high density in the landuse.**

1. Does the weed reduce the establishment of desired plants?		SCORE
<input type="checkbox"/> >50% reduction	The weed stops the establishment of more than 50% of desired plants (e.g. regenerating pasture, sown crops, planted trees, regenerating native vegetation), by preventing germination and/or killing seedlings.	3
<input type="checkbox"/> 10-50% reduction	The weed stops the establishment of between 10% and 50% of desired plants.	2
<input type="checkbox"/> <10% reduction	The weed stops the establishment of less than 10% of desired plants.	1
<input type="checkbox"/> none	The weed does not affect the germination and seedling survival of desired plants.	0
<input type="checkbox"/> don't know		?

This question looks at whether the weed prevents the establishment of desired plants, so the density of these plants is reduced. The weed may prevent germination by dense shading, or by forming physical barriers to water movement into the soil. The weed may kill seedlings by denying them access to soil moisture, sunlight and nutrients.

Note that the desired plants may mainly establish after a major disturbance (e.g. cultivation prior to planting, bushfire), so the weed itself may also be establishing. In these cases does the weed actually have a major effect?

Weeds which are likely to cause over 50% reductions in establishment are gorse and early-germinating (and unsprayed) salvation Jane in pastures, and phalaris and watsonia in native vegetation.

2. Does the weed reduce the yield or amount of desired vegetation?		SCORE
<input type="checkbox"/> >50% reduction	The weed reduces crop, pasture or forestry yield, or the amount of mature native vegetation by over 50%.	4
<input type="checkbox"/> 25-50% reduction	The weed reduces yield or amount of desired vegetation by between 25% and 50%.	3
<input type="checkbox"/> 10-25% reduction	The weed reduces yield or amount of desired vegetation by between 10% and 25%.	2
<input type="checkbox"/> <10% reduction	The weed reduces yield or amount of desired vegetation by up to 10%.	1
<input type="checkbox"/> none	The weed has no effect on growth of the desired vegetation. Or the weed may become desirable vegetation at certain times of year (e.g. providing useful summer feed), which balances out its reduction in the growth of other desirable plants.	0
<input type="checkbox"/> don't know		?



This question looks at the degree of yield loss (in crops, pastures, forestry) or suppression (in mature native vegetation) caused by the weed. It follows on from question 1, and looks at the growth achieved by plants which did establish despite the weed. The question is answered on a per hectare basis, in comparison to similar vegetation which is free of the weed. For native vegetation it may be useful to think in terms of percentage cover.

Weeds will reduce growth of other plants by competing for sunlight, water and nutrients. Competition is greater where a weed is larger (e.g. tall with a dense leaf canopy and an extensive root system) and grows at the same time as the desirable plants. Some weeds also compete by forming physical barriers which stop plants growing to reach light, water and/or nutrients (e.g. tuber mat of bridal creeper). A special case are parasitic weeds which directly attack other plants. Weeds which could cause >50% reductions in the yield/amount of desired vegetation would include Allepo pines, serrated tussock and branched broomrape.

Some weeds may increase the amount of useful vegetation in a landuse. For example, does a perennial weed of grazing land provide nutritious summer feed, thus increasing total pasture available throughout the year?

3. Does the weed reduce the quality of products or services obtained from the landuse?		SCORE
<input type="checkbox"/> <b>high</b>	The weed severely reduces product quality such that it cannot be sold. This may be due to severe contamination, toxicity, tainting and/or abnormalities (chemical and/or physical). For <b>native vegetation</b> , the weed severely reduces biodiversity (plants and animals) such that it is not suitable for nature conservation and/or nature-based tourism. For <b>urban</b> areas, the weed causes severe structural damage to physical infrastructure such as buildings, roads and footpaths.	3
<input type="checkbox"/> <b>medium</b>	The weed substantially reduces product quality such that it is sold at a much lower price for a low grade use. For <b>native vegetation</b> , the weed substantially reduces biodiversity such that it is given lower priority for nature conservation and/or nature-based tourism. For <b>urban</b> areas, the weed causes some structural damage to physical infrastructure such as buildings, roads and footpaths.	2
<input type="checkbox"/> <b>low</b>	The weed slightly reduces product quality, lowering its price but still passing as first grade product. For <b>native vegetation</b> , the weed has only marginal effects on biodiversity but is visually obvious and degrades the natural appearance of the landscape. For <b>urban</b> areas, the weed causes negligible structural damage, but reduces the aesthetics of an area through untidy visual appearance and/or unpleasant odour.	1
<input type="checkbox"/> <b>none</b>	The weed does not effect the quality of products or services.	0
<input type="checkbox"/> <b>don't know</b>		?

