Limestone Coast Pest Management Strategy

A regional biosecurity plan for the management of invasive species

Part 2: Pest Management Plan

Pest Risk Assessment

SUMMARY

The aim of this strategy is to determine the priority pest plants and pest animals of the Limestone Coast Landscape Board region of South Australia. Prioritisation will allow the development of appropriate and strategic policies and actions to protect the region's biodiversity and the value of it's primary industries.

It is important to note that the risk assessments were carried out at a regional scale and will therefore not reflect all local situations or priorities. Such specific local issues can be reflected in local policies and management plans; however a regional approach is required for strategic planning purposes.

The strategy methodology follows the draft National Post-border Weed Risk Management Protocol developed by Standards Australia. A weed and pest risk assessment system developed by the then Department of Water Land Biodiversity Conservation (DWLBC), now Biosecurity SA, was used to determine which pests pose the greatest threats to primary industries and the environment in the Limestone Coast region.

A review of the risk assessments was conducted in 2020 for a nominated selection of pest plants and pest animals. The review also included the assessment of pest species declared since 2009 that are relevant to the Limestone Coast region.

In the original assessment process in 2009, various stakeholders assisted with specialist technical information on the pest plant and pest animal species and land use practices addressed in this project. The most appropriate management actions for these pests were then identified using a feasibility of containment assessment system utilised by Biosecurity SA.

The results of the strategy will provide the basis for the Limestone Coast Landscape Board to complete regional pest policies. It will also assist the Board and other stakeholders to prioritise on ground works. Table 1.1 lists the priority pest plant and pest animal species identified by the assessment.

Table 1.1   Priority pest plant and pest animal list
   #   Environmental pest plants
   ^   Agricultural pest plants

Management Action	Declared Species		Non declared species
	Pest plants	**Pest animals**	
Alert List *Species that are not known to be present in the region and which represent a significant threat. Aims to prevent the species arriving and establishing in the management area*	Alisma Alkali sida Alligator weed Arrowhead Broadkernel espartillo Broomrape Cabomba Calomba daisy Cane needlegrass Chilean needlegrass Distichlis Dune onion weed Elodea Eurasian watermilfoil Horsetail Hydrocotyle	Cane toad Common myna House crow Indian ringneck Laughing dove Red-eared slider Red-whiskered bulbul Song thrush Tree sparrow Water buffalo	Blue mustard Pheasant's eye Water primrose

Management Action	Declared Species		Non declared species
	Pest plants	**Pest animals**	
	Lagarosiphon Lantana Leafy elodea Mexican feathergrass Nightstock Parrot's feather Plumerillo Poison buttercup Poison Ivy Primrose willow Ragwort Rhus tree Sagittaria Salvinia Senegal tea plant Serrated tussock Tree Heath Water caltrop Water dropwort Water hyacinth Water soldier		
Eradication from Region *Aims to remove the pest species from the management area*	Bridal veil# Golden dodder^	Dingo/Wild dog^ Goat#^ Feral pig#^	
Destroy Infestations *Aims to significantly reduce the extent of the pest species in the management area*	Blackberry# Bridal creeper, western cape form# Buffel grass#^ Fountain grass#^ Innocent weed^ Pampas grass# Silverleaf nightshade^ Texas needlegrass^ White weeping broom#	Chital, Rusa & Sambar deer#^ Hog deer#^ Mallard# Red & Wapiti deer#^	Tree of heaven
Contain Spread *Aims to prevent the ongoing spread of the pest species in the management area*	African boxthorn#^ African feathergrass#^ African lovegrass#^ Aleppo pine# Asparagus fern# Bathurst burr^ Bluebell creeper# Boneseed# Caltrop^ Cape tulip (1&2 leaf)^ Coolatai grass#^ Creeping knapweed^ Erica# Gorse#^ Hoary cress^ Madeira vine#	Brown rat Fallow deer#^ Rabbit#^	Radiata pine# Carp

Management Action	Declared Species		Non declared species
	Pest plants	Pest animals	
	Prickly pear^# Salvation Jane^ Three corner jack^ Three horned bedstraw^ Variegated thistle^		
Protect Sites *Aims to prevent spread of the pest species to key sites/assets of high economic, environmental and/or social value*	Apple of Sodom^ Arum Lily# Bladder campion^ Coastal tea tree# Cape broom# Cotoneaster# Cutleaf mignonette^ Dolichos pea# English broom# False caper^ Field bindweed^ Gazania# Horehound^ Italian Buckthorn# Lincoln weed^ Mirror bush# Muskweed# Noogoora burr^ Olive# Polygala# Sallow wattle# Spiny rush#^ Swamp oak# Willow spp.#^	Black rat#^	Bedstraw^ Blue psoralea# Cootamundra wattle# Couch#^ Ivy# Kikuyu#^ Sea wheatgrass# Slender thistle^ Solider thistle^ Spear thistle^ Wild carrot^ Goldfish Marron
Manage Pest *Aims to reduce the overall economic, environmental and/or social impacts of the pest species through targeted management*	Bridal creeper# Desert ash# Yellow burrweed^	Feral cat# Fox#^ House mouse#^ Starling#^ Eurasian blackbird#^ Domestic pigeon#^ Hare	Annual rye grass^ Bracken fern^ Capeweed^ Coastal wattle# Fat hen^ Golden wreath wattle# Phalaris^ Pin cushion daisy^# Poa grass^# Pyp grass#^ Tall wheatgrass# Veldt grass# Western coastal wattle# Wild oats#^ Wild radish^ Trout Carp gudgeon Gambusia Redfin

Management Action	Declared Species		Non declared species
	Pest plants	Pest animals	
Manage Sites *Aims to maintain the overall economic, environmental and/or social value of key sites/assets through improved general pest management*	Dog rose# Perennial thistle^ Skeleton weed^ Sweet briar# Sweet pittosporum#		Blue periwinkle# Buchan weed^# Dock^ Fleabane^ Freesia# Marram grass# Onion grass^ Onion weed^ Poplars^# Silver grass^ Soursob^ South African weed orchid# Tagasaste# Williams grass^ Wireweed^ Tench
Monitor *Aims to detect any significant changes in the species 'pest risk*	Arum lily# Athel pine^# Chilean dodder^ Red dodder^ Hawthorn/ May# Wild artichoke^		Agave# Butterfly bush# English oak# Marguerite daisy# Sea spurge# Wandering jew#
Limited Action *The pest species would only be targeted for coordinated control in the management area if its local presence makes it likely to spread to land uses where it ranks as a higher priority.*			Bamboo# Blackberry nightshade^ Bulbil watsonia# Ox tongue^ Pepper tree Sorrell^ White arctotis

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1 THE LIMESTONE COAST REGION

The Limestone Coast Landscape Board region is situated in the South East corner of South Australia. It is bounded by the Victorian border to the east, the Southern Ocean to the south and west and the Murraylands and Riverland Landscape Board region to the north.