This question looks at whether the weed effects the quality of products or services obtained from a landuse. Products affected by the weed may include meat, grain/seed, milk, wool, timber, fruit, hay, and/or water. For native vegetation, consider services such as nature conservation and tourism. An example of a high effect on quality is dodder preventing the sale of seed crops. Reduction in stock condition/liveweight should not be considered here - this is due to either a reduction in available feed (question 2) or animal health effects caused by eating the weed (question 5).

For this question, ignore a weed's proclamation status with regard to moving contaminated produce in South Australia, but do consider noxious weed lists and seed quality standards of other states or countries. This prevents bias against non-proclaimed weeds when comparing them to existing proclaimed plants.

<b>4. Does the weed restrict the physical movement of people, animals, vehicles, machinery and/or water?</b>		<i>SCORE</i>
<input type="checkbox"/> <b>high</b>	Weed infestations are impenetrable throughout the year, preventing the physical movement of people, animals, vehicles, machinery and/or water.	3
<input type="checkbox"/> <b>medium</b>	Weed infestations are rarely impenetrable, but do significantly slow the physical movement of people, animals, vehicles, machinery and/or water throughout the year.	2
<input type="checkbox"/> <b>low</b>	Weed infestations are never impenetrable, but do significantly slow the physical movement of people, animals, vehicles, machinery and/or water at certain times of the year <b>or</b> provide a minor obstruction throughout the year.	1
<input type="checkbox"/> <b>none</b>	The weed has no effect on physical movement.	0
<input type="checkbox"/> <b>don't know</b>		?

This question looks at the degree to which a dense infestation of the weed physically restricts movement. Weeds may restrict movement by being tall, thorny, tangled and/or dense. For this question, ignore any deliberate restrictions on movement aimed solely at limiting the spread of weed propagules.

Examples of weed limits on movement include:

- slowing of stock mustering
- blockages of farm machinery at crop sowing and/or harvesting
- tyre punctures
- slowing of water flow in irrigation systems
- interference with boat access
- interference with thinning operations in forestry
- preventing stock access to pasture and/or water
- preventing animal access to nesting sites

Weeds which would score highly include blackberry and gorse at high densities, forming impenetrable thickets.

<b>5. Does the weed affect the health of animals and/or people?</b>		<i>SCORE</i>
<input type="checkbox"/> <b>high</b>	The weed is highly toxic and frequently causes death and/or severe illness in people, stock, and/or native animals.	3
<input type="checkbox"/> <b>medium</b>	The weed occasionally causes significant physical injuries (due to spines or barbs) and/or significant illness (chronic poisoning, strong allergies) in people, stock, and/or native animals, occasionally resulting in death.	2
<input type="checkbox"/> <b>low</b>	The weed can cause slight physical injuries or mild illness in people, stock, and/or native animals, with no lasting effects.	1
<input type="checkbox"/> <b>none</b>	The weed does not affect the health of animals or people.	0
<input type="checkbox"/> <b>don't know</b>		?

This question looks at how the weed affects the health of animals (domestic stock and native) and people. Note that if a weed is toxic but is not palatable then it may not actually be grazed. Ignore any starvation

effects from reduced growth of pasture or reduced access to pasture, as these have been covered in questions 2 and 4. A weed with high effects on health would be poison ivy.