The Limestone Coast Landscape Board region is made up of nine local government areas, these being the District Councils of Grant, Robe, Tatiara, Kingston District Council, Naracoorte Lucindale Council, Wattle Range Council, Coorong Council, Southern Mallee District Council and the City of Mount Gambier. Mount Gambier is the main regional centre and the only city in the Limestone Coast of South Australia. The principal townships are Bordertown, Keith, Kingston, Millicent, Naracoorte, Penola and Robe.

The highest annual rainfalls are found in the southern areas of the region where the average precipitation is approximately 850mm. Rainfall decreases in the north to approximately 450mm per annum. The majority of rain falls during the winter months, particularly in the coastal zones. The climate of the Limestone Coast is a cool Mediterranean temperate climate; warmer in the upper Limestone Coast than the lower Limestone Coast.

The majority of soil types in the Limestone Coast 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 and 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 Limestone Coast, 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 highly productive for the viticulture industry.

Primary production is varied across the region. In the southern zone, there is high forestry activity, dairy production and livestock production. In the north, large scale cropping, vineyards and grazing are the prominent practices. The majority of the Limestone Coast Landscape Board 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 economic, environmental and social impact due to the presence of pest plants and pest animals is well documented (McLeod 2018, Sinden *et al.* 2004, Gong *et al.* 2009). At a national scale pest plants are suggested to impact upon agricultural production and loss of biodiversity to the tune of $5 billion per annum, while pest animals have a direct economic impact of at least $743 million per annum.

2 REGIONAL LAND USE

2.1 THE IMPORTANCE OF LAND USE AND ITS ROLE IN PEST MANAGEMENT

There are various factors which will determine the capacity of exotic plants and animals to become "pests" and have an impact on a landscape. Climate and availability of natural resources are very important factors which allow pest plants and pest animals to invade and exploit their environment. Land use and its management are extremely important in the capacity of an individual species or combination of species to dominate a landscape.

The classification and description of land use and its management is significant for the monitoring and evaluation of each pest plant and pest animal and the impacts on the costs of primary production, environment, social and cultural values.

While the full impact of climate change on pest plant and animal populations is becoming more undertsood, it is known that land use and its management can change rapidly particularly in agricultural production, where the marketplace often determines which enterprises are undertaken in the short to medium term.

Climate and soils will be a limiting factor for the adoption of some land uses; however the use of irrigation or controlled environments such as glasshouse production can extend the land use options available.

The Australian Land Use and Management (ALUM) classification scheme has been agreed to by all state and territory authorities in Australia and is based on a classification system developed by Baxter and Russell in 1994. The ALUM classification Table 2.1, is a simple classification system, which provides the basis for measuring land use and its management across the whole of Australia at a range of landscapes, from National to catchment levels. It has six primary classes, which are then split into secondary and tertiary classifications to allow for more detailed land use categories.

The latest land use survey and classification for the Limestone Coast region was conducted in 2014 utilising ALUM classification version 7.

Limestone Coast Landscape Board land use consolidation, Table 2.2, shows the comparison between the land uses in the Limestone Coast Landscape Board region and the classification identified under the ALUM classification.

The adoption and use of the ALUM classification system will ensure that the Limestone Coast Landscape Board will be able meet national standards in monitoring and evaluating the impact of land use and its management on the presence of pest plants and pest animals.

Table 2.1   ALUM classification version 7 – summary

AUSTRALIAN LAND USE AND MANAGEMENT CLASSIFICATION Version 7 (Revision as at 19 May 2010)

1 Conservation and Natural Environments	2 Production from Relatively Natural Environments	3 Production from Dryland Agriculture and Plantations	4 Production from Irrigated Agriculture and Plantations	5 Intensive Uses	6 Water
1.1.0 Nature conservation 1.1.1 Strict nature reserves 1.1.2 Wilderness area 1.1.3 National park 1.1.4 Natural feature protection 1.1.5 Habitat/species management area 1.1.6 Protected landscape 1.1.7 Other conserved area	**2.1.0 Grazing native vegetation**	**3.1.0 Plantation forestry** 3.1.1 Hardwood plantation 3.1.2 Softwood plantation 3.1.3 Other forest plantation 3.1.4 Environmental forest plantation	**4.1.0 Irrigated plantation forestry** 4.1.1 Irrigated hardwood plantation 4.1.2 Irrigated softwood plantation 4.1.3 Irrigated other forest plantation 4.1.4 Irrigated environmental forest plantation	**5.1.0 Intensive horticulture** 5.1.1 Shadehouses 5.1.2 Glasshouses 5.1.3 Glasshouses (hydroponic) 5.1.4 Abandoned intensive horticulture	**6.1.0 Lake** 6.1.1 Lake - conservation 6.1.2 Lake - production 6.1.3 Lake - intensive use 6.1.4 Lake - saline
1.2.0 Managed resource protection 1.2.1 Biodiversity 1.2.2 Surface water supply 1.2.3 Groundwater 1.2.4 Landscape 1.2.5 Traditional indigenous uses	**2.2.0 Production forestry** 2.2.1 Wood production 2.2.2 Other forest production	**3.2.0 Grazing modified pastures** 3.2.1 Native/exotic pasture mosaic 3.2.2 Woody fodder plants 3.2.3 Pasture legumes 3.2.4 Pasture legume/grass mixtures 3.2.5 Sown grasses	**4.2.0 Grazing irrigated modified pastures** 4.2.1 Irrigated woody fodder plants 4.2.2 Irrigated pasture legumes 4.2.3 Irrigated legume/grass mixtures 4.2.4 Irrigated sown grasses	**5.2.0 Intensive animal husbandry** 5.2.1 Dairy sheds and yards 5.2.2 Cattle feedlots 5.2.3 Sheep feedlots 5.2.4 Poultry farms 5.2.5 Piggeries 5.2.6 Aquaculture 5.2.7 Horse studs 5.2.8 Stockyards/saleyards 5.2.9 Abandoned intensive animal husbandry	**6.2.0 Reservoir/dam** 6.2.1 Reservoir 6.2.2 Water storage - intensive use/farm dams 6.2.3 Evaporation basin
1.3.0 Other minimal use 1.3.1 Defence land - natural areas 1.3.2 Stock route 1.3.3 Residual native cover 1.3.4 Rehabilitation		**3.3.0 Cropping** 3.3.1 Cereals 3.3.2 Beverage and spice crops 3.3.3 Hay and silage 3.3.4 Oil seeds 3.3.5 Sugar 3.3.6 Cotton 3.3.7 Alkaloid poppies 3.3.8 Pulses	**4.3.0 Irrigated cropping** 4.3.1 Irrigated cereals 4.3.2 Irrigated beverage and spice crops 4.3.3 Irrigated hay and silage 4.3.4 Irrigated oil seeds 4.3.5 Irrigated sugar 4.3.6 Irrigated cotton 4.3.7 Irrigated alkaloid poppies 4.3.8 Irrigated pulses 4.3.9 Irrigated rice	**5.3.0 Manufacturing and industrial** 5.3.1 General purpose factory 5.3.2 Food processing factory 5.3.3 Major industrial complex 5.3.4 Bulk grain storage 5.3.5 Abattoirs 5.3.6 Oil refinery 5.3.7 Sawmill 5.3.8 Abandoned manufacturing and industrial	**6.3.0 River** 6.3.1 River - conservation 6.3.2 River - production 6.3.3 River - intensive use
minimum level of attribution		**3.4.0 Perennial horticulture** 3.4.1 Tree fruits 3.4.2 Oleaginous fruits 3.4.3 Tree nuts 3.4.4 Vine fruits 3.4.5 Shrub nuts, fruits and berries 3.4.6 Perennial flowers and bulbs 3.4.7 Perennial vegetables and herbs 3.4.8 Citrus 3.4.9 Grapes	**4.4.0 Irrigated perennial horticulture** 4.4.1 Irrigated tree fruits 4.4.2 Irrigated oleaginous fruits 4.4.3 Irrigated tree nuts 4.4.4 Irrigated vine fruits 4.4.5 Irrigated shrub nuts, fruits and berries 4.4.6 Irrigated perennial flowers and bulbs 4.4.7 Irrigated perennial vegetables and herbs 4.4.8 Irrigated citrus 4.4.9 Irrigated grapes	**5.4.0 Residential and farm infrastructure** 5.4.1 Urban residential 5.4.2 Rural residential with agriculture 5.4.3 Rural residential without agriculture 5.4.4 Remote communities 5.4.5 Farm buildings/infrastructure	**6.4.0 Channel/aqueduct** 6.4.1 Supply channel/aqueduct 6.4.2 Drainage channel/aqueduct 6.4.3 Stormwater
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		3.6.0 Land in transition 3.6.1 Degraded land 3.6.2 Abandoned land 3.6.3 Land under rehabilitation 3.6.4 No defined use 3.6.5 Abandoned perennial horticulture	**4.6.0 Irrigated land in transition** 4.6.1 Degraded irrigated land 4.6.2 Abandoned irrigated land 4.6.3 Irrigated land under rehabilitation 4.6.4 No defined use (irrigation) 4.6.5 Abandoned irrigated perennial horticulture	**5.6.0 Utilities** 5.6.1 Fuel powered electricity generation 5.6.2 Hydro electricity generation 5.6.3 Wind farm electricity generation 5.6.4 Electricity substations and transmission 5.6.5 Gas treatment, storage and transmission 5.6.6 Water extraction and transmission	**6.6.0 Estuary/coastal waters** 6.6.1 Estuary/coastal waters - conservation 6.6.2 Estuary/coastal waters - production 6.6.3 Estuary/coastal waters - intensive use
				5.7.0 Transport and communication 5.7.1 Airports/aerodromes 5.7.2 Roads 5.7.3 Railways 5.7.4 Ports and water transport 5.7.5 Navigation and communication	
				5.8.0 Mining 5.8.1 Mines 5.8.2 Quarries 5.8.3 Tailings 5.8.4 Extractive industry not in use	
				5.9.0 Waste treatment and disposal 5.9.1 Effluent pond 5.9.2 Landfill 5.9.3 Solid garbage 5.9.4 Incinerators 5.9.5 Sewage/sewerage	

Table 2.2   Limestone Coast Landscape Board land use consolidation

ALUM Classification V7_Primary land use	ALUM Classification V7_Secondary land use		Limestone Coast PMS land use
1 Conservation and natural environments	1.1	Nature conservation	Native Vegetation
	1.2	Managed resource protection	Native Vegetation
	1.3	Other minimal use	Native Vegetation
2 Production from relatively natural environments	2.1	Grazing native vegetation	Grazing
	2.2	Production forestry	Forestry
3 Production from dryland agriculture and plantations	3.1	Plantation forestry	Forestry
	3.2	Grazing modified pastures	Grazing
	3.3	Cropping	Cropping
	3.4	Perennial horticulture	Perennial Horticulture
	3.5	Seasonal horticulture	Perennial Horticulture
	3.6	Land in transition	Perennial Horticulture
4 Production from irrigated agriculture and plantations	4.1	Irrigated plantation forestry	Forestry
	4.2	Grazing irrigated modified pastures	Irrigated Crops and Pastures
	4.3	Irrigated cropping	Irrigated Crops and Pastures
	4.4	Irrigated perennial horticulture	Perennial Horticulture
	4.5	Irrigated seasonal horticulture	Irrigated Crops and Pastures
	4.6	Irrigated land in transition	Grazing
5 Intensive uses	5.1	Intensive horticulture	Perennial Horticulture
	5.2	Intensive animal husbandry	Grazing
	5.3	Manufacturing and industrial	Urban
	5.4	Residential and farm infrastructure	Urban
	5.5	Services	Urban
	5.6	Utilities	Urban
	5.7	Transport and communication	Urban
	5.8	Mining	Urban
	5.9	Waste treatment and disposal	Urban
6 Water	6.1	Lake	Aquatic
	6.2	Reservoir	Aquatic
	6.3	River	Aquatic
	6.4	Channel/aqueduct	Aquatic
	6.5	Marsh/wetland	Aquatic
	6.6	Estuary/coastal waters	Aquatic

Figure 2.1   Major land uses of Limestone Coast Landscape Board region.

3   METHOD

3.1   PEST PLANT RISK ASSESSMENT

Determining priority pest plants allows effective and efficient policies to be developed that protect the economic, environmental, social and cultural assets of the region. Prioritisation is required in order to allocate limited human and financial resources for the most beneficial outcome for the region. Every pest assessed in this plan has been assigned to a strategic management action category according to its results within the particular land use.

The species identified are a combination of the declared plant list under the Landscape SA Act 2019 and other non-declared plants considered to be pests in the Limestone Coast region.

3.1.1   Determining the pest list

In 2005 a comprehensive assessment process was undertaken by obtaining information from various stakeholders. This was a detailed and thorough process by which groups were formed for each land use consisting of professionals and community members active in each particular land use. As a group, members then undertook the weed risk assessment for the land use they were representing.

A second assessment was undertaken in 2009 by investigating and assessing other South Australian Natural Resource Management regional weed risk assessments. Pest plants were identified which were not previously assessed in a particular land use, or were not assessed at all in the South East weed risk assessment in 2005.

In 2020, a limited review of the Pest Management Strategy was conducted. The review included the assessment of a selection of existing and newly declared pest plants and animals that had been declared since 2009 under the Natural Resources Management Act 2004 and the subsequent Landscape SA Act 2019.

3.1.2   Applying the SA Weed Risk Management System

In 2008, South Australia, developed a ranking system to use in planning control programs and in assessing new species for declaration. The then Department of Water Land and Biodiversity Conservation (DWLBC), now Biosecurity SA, Weed Risk Management Scoresheet, produced in consultation with regional Authorised Officers, were based on a ranking system developed to determine Weeds of National Significance (WoNS) in Australia.

Pest plants are assessed separately for different land uses so that the most important pest plants of different land uses can be accurately identified. This project assessed pest plants 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 pest plant. This process allows an objective assessment to be made on a pest plants threat rather than simply react to its presence and appearance. The South Australian Weed Management Guide can be seen in Appendix 1.