<b>6. Does the weed have major, positive or negative effects on environmental health?</b>				
	<input type="checkbox"/> major positive effect	<input type="checkbox"/> major negative effect	<input type="checkbox"/> minor or no effect	<input type="checkbox"/> don't know
scoring for (a) - (f):	-1	1	0	?
<b>(a) food/shelter ?</b>	<i>Examples of negative effects are blackberry harbouring rabbits and grass weeds hosting wheat root diseases. An example positive effect is boxthorn providing stock shelter. Ignore pasture for livestock as this was covered in question 2.</i>			
<b>(b) fire regime?</b>	<i>This includes changes to the normal frequency, intensity, and/or timing of fires. Examples of weeds having major effects include exotic grasses invading shrubby native vegetation.</i>			
<b>(c) increase nutrient levels?</b>	<i>For example, legumes can increase soil nitrogen. This may make native vegetation more prone to invasion by other weeds, but would be beneficial in agriculture. Ignore competition for nutrients (decreased nutrient levels) as this was covered indirectly in question 2.</i>			
<b>(d) soil salinity?</b>	<i>Are the leaves of the weed high in salt? Leaf decomposition may increase salinity at the soil surface. Example plants are iceplant and tamarix.</i>			
<b>(e) soil stability?</b>	<i>Does the weed increase soil erosion, or silting of waterways?</i>			
<b>(f) soil water table?</b>	<i>Does the weed substantially raise or lower the soil water table compared to other plants present? Is this positive or negative? Ignore competition for water as this was covered in question 2.</i>			
Total (a + b + c + d + e + f)	>3	2 or 3	1	0 or less
SCORE FOR 6.	3	2	1	0

*This question looks at whether the weed has major, long-term effects on a landuse's environment. These effects may be beneficial or detrimental. Effects are more likely where the weed substantially changes the vegetation structure, such as woody weed invasion of grassland. Decisions on major effects should be well-known (e.g. backed up by scientific studies or expert opinion).*

## POTENTIAL DISTRIBUTION

This section looks at what proportion of a landuse is at risk from the weed in question. This will depend on the **climate and soil preferences of the weed**. For example, some weeds may only be suited to higher rainfall areas of a Board, or only be a problem on alkaline soils. **Differences within the landuse also need to be considered**. For example in the perennial horticulture landuse, a weed may be a problem in citrus but not occur in vineyards. This score should also be based on where the weed will grow at the density you assumed in scoring Impacts. That is, if you assumed a high density in scoring impacts then ignore areas where the weed would only persist at a low density when determining potential distribution

This question is best answered with topographic, landuse and soil maps for the Board area. These can be analysed electronically using a GIS system such as ArcView, or done on paper maps. Data and maps can be obtained from PIRSA. If using maps the following steps will help in estimating the percentage area of a landuse that is suitable for the weed:

1. Map the landuse in your Board. If you do not have a landuse map, you could shade areas on clear plastic laid over topographic maps.
2. Consider the climatic and soil preferences of the weed, and the vegetation/crop/pasture types within the landuse to which the weed is suited. Lay a sheet of plastic over the landuse map, and shade the areas of the landuse which are suitable for the weed.
3. Compare the weed's map to the landuse map to estimate the percentage of the landuse which is suitable for the weed. Answer as follows:

<b>In the Board, what percentage area of the landuse is suitable for the weed?</b>		<i>SCORE</i>
<input type="checkbox"/> <b>&gt; 80% of landuse</b>	The weed has a potential to spread to more than 80% of the landuse in the Board.	<i>10</i>
<input type="checkbox"/> <b>60-80% of landuse</b>	The weed has a potential to spread to between 60% and 80% of the landuse in the Board.	<i>8</i>
<input type="checkbox"/> <b>40-60% of landuse</b>	The weed has a potential to spread to between 40% and 60% of the landuse in the Board.	<i>6</i>
<input type="checkbox"/> <b>20-40% of landuse</b>	The weed has a potential to spread to between 20% and 40% of the landuse in the Board.	<i>4</i>
<input type="checkbox"/> <b>10-20% of landuse</b>	The weed has a potential to spread to between 10% and 20% of the landuse in the Board.	<i>2</i>
<input type="checkbox"/> <b>5-10% of landuse</b>	The weed has a potential to spread to between 5% and 10% of the landuse in the Board.	<i>1</i>
<input type="checkbox"/> <b>1-5% of landuse</b>	The weed has a potential to spread to between 1% and 5% of the landuse in the Board.	<i>0.5</i>
<input type="checkbox"/> <b>unsuited to landuse</b>	The weed is not suited to growing in any part of the landuse in the Board.	<i>0</i>
<input type="checkbox"/> <b>don't know</b>		<i>?</i>

## COMPARATIVE WEED RISK SCORE

The score for weed risk is calculated by adjusting the invasiveness, impacts and potential distribution scores to range from 0 to 10, and then multiplying these. Weed risk will have a maximum of 1000, and a minimum of 0. The spreadsheet does this for you.

To calculate manually, adjust the raw scores as follows:

Invasiveness: Divide by 15 and multiply by 10. Round off to one decimal place.

Impacts: Divide by 19, and multiply by 10. Round off to one decimal place.

Potential distribution: Leave unchanged.

$$\text{Comparative Weed Risk} = \text{Invasiveness} \times \text{Impacts} \times \text{Potential distribution}$$

Splitting up these possible scores into bands of 20% gives cutoffs for classes of weed risk:

Frequency Band		Weed Risk Score	Weed Risk
80 - 100%	(top 20% of possible scores)	192+	<i>Very high</i>
60 - 80%		< 192	<i>High</i>
40 - 60%		< 101	<i>Medium</i>
20 - 40%		< 39	<i>Low</i>
0 - 20%	(bottom 20% of possible scores)	< 13	<i>Negligible</i>

**Do not compare scores between landuses.** Landuses differ in their value and this is hard to measure. Also, average weed risk scores may be lower in agricultural landuses compared to other landuses. This is simply because of the greater level of weed management in agriculture. It does not mean that agricultural weeds are less important.

### Why multiply the invasiveness, impacts and potential distribution scores?

- Multiplying gives a greater spread in the scores than adding (i.e. range from 0-1000 compared to 0-30).
- Multiplying is logical, as it recognises the interactions between the criteria. Say the impacts of a weed can be measured in dollars per hectare per year, the potential distribution is known in hectares, and the invasiveness (i.e. rate of spread) is measured in terms of the increase in hectares compared to the previous year:

$$\begin{array}{ccccc} \text{Impact} & \times & \text{Potential Distribution} & \times & \text{Invasiveness} \\ \$ / \text{hectares} / \text{year} & & \text{hectares} & & \text{hectares}(\text{current year}) / \text{hectares} (\text{previous year}) \end{array}$$

When multiplying, all of the hectares units cancel so that weed importance is measured in total dollars per year. In multiplying the invasiveness, impacts and potential distribution criteria scores, we are mimicking the above calculation, without having the actual dollar and hectare figures.

## 2) FEASIBILITY OF CONTAINMENT

The feasibility of containment questions are divided into three main criteria; control costs, current distribution and persistence. **Control costs** considers the weed management costs of detection, on-ground control and enforcement/education needs. **Current distribution** considers how widespread the weed is. **Persistence** refers to the expected duration of control works. Scores for each of these criteria are multiplied (each ranging between 0 and 10), to give a feasibility score out of 1000.

Assess feasibility for the **landuse at risk**, so that its score can be directly compared to the weed risk score from the same landuse to set control priorities.

In the following questions higher scores indicate lower feasibility of containment.

### CONTROL COSTS

This section indicates the control cost per hectare in the **first year of targeted control**, for an infestation of the weed that has reached its **maximum density in the landuse at risk**. The four main cost factors associated with coordinated control programs are searching for the weed, accessing and treating infestations, and achieving landholder commitment.

1. How detectable is the weed?		Total (a+b+c+d)	SCORE
<b>(a) Height at maturity</b>	<b>(b) Shoot growth present</b>	7 or 8	3
<input type="checkbox"/> <0.5 m            2	<input type="checkbox"/> <4 months            2	5 or 6	2
<input type="checkbox"/> 0.5-2 m            1	<input type="checkbox"/> 4-8 months            1	3 or 4	1
<input type="checkbox"/> >2 m            0	<input type="checkbox"/> >8 months            0	0, 1 or 2	0
<input type="checkbox"/> don't know            ?	<input type="checkbox"/> don't know            ?		?
<b>(c) Distinguishing features</b>	<b>(d) Pre-reproductive height in relation to other vegetation</b>		
<input type="checkbox"/> non-descript            2	<input type="checkbox"/> below canopy            2		
<input type="checkbox"/> sometimes distinct            1	<input type="checkbox"/> similar height            1		
<input type="checkbox"/> always distinct            0	<input type="checkbox"/> above canopy            0		
<input type="checkbox"/> don't know            ?	<input type="checkbox"/> don't know            ?		