Weed Risk

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

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+	*Very high*
60 - 80%	< 192	*High*
40 - 60%	< 101	*Medium*
20 - 40%	< 39	*Low*
0 - 20% (bottom 20% of possible scores)	< 13	*Negligible*

Feasibility of control

Within the landuse the feasibility of controlling the pest plant is also an important consideration in prioritising control efforts. Feasibility of control consists of scores for control costs, current distribution and persistence. Control costs investigate how detectable the plant is, general accessibility to infestations, operating costs, labour costs and level of cooperation expected from landholders. The current distribution of the pest plant within its landuse is calculated together with the spatial pattern of the plant, i.e. is it 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 similar to the weed risk, as seen below:

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*

3.1.3 Determine Regional Weed Management Priorities

By comparing a pest plant'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 pest plants that have a high risk and are feasible to control. Pest plants that are very low risk will not be recommended for control over other higher priority species, even if they are present. Likewise, species that are widespread but not feasible

to control will not rank as a high priority. A matrix for completing this comparison is shown in Table 3.1. The management categories are described below:

Table 3.1   Regional management guidelines based on weed risk and feasibility of containment

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13	LIMITED ACTION	LIMITED ACTION	LIMITED ACTION	LIMITED ACTION	MONITOR
Low <39	LIMITED ACTION	LIMITED ACTION	LIMITED ACTION	MONITOR	MONITOR
Medium <101	MANAGE SITES	MANAGE SITES	MANAGE SITES	PROTECT SITES	CONTAIN SPREAD
High <192	MANAGE WEED	MANAGE WEED	PROTECT SITES	CONTAIN SPREAD	DESTROY INFESTATIONS
Very High >192	MANAGE WEED	PROTECT SITES & MANAGE WEED	CONTAIN SPREAD	DESTROY INFESTATIONS	ERADICATE

ALERT

3.1.4   Guiding principles for each of the management categories in the weed risk matrix:

ALERT
This category refers to species that are not known to be present in the management area but which represent a significant threat. Such species would score "0" in Feasibility of Containment due to their absence.
This management category aims to prevent the species arriving and establishing in the management area through:
- Prevention of entry to management area
- Ongoing surveillance for incursions of the species (e.g. nursery inspections)
- Training and awareness activities for the community to enable early detection

ERADICATE
This management category aims to remove the weed species from the management area through:
- Detailed surveillance and mapping to locate all infestations
- Destruction of all infestations including seedbanks
- Prevention of entry to management area and movement and sale within
- Removal and prohibition of all cultivated plants
- Monitoring progress towards eradication

DESTROY INFESTATIONS
This management category aims to significantly reduce the extent of the weed species in the management area through:

- Detailed surveillance and mapping to locate all infestations
- Destruction of all infestations, aiming for local eradication at feasible sites
- Prevention of entry to management area and movement and sale within the region
- Prohibiting cultivated growth
- Monitoring progress towards reduction

CONTAIN SPREAD

This management category aims to prevent the ongoing spread of the weed species in the management area through:

- Surveillance and mapping to locate all infested properties
- Control of all infestations, aiming for a significant reduction in weed density
- Prevention of entry to management area and movement and sale within the region
- Preventing spread from cultivated plants (if grown)
- Monitoring change in current distribution

PROTECT SITES

The 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 industries/habitats (higher weed risk).This management category aims to prevent spread of the weed species to key sites/assets of high economic, environmental and/or social value through:

- Surveillance and mapping to locate all infested areas
- Identification of key sites/assets in the management area
- 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 management area
- Preventing spread from cultivated plants (if grown) in close proximity to key sites/assets
- Monitoring change in current distribution within and in close proximity to key sites/assets

MANAGE WEED

This management category aims to reduce the overall economic, environmental and/or social impacts of the weed species through targeted management including:

- Research and development of integrated weed management (IWM) packages for the species, including herbicides and biological control where feasible
- Promoting IWM packages to landholders
- Monitoring decrease in weed impacts with improved management
- Identifying key sites/assets in the management area and ensuring adequate resourcing to manage the weed species

MANAGE SITES

This management category aims to maintain the overall economic, environmental and/or social value of key sites/assets through improved general weed management such as:

- Promoting general IWM principles to landholders, including the range of control techniques, maintaining competitive vegetation/crops/pastures, hygiene and property management plans.
- Identifying key sites/assets in the management area and ensuring adequate resourcing to manage these to maintain their values
- Broaden focus beyond weeds to all threatening processes

MONITOR

This management category aims to detect any significant changes in the species' weed risk by:

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

LIMITED ACTION
The weed species would only be targeted for coordinated control in the management area if its local presence makes it likely to spread to land uses where it ranks as a higher priority.
- Undertake control measures if required for the benefit of other land uses at risk
- Otherwise limited advice to land managers if required.

3.2   VERTEBRATE PEST RISK ASSESSMENT

Determining priority pest animals 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 limited human and financial resources for the most beneficial outcome for the region. Every pest animal assessed in this project has been assigned to a strategic management action category according to its results within the particular land use.

The pest animals assessed in this report are declared under the Landscape SA Act 2019. Non declared species are acknowledged as potential pests but due to time constraints and the scope of this project they were not put through the risk management system.

3.2.1   Determining the pest list

In 2009, a steering group was formed consisting of members with expert knowledge of each of the land uses. Criteria were defined to exclude some species on the basis of not present in the region, widespread in the region and not present but poses a risk to the region. Some animals were assessed on the basis that the species maybe present in captivity but not found in feral/wild populations, such as water buffalo.

In 2020, a limited review of the Pest Management Strategy was conducted. The review included the assessment of a selection of existing and newly declared pest plants and animals that had been declared since 2009 under the Natural Resources Management Act 2004 and the subsequent Landscape SA Act 2019.

3.2.2   Applying the SA Pest Risk Management System

The SA Pest Animal Risk Management Guide was developed by the Animal and Plant Control Group of the then Department for Water, Land and Biodiversity Conservation (DWLBC) now Biosecurity SA, in cooperation with staff of Rural Solutions SA and Natural Resource Management Boards to help in prioritising pest animals for control programs.

This guide was based on and consistent with the SA Weed Risk Assessment System developed by Dr John Virtue, Biosecurity SA. The pest animal risk assessment system can be broadly applied to many geographic scales and for any land use. Other existing risk assessment systems have been used in the development of this guide (see references).

The assessment process involves a series of questions to compare the relative risk and feasibility of control of different pest animals. Pest animals are assessed separately for various *land uses* so that the most important pest animals of different land uses can be identified.

While the initial pest animal list in 2009 for each land use within the Limestone Coast region was determined through the consultation process, the pest attribute information (i.e. distribution, growth habit, reproduction capability, control methods etc) was obtained from various sources of literature.

The key features of the risk assessment process are explained in the following sections. This information has been adapted from the *SA Pest Animal Risk Management System and Guide – June 2007*.

Comparative Pest Risk (CPR)

The pest animal risk questions are divided into three main criteria: **Invasiveness**, **Impacts** and **Potential distribution**.

Invasiveness is used as an indicator as to how fast the pest animal can spread within a particular land use. It takes account of how well the pest animal can establish, reproduce and disperse.