*This question indicates the cost of finding infestations of the weed. Parts (a), (b) and (c) relate to finding new infestations. Part (d) relates to finding and treating plants prior to reproduction.*

*(a) Taller plants can be spotted from greater distances.*

*(b) Shoot growth considers when shoots are visible (live or dead). Annuals and some perennials (e.g., bridal creeper, bulbil watsonia) have shoots present for a limited period of the year.*

*(c) Distinguishing features include appearance and smell of foliage, flowers and fruits. This indicates how conspicuous the weed is amongst other vegetation. For example, the shape and foliage of a pine tree is quite obvious amongst native vegetation.*

*(d) Pre-reproductive height refers to locating the weed for control prior to seed set or bulb formation. Control must occur before reproduction if local eradication is to occur. The pre-reproductive height will mostly be less than at maturity and the weed will also probably be growing amongst other vegetation. Hence the weed's height is described relative to the canopy height of this other vegetation. For example, if considering a weed of the Crop/Pasture Rotation landuse then the canopy will be the height of the crop.*

2. What is general accessibility of known infestations?		SCORE
<input type="checkbox"/> low	Most infestation sites difficult to access	2
<input type="checkbox"/> medium	Most infestation sites readily accessible	1
<input type="checkbox"/> high	All infestation sites readily accessible	0
<input type="checkbox"/> not present	Not known to be present in Board	0
<input type="checkbox"/> don't know		?

Sites may be difficult to traverse due to slope, rockiness, dense vegetation and/or surface water. This will slow down searching and control activities. There may be seasonal differences in accessibility (e.g. winter waterlogging), but answer in terms of the optimal search and control times for the weed.

3. How expensive is control of the weed, using techniques which both maximise efficacy and minimise off-target damage?				SCORE
<b>(a) Chemicals, fuel and equipment operating costs</b>		<b>(b) Labour costs</b>		Range between 0 and 8
<input type="checkbox"/> very high	4	<input type="checkbox"/> very high	4	Total (a+b)
<input type="checkbox"/> high	3	<input type="checkbox"/> high	3	<input type="checkbox"/> don't know
<input type="checkbox"/> medium	2	<input type="checkbox"/> medium	2	
<input type="checkbox"/> low	1	<input type="checkbox"/> low	1	
<input type="checkbox"/> not applicable	0	<input type="checkbox"/> not applicable	0	
<input type="checkbox"/> don't know	?	<input type="checkbox"/> don't know	?	

Select a cost category (A, B or C) for the landuse being considered. This allows for more realistic control cost estimates.

	Cost Categories			SCORE
	A	B	C	
<b>Very high</b>	>\$1000/ha	>\$500/ha	>\$100/ha	4
<b>High</b>	\$500-1000/ha	\$250-500/ha	\$50-100/ha	3
<b>Medium</b>	\$250-500/ha	\$100-250/ha	\$25-50/ha	2
<b>Low</b>	<\$250/ha	<\$100/ha	<\$25/ha	1

Herbicides are the main means by which weeds are controlled. Physical control methods may be cultivation, cutting/slashing stems or extraction (e.g., boxthorn plucker). Do not consider capital costs for purchasing application equipment in this question.

4. What is the likely level of cooperation from landholders within the landuse at risk?		SCORE
<input type="checkbox"/> low	Weed control is rarely undertaken in the landuse. Cost of control is beyond the financial and technical capacity of landholders.	2
<input type="checkbox"/> medium	Control of the weed will require a significant change in existing weed management practices, but this will be within the financial and technical capacity of landholders.	1
<input type="checkbox"/> high	Control of the weed will require minimal change in existing weed management practices.	0
<input type="checkbox"/> don't know		?