Impacts criteria determines the **potential** economic, environmental and social effects of a pest animal, with the questions covering the pest animal's effect on establishment and growth of desired plants and animal, human and environmental health as well as reductions in product quality, and limits on physical movement.

Potential distribution considers what proportion of a land use is at risk from the pest animal in question. This will depend on the climate and habitat preferences of the pest animal. For example, some pest animals may only be suited to higher rainfall areas, or may only be a problem on sandy well-drained soils.

Scores for invasiveness, impacts and potential distribution are multiplied to give a comparative pest animal risk score, that is:

Comparative Pest Risk = Invasiveness × Impacts × Potential distribution

Dividing the scores into bands of 20% provides discreet classes of pest risk.

Frequency Band	Comparative Pest Risk (CPR) Score	Pest Animal Risk
80 - 100% (top 20% of possible score)	157+	*Very high*
60 - 80%	84 -156	*High*
40 - 60%	31-83	*Medium*
20 - 40%	10-30	*Low*
0 - 20% (bottom 20% of possible score)	<10	*Negligible*

Feasibility of containment (FOC)
The feasibility of containment questions are divided into three main criteria; **Control costs**, **Current distribution** and **Persistence**.

Control costs consider the costs associated with the detection of the pest animal, on-ground control, enforcement /education needs, and achieving landholder commitment.

Current distribution considers the proportion of the land use currently occupied, and the overall pattern of pest animal populations.

Persistence refers to how long it takes to eradicate the pest animal. It considers the efficacy of targeted control actions, susceptibility to control actions, re-colonisation and persistence in the land use.

The score for feasibility of containment is calculated by adjusting then multiplying the control costs, current distribution and persistence scores, that is:

Feasibility of Containment = Control Costs × Current Distribution × Persistence

Dividing the scores into bands of 20% provides discreet classes for feasibility of containment.

Frequency Band	Feasibility of Containment (FOC) Score	Feasibility of Containment
80 - 100% (top 20% of possible scores)	>111	*Negligible*
60 - 80%	111-55	*Low*
40 - 60%	31-54	*Medium*
20 - 40%	13-30	*High*
0 - 20% (bottom 20% of possible scores)	<13	*Very High*

3.2.3 Pest Animal Management Action Priorities

By comparing the comparative pest risk and the feasibility of containment of each pest animal in a matrix a management action is identified that defines the pest management priorities for each land use. For example a pest animal with a high Comparative Pest Risk (CPR) and high Feasibility of Containment (FOC) will be assigned a higher priority management action than a pest animal with a high CPR and low FOC.

The pest risk assessment results are typically displayed as a matrix, as shown in Table 3.2. Management actions for each sector of the matrix and explanatory notes for each management action are described in the remainder of this section.

Table 3.2   Pest animal risk assessment management action matrix

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible <10	NO ACTION	NO ACTION	NO ACTION	NO ACTION	MONITOR
Low 10-30	NO ACTION	NO ACTION	NO ACTION	MONITOR	PROTECT SITES
Medium 31-83	MANAGE SITES	MANAGE SITES	MANAGE SITES	PROTECT SITES	CONTAIN SPREAD
High 84-156	MANAGE PEST ANIMAL POPULATIONS	MANAGE PEST ANIMAL POPULATIONS	PROTECT SITES	CONTAIN	DESTROY POPULATIONS
Very High >157	MANAGE PEST ANIMAL POPULATIONS	PROTECT SITES & MANAGE PEST ANIMAL POPULATIONS	CONTAIN SPREAD	DESTROY POPULATIONS	ERADICATE FROM REGION

3.2.4   Guiding principles for each of the management categories in the vertebrate pest matrix

ERADICATE FROM REGION
This management category aims to remove the pest animal species from the region through:
- Detailed surveillance and mapping to locate all populations
- Destruction of all populations including juveniles
- Prevention of entry to region and keeping, movement and sale within the region
- Monitoring progress towards eradication

DESTROY POPULATIONS
This management category aims to significantly reduce the extent of the pest animal species in the region through:
- Detailed surveillance and mapping to locate all populations
- Destruction of all populations, aiming for local eradication at feasible sites
- Prevention of entry to region and keeping, movement and sale within the region
- Considering quarantine provisions
- Monitoring progress towards reduction

CONTAIN SPREAD
This management category aims to prevent the ongoing spread of the pest animal species in the region through:
- Surveillance and mapping to locate all infested properties
- Enforcing control of all populations, aiming for a significant reduction in pest animal density through high level initial control and sustained management

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- Controlling entry, movement and keeping under permit conditions
- Monitoring change in current distribution

PROTECT SITES

The pest animal may be of limited current distribution but only threatens limited industries/habitats (lower pest animal risk), or the pest animal may be more widespread but is yet to invade/impact upon many key sub-regional industries/habitats (higher pest animal risk). This management category aims to prevent spread of the pest animal species to key sites/assets of high economic, environmental and/or social value through:

- Surveillance and mapping to locate all infested sub-regions
- Identification of key sites/assets in the region
- Enforcing control of populations in close proximity to key sites/assets, aiming for a significant reduction in pest animal density
- Controlling entry, movement and keeping under permit conditions
- Monitoring change in current distribution within and in close proximity to key sites/assets

MANAGE PEST ANIMAL POPULATION

This management category aims to reduce the overall economic, environmental and/or social impacts of the pest animal species through targeted management, including:

- Research and development of integrated pest animal management (IPM) packages for the species, including cultural, chemical and biological control where feasible
- Promoting IPM packages to landholders
- Monitoring decrease in pest animal impacts with improved management
- Identifying key sites/assets in the region and ensuring adequate resources to manage the pest animal species

MANAGE SITES

This management category aims to maintain the overall economic, environmental and/or social value of key sites/assets through improved general pest animal management, such as:

- Promoting general IPM principles to landholders, including the range of control techniques and farm management practices.
- Identifying key sites/assets in the region and ensuring adequate resources to manage these to maintain their values
- Broaden focus beyond pest animals to all threatening processes

MONITOR

This management category aims to detect any significant changes in the species' pest animal risk by:

- Monitoring the spread of the species and review any perceived changes in pest animal invasiveness.

NO ACTION

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

4   RESULTS

For this assessment the Limestone Coast region was divided into the following land uses, listed below according to the largest percentage of area occupied.

Grazing,	1,547,993 ha	53%
Biodiversity	400,705 ha	14%
Cropping	256,414 ha	9%
Forestry	168,901 ha	6%
Aquatic[1]	391,184 ha	13%
Urban	77,539 ha	3%
Irrigated crops and pastures	71,399 ha	2%
Perennial horticulture	22,069 ha	1%
Total Area	**2,936,204 Ha**	

This section provides the results of pest plant and pest animal assessment by land use categories. Within each land use sub-section, a description of its location and key pest plant and pest animal species are then discussed.