Aside from the “on-ground” costs of searching and control, a coordinated control program will have overarching costs of extension/education, enforcement, project management and administration. The ease of motivating and coordinating landholders in an ongoing program will vary between landuses, particularly in relation to their financial capacity to support a control program.

### **CURRENT DISTRIBUTION**

This section indicates how widespread the weed currently is within the landuse. It considers the proportion of the landuse infested, and the overall pattern of infestations.

<b>1. What percentage area of the <u>landuse</u> is currently infested by the weed?</b>		<b>SCORE</b>
<input type="checkbox"/> <b>&gt;80% of landuse</b>	The weed infests more than 80% of the landuse in the Board.	10
<input type="checkbox"/> <b>60-80% of landuse</b>	The weed infests between 60% and 80% of the landuse.	8
<input type="checkbox"/> <b>40-60% of landuse</b>	The weed infests between 40% and 60% of the landuse.	6
<input type="checkbox"/> <b>20-40% of landuse</b>	The weed infests between 20% and 40% of the landuse.	4
<input type="checkbox"/> <b>10-20% of landuse</b>	The weed infests between 10% and 20% of the landuse.	2
<input type="checkbox"/> <b>5-10% of landuse</b>	The weed infests between 5% and 10% of the landuse.	1
<input type="checkbox"/> <b>1-5% of landuse</b>	The weed infests between 1% and 5% of the landuse.	0.5
<input type="checkbox"/> <b>&lt;1% of landuse</b>	The weed is present in the landuse but infests less than 1%.	0.1
<input type="checkbox"/> <b>0% of landuse but in 20-40% of Board</b>	The weed is not known to be present in the landuse but does infest between 20% and 40% of the Board area.	2
<input type="checkbox"/> <b>0% of landuse but in 10-20% of Board</b>	The weed is not known to be present in the landuse but does infest between 10% and 20% of the Board area.	1
<input type="checkbox"/> <b>0% of landuse but in 5-10% Board</b>	The weed is not known to be present in the landuse, but does infest between 5% and 10% of the Board.	0.5
<input type="checkbox"/> <b>0% of landuse but in 1-5% Board</b>	The weed is not known to be present in the landuse, but does infest 1-5% of Board.	0.1
<input type="checkbox"/> <b>0% of landuse but &lt;1% of Board</b>	The weed is not known to be present in the landuse, but does infest <1% of Board. Or the species is not naturalised in the Board but is cultivated (e.g. olives).	0.05
<input type="checkbox"/> <b>0% of Board</b>	The species is not known to be present in the Board.	0
<input type="checkbox"/> <b>don't know</b>		?

The aim of containment is to prevent weed spread to a susceptible landuse. The greater the area of landuse that is already occupied, then the less feasible is containment. In the above table it is assumed to be highly unlikely that a weed could infest >40% of the Board area and not also be present in the landuse.

<b>2. What is the pattern of the weed's distribution across the Board area?</b>		<b>SCORE</b>
<input type="checkbox"/> <b>widespread</b>	The weed occurs in large and small infestations across most of the Board area.	2
<input type="checkbox"/> <b>evenly scattered</b>	The weed occurs as discrete, mainly small infestations across much of the Board area.	1
<input type="checkbox"/> <b>restricted</b>	The weed is localised to 1-2 hundreds of the Board area. Or the weed is not known to be naturalised in the Board area.	0
<input type="checkbox"/> <b>don't know</b>		?

A weed which is widespread will be more difficult to contain than one which is restricted to a small section of the Board. The former will have more landholders potentially exposed to spread of the weed.

### **PERSISTENCE**

This section indicates how long it takes to eradicate the weed. It considers the efficacy of targeted control treatments, reproductive age, seedbank longevity and the likelihood of ongoing dispersal.

<b>1. How effective are targeted control treatments applied to infestations of the weed?</b>		<b>SCORE</b>
<input type="checkbox"/> <b>low</b>	More than 25% of weeds survive annual targeted treatment/s.	3
<input type="checkbox"/> <b>medium</b>	Up to 25% of weeds survive annual targeted treatment/s.	2
<input type="checkbox"/> <b>high</b>	Up to 5% of weeds survive annual targeted treatment/s.	1
<input type="checkbox"/> <b>very high</b>	Up to 1% of weeds survive annual targeted treatment/s.	0
<input type="checkbox"/> <b>don't know</b>		?