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[1] The aquatic landuse category also includes the inshore waters area. The inland portion of the aquatic landuse covers approximately 2% of the Limestone Coast Landscape Board region

4.1 GRAZING

4.1.1 Description

As the dominant land use in the Limestone Coast region, dryland grazing comprises approximately 53% or 1,547,993 hectares of generally improved pastures. Primarily, stock includes sheep and cattle, with a small number of specialist farms producing goats, deer and pigs. Pastures predominantly consist of grass species, clover and lucerne, dependant on soil type, rainfall, temperature and other variables. Some farms are intensively managed, with high inputs and subsequent returns, while others are based on a minimalist approach. Variable environmental factors such as rainfall and soil type play a significant role in the range and distribution of pest species across this land use.

4.1.2 Assumptions

Pest plants

The assumption of this land use is that there is very little pest plant control conducted by landowners. The main method of management is spray grazing using a broadleaf herbicide spray such as 2,4D 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 plant by reducing its ability to flower. This technique is commonly used for Salvation Jane and thistles.

Vertebrate pests

Pest animal control is conducted seasonally on an as needs basis. The main method of management is 1080 baiting for foxes conducted during lambing and 1080 poisoned oats for rabbits during late summer. Shooting is used as a control technique by some landholders.

Figure 4.1   Map of grazing land use
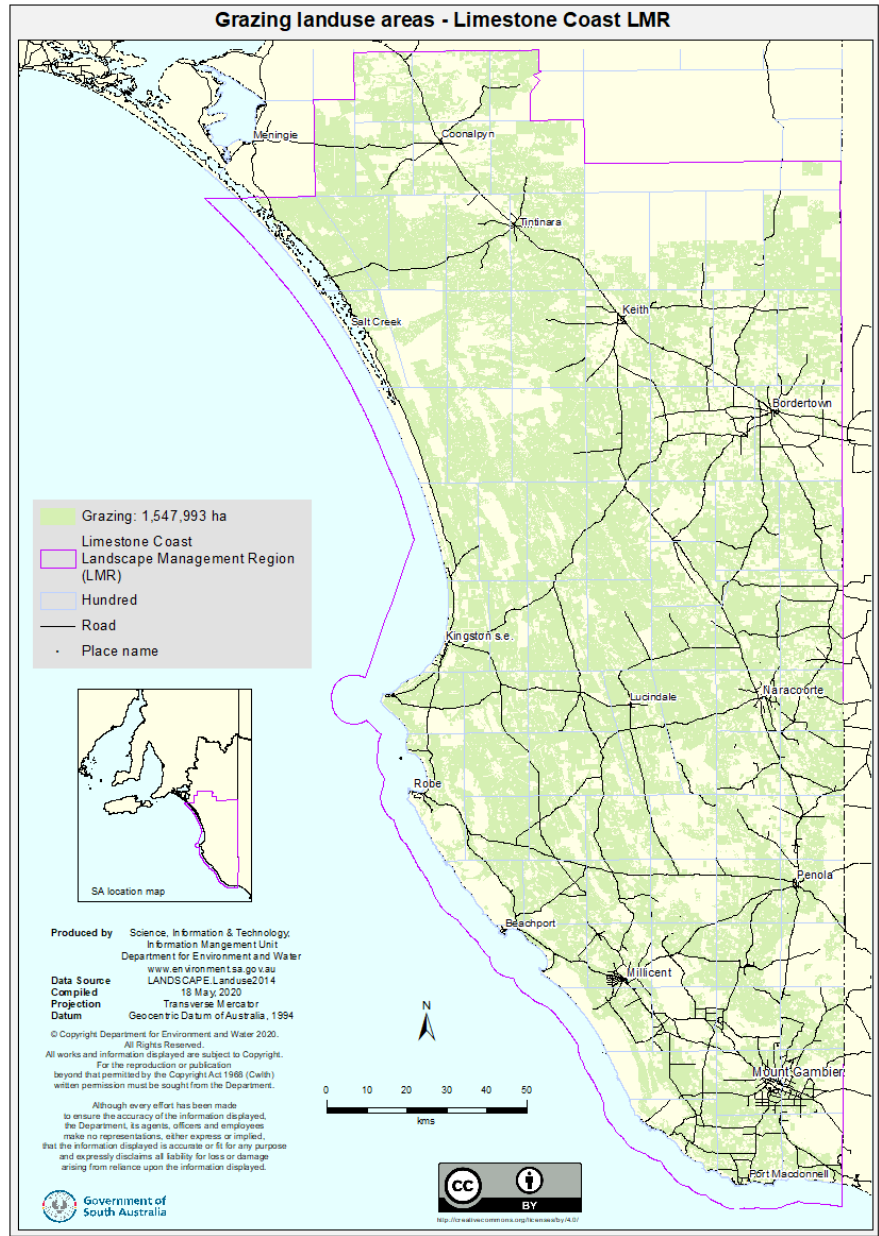
Grazing landuse areas - Limestone Coast LMR

4.1.3 Results

Tables 4.1 and 4.2 show the results from the weed risk assessment of the grazing land use. Tables 4.3 and 4.4 show the results from the vertebrate pest risk assessment.

Table 4.1   Weed risk assessment results table for grazing land use (* denotes reviewed in 2020)

Grazing	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
African boxthorn*	6.7	3.7	6.0	147	High	6.0	1.7	4.5	45	Medium
African feathergrass	6.0	2.1	4.0	51	Medium	3.3	0.1	3.6	1	Very High
African lovegrass	6.7	2.1	4.0	56	Medium	2.7	0.9	4.5	11	Very High
African rue	5.3	2.6	2.0	28	Low	3.3	0.0	2.7	0	Alert
Apple of Sodom*	5.3	3.7	2.0	39	Medium	4.0	1.3	5.5	27	High
Bathurst burr*	6.0	3.7	2.0	44	Medium	2.7	0.1	6.4	1	Very High
Blackberry*	7.3	5.3	2.0	77	Medium	5.3	0.4	5.5	12	Very High
Bladder campion	7.3	2.1	1.0	15	Low	4.0	0.1	3.6	1	Very High
Bracken fern	3.3	2.6	4.0	35	Low	4.7	3.3	5.5	85	Low
Broadkernel espartillo	7.3	4.2	6.0	185	High	3.3	0.0	4.5	0	Alert
Broomrape	7.3	3.2	6.0	139	High	7.3	0.0	6.4	0	Alert
Buchan weed	4.0	2.1	4.0	34	Low	4.7	5.0	3.6	85	Low
Buffel grass*	8.0	3.2	6.0	152	High	4.0	0.1	5.5	2	Very High
Calomba daisy	4.7	2.1	4.0	39	Medium	1.3	0.1	5.5	1	Very High
Caltrop*	6.0	2.6	4.0	63	Medium	4.0	0.4	6.4	11	Very High
Cane needlegrass	7.3	4.2	8.0	247	Very High	3.3	0.0	4.5	0	Alert
Cape tulip - 1 leaf	6.7	4.2	2.0	56	Medium	4.0	0.1	6.4	2	Very High
Cape tulip - 2 leaf	5.3	4.2	2.0	45	Medium	4.0	0.1	7.3	2	Very High
Capeweed	6.7	3.2	8.0	168	High	4.0	6.7	5.5	145	Negligible

Grazing	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Chilean needlegrass*	6.7	6.3	8.0	337	Very High	4.0	0.0	3.6	0	Alert
Coastal tea tree*	6.7	3.7	6.0	147	High	6.0	1.7	3.6	36	Medium
Coolatai grass*	5.3	3.7	4.0	79	Medium	4.0	0.1	3.6	1	Very High
Creeping knapweed	4.0	2.6	4.0	42	Medium	5.3	0.0	4.5	0	Alert
Cutleaf mignonette*	5.3	2.1	4.0	45	Medium	3.3	2.5	3.6	30	High
Dock	4.0	1.6	2.0	13	Negligible	2.7	5.0	5.5	73	Low
Dodder (Chilean & red)	8.7	2.1	1.0	18	Low	5.3	0.4	7.3	16	High
Dog rose	4.0	2.1	4.0	34	Low	4.0	3.3	1.8	24	High
Espartillo*	5.3	2.6	2.0	28	Low	5.3	0.0	5.5	0	Alert
False caper*	6.0	2.6	4.0	63	Medium	4.0	1.3	6.4	32	Medium
Gorse/ Furze	6.0	4.7	2.0	57	Medium	4.0	0.1	4.5	2	Very High
Hoary cress*	5.3	2.1	4.0	45	Medium	3.3	0.8	5.5	15	High
Horehound	6.7	4.7	6.0	189	High	2.7	2.5	5.5	36	Medium
Innocent weed*	5.3	3.2	4.0	67	Medium	4.7	0.1	3.6	1	Very High
Khaki weed	6.0	4.7	4.0	114	High	4.7	0.1	4.5	2	Very High
Lincoln weed*	6.7	1.6	4.0	42	Medium	4.0	0.9	6.4	23	High
Mexican feathergrass*	8.7	4.7	8.0	328	Very High	5.3	0.0	6.4	0	Alert
Noogoora burr complex	5.3	2.6	2.0	28	Low	2.7	0.1	6.4	1	Very High
Onion grass	6.0	1.6	6.0	57	Medium	4.7	3.3	7.3	113	Negligible
Onion weed	6.0	1.6	6.0	57	Medium	4.7	3.3	7.3	113	Negligible
Parramatta grass	7.3	2.1	4.0	62	Medium	4.0	2.5	5.5	55	Medium
Perennial thistle	7.3	2.1	4.0	62	Medium	4.0	2.5	5.5	55	Medium
Plumerillo	7.3	2.1	4.0	62	Medium	4.0	2.5	5.5	55	Medium

Grazing	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Prickly acacia	7.3	2.1	4.0	62	Medium	4.0	2.5	5.5	55	Medium
Ragwort	7.3	2.1	4.0	62	Medium	4.0	2.5	5.5	55	Medium
Salvation Jane	5.3	4.7	8.0	202	Very High	3.3	2.5	5.5	45	Medium
Serrated tussock	8.0	5.3	10.0	421	Very High	5.3	0.0	4.5	0	Alert
Silver grass	6.7	1.6	8.0	84	Medium	4.7	5.0	4.5	106	Low
Skeleton weed	7.3	1.6	4.0	46	Medium	5.3	1.7	7.3	65	Low
Slender thistle	4.7	3.2	8.0	118	High	3.3	5.0	4.5	76	Low
Silverleaf nightshade*	6.7	3.2	6.0	126	High	6.0	0.1	6.4	3	Very High
Soldier thistle	5.3	3.7	6.0	118	High	3.3	5.0	4.5	76	Low
Sorrell	3.3	2.1	4.0	28	Low	3.3	6.7	4.5	101	Low
Soursob	4.0	1.1	4.0	17	Low	2.7	3.3	7.3	65	Low
Spear thistle	4.0	3.2	8.0	101	High	3.3	5.0	4.5	76	Low
Spiny rush*	6.0	4.2	4.0	101	High	6.0	1.7	4.5	45	Medium
Swamp oak*	4.7	4.2	4.0	79	Medium	6.0	0.8	4.5	23	High
Texas needlegrass*	6.7	3.2	6.0	126	High	3.3	0.1	5.5	2	Very High
Three corner jack	6.7	3.7	4.0	98	Medium	2.7	0.1	5.5	1	Very High
Variegated thistle	5.3	3.7	6.0	118	High	2.0	2.5	4.5	23	High
Water dropwort	5.3	4.7	6.0	152	High	3.3	1.3	5.5	23	High
Wild artichoke	3.3	3.2	2.0	21	Low	5.3	0.9	5.5	27	High
Yellow burweed*	5.3	4.7	6.0	152	High	4.0	3.3	5.5	73	Low

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Table 4.2   Weed risk assessment matrix for grazing land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	*Low* >56	*Medium* >31	*High* >14	*Very High* <14
Negligible <13		Dock			
Low <39		Bracken fern Buchan weed Sorrell Soursob		Dodder (Chilean & red), Dog rose, Wild artichoke	Bladder campion, Noogoora burr
Medium <101	Onion grass Onion weed	Skeleton weed Silver grass	False caper, Parramatta grass, Perennial thistle,	Apple of Sodom Cutleaf mignonette Hoary Cress Lincoln weed Swamp Oak	African feathergrass, African lovegrass, Bathurst burr, Blackberry, Calomba Daisy Caltrop, Cape tulips, Coolatai grass Creeping knapweed, Gorse, Innocent weed, Three Corner jack
High <192	Capeweed	Slender thistle Soldier thistle Spear thistle Yellow burr weed	African boxthorn Horehound Coastal Tea tree Salvation Jane Spiny rush	Variegated thistle	Silverleaf nightshade, Coolatai grass, Khaki weed Buffel Grass Texas needlegrass
Very High >192					

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Table 4.3   **Vertebrate pest risk assessment results for grazing land use (* denotes reviewed in 2020)**

GRAZING	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CPR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit*	9.1	4.8	10.0	436	Very High	5.9	6.7	5.0	196	Negligible
Red fox*	7.3	6.0	10.0	436	Very High	6.7	10.0	7.3	485	Negligible
Goat*	7.3	4.0	10.0	291	Very High	5.3	1.7	2.7	24	High
European hare*	4.5	2.0	6.0	55	Medium	8.0	5.0	8.2	327	Negligible
Dingo, Wild dog*	5.5	6.0	10.0	327	Very High	4.7	0.9	2.7	11	Very High
Hog deer*	6.4	3.2	8.0	163	Very High	7.3	0.8	2.7	17	High
Red & Wapiti deer*	6.4	3.6	10.0	229	Very High	6.0	3.3	3.6	73	Low
Rusa, Chital & Sambar deer*	6.4	3.6	10.0	229	Very High	6.0	1.3	2.7	20	High
Fallow deer*	6.4	3.6	10.0	229	Very High	6.0	3.3	3.6	73	Low
Pig*	7.3	6.8	6.0	297	Very High	5.3	0.8	1.8	8	Very High

Table 4.4   Vertebrate pest risk assessment matrix for grazing land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible <11					
Low 11-34					
Medium 35-88	HARE				
High 89-168					
Very High >168	RABBIT FOX	FALLOW, RED & WAPITI DEER		GOAT HOG, RUSA, SAMBAR & CHITAL DEER	WILD DOG/ DINGO PIG

4.1.4   Summary

Pest plants

From this assessment it is seen in table 4.2 that Silverleaf nightshade and Khaki weed are ranked in the Destroy Infestations category. As a result the regional management actions will aim to significantly reduce the extent of these weeds.