*Do the herbicide and physical control treatments costed above kill all plants in an infestation? Efficacy can be reduced due to:*

- *tolerance to or recovery from treatment*
- *incomplete application of a treatment (e.g., some plants receive a sub-lethal dose of herbicide, missed plants)*
- *vegetative regeneration (e.g. silverleaf nightshade)*
- *"out of season" growth (e.g. early or late germination of annuals)*

<b>2. What is the minimum time period for reproduction of sexual or vegetative propagules?</b>		<b>SCORE</b>
<input type="checkbox"/> <b>&lt;1 month</b>	Minimum generation time <1 month.	3
<input type="checkbox"/> <b>&lt;1 year</b>	Minimum generation time 1-12 months.	2
<input type="checkbox"/> <b>&lt;2 years</b>	Minimum generation time 12-24 months.	1
<input type="checkbox"/> <b>&gt;2 years</b>	Minimum generation time >24 months.	0
<input type="checkbox"/> <b>don't know</b>		?

The shorter the time period to reproduction, the greater the frequency of control treatments required and the greater the chance of plants being missed prior to reproduction. Aquatic plants such as salvinia can have rapid vegetative reproduction.

3. What is the maximum longevity of sexual or vegetative propagules?		SCORE
<input type="checkbox"/> >5 years	Sexual or vegetative propagules can remain dormant for at least 5 years.	2
<input type="checkbox"/> 2-5 years	Sexual or vegetative propagules can remain dormant for 2-5 years.	1
<input type="checkbox"/> <2 years	Sexual or vegetative propagules remain dormant for less than 2 years.	0
<input type="checkbox"/> don't know		?

Soil seedbank longevity is the primary determinant of how long an infestation must be treated to achieve eradication.

4. How likely are new propagules to continue to arrive at control sites, or start new infestations?		Total (a+b)	SCORE
<b>(a) Long-distance dispersal by natural means</b>	<b>(b) Grown</b>		
<input type="checkbox"/> frequent	2	<input type="checkbox"/> commonly planted	2
<input type="checkbox"/> occasional	1	<input type="checkbox"/> occasionally planted	1
<input type="checkbox"/> rare	0	<input type="checkbox"/> not planted	0
<input type="checkbox"/> don't know	?	<input type="checkbox"/> don't know	?
		4	3
		2-3	2
		1	1
		0	0

#### FEASIBILITY OF CONTAINMENT SCORE

The score for feasibility of containment is calculated by adjusting the control costs, current distribution and persistence scores to range from 0 to 10, and then multiplying these. Feasibility of containment will have a maximum of 1000, and a minimum of 0. The spreadsheet does this for you.

Splitting up these possible scores into bands of 20% gives cutoffs for classes of feasibility of containment:

Frequency Band	Feasibility Score	Feasibility of Containment
80 - 100% (top 20% of possible scores)	113+	Negligible
60 - 80%	< 113	Low
40 - 60%	< 56	Medium
20 - 40%	< 31	High
0 - 20% (bottom 20% of possible scores)	< 14	Very High

**Why multiply the Control Costs, Current Distribution and Duration of Control scores?**

- Multiplying gives a greater spread in the scores than adding (i.e. range from 0-1000 compared to 0-30).
- Multiplying is logical, as it recognises the interactions between the criteria. Say the control costs of a weed can be measured in dollars per hectare per year, the current distribution is known in hectares, and the duration of control is known in years:

$$\begin{array}{ccccccc} \text{Control Costs} & \times & \text{Current Distribution} & \times & \text{Duration of Control} & & \\ \$ / \text{hectares} / \text{year} & & \text{hectares} & & \text{years} & & \end{array}$$

When multiplying, all of the hectares units cancel so that feasibility of control is measured in total dollars. In multiplying the control costs, current distribution and duration of control criteria scores, we are mimicking the above calculation, without having the actual dollar and hectare figures.