It was found that a large number of weeds were feasible to contain the spread at the regional scale. Some of these weeds included African feathergrass, Bathurst burr, Blackberry, Caltrop, Cape tulip, Creeping knapweed, Gorse, Innocent weed and Three corner jack.

Vertebrate pests

According to table 4.4 populations of Wild dog/Dingo have been identified as being able to be eradicated from the region, while Goat, Hog deer, Sambar, Rusa and Chital deer have management actions targeted at reducing their populations and limiting their spread throughout the region.

4.2 BIODIVERSITY AREAS

4.2.1 Description

While almost 14% or 400,705 hectares of the Limestone Coast region is comprised of native vegetation, this represents only 13% of the original vegetation in the area prior to European settlement. Large parcels of this land use are publicly owned, including crown lands, national parks or local government owned. There are a range of different ecosystems across the region dependant on soil type, topography, rainfall and nutrient availability. These include coastal heath, mallee scrub, grassy woodlands and wetland environments. There is some overlap between the native vegetation land use and aquatic land use, especially in coastal conservation zones such as Canunda National Park.

Pest plants invading bushland are difficult to control due to poor accessibility to infestations and limited resources for control. Many of the pest plants in biodiversity areas are garden escapees such as Dolichos pea and Bridal creeper. These plants impact on the biodiversity areas by smothering plants and competing for water, nutrients and sunlight, thus reducing the ability of the native plants to survive and reproduce.

There is a significant risk associated with pest plants in biodiversity areas, particularly the severe impact that can be seen as a result of competition. Management of biodiversity areas in the Limestone Coast is limited by availability of public and private expertise and the lack of return on investment in pure dollar terms. As yet, a suitable method of calculating the financial returns of environmental works has not been adopted.

4.2.2 Assumptions

Pest plants

It is presumed that there is no continual routine pest plant control being conducted in biodiversity areas across the Limestone Coast. Some species may be targeted for control due to funding being available, such as the Western Cape bridal creeper. Alternatively pest plants may be controlled in areas of very high conservation value, i.e. to protect threatened species.

The products and services obtained from the land use are conservation and recreational values. Biological control is considered routine control for pest plants where it is available, such as Bridal creeper rust fungus.

Whilst Coastal wattle is indigenous to the coastal area of the Limestone Coast region, its increasing range and dominance inland is of concern to biodiversity area managers, hence it was included in the pest plant list. As a native plant, Coastal wattle is protected by the Native Vegetation Act 1991 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 Limestone Coast. Of particular concern are Golden wreath wattle, Bluebell creeper and Coastal tea tree. Because these species are not indigenous to the region control may be carried out without legislative exemption.

Vertebrate pests

Pest management is conducted through occasional use of 1080 poisoned baits for wild dog, fox and rabbit control. Shooting is the primary management tool for large pest animal species, i.e. deer, pigs, buffalo. used in conservation areas. Biological control for rabbits is present in the region but not an adequate control measure on its own.

Figure 4.2   Map of native vegetation land use
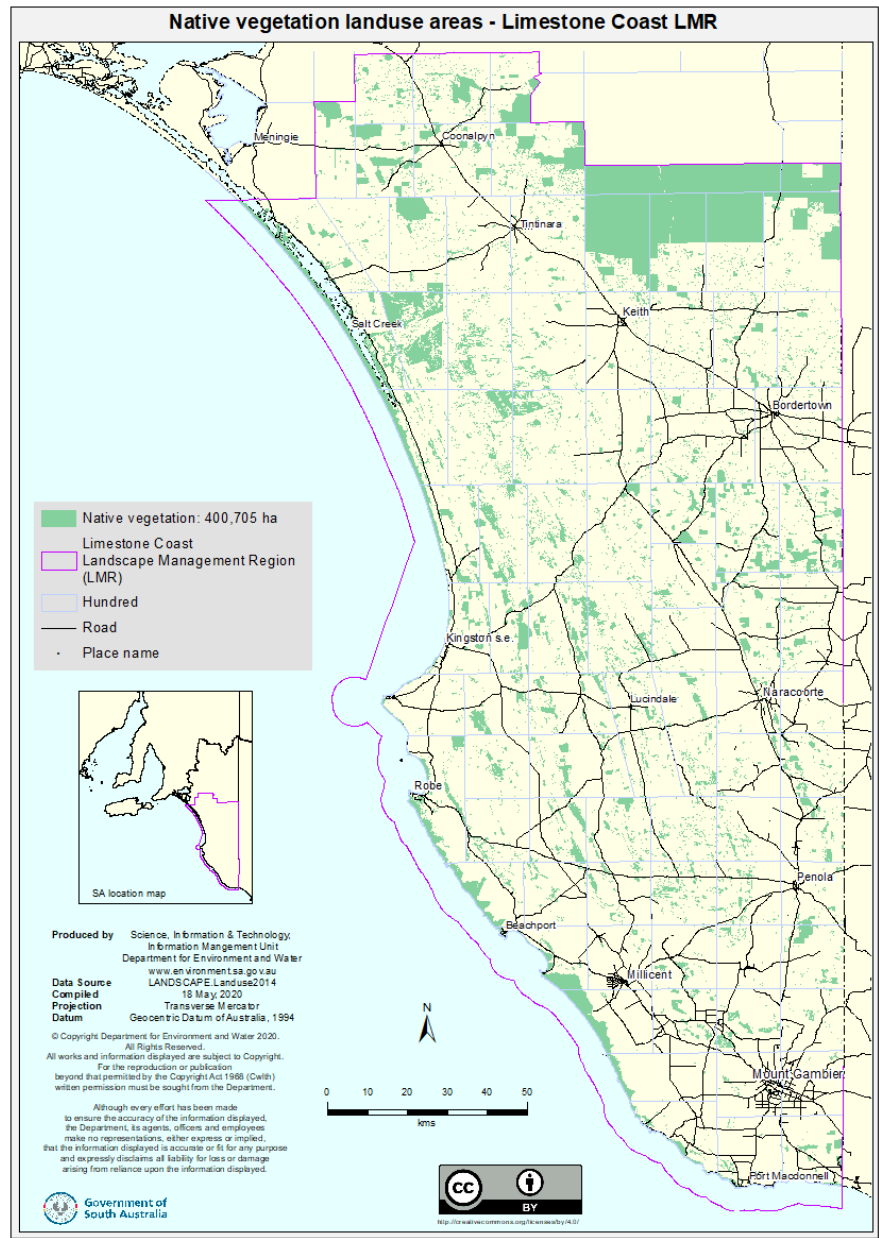
4.2.3 Results

In tables 4.5 and 4.6 the results are shown from the weed risk assessment for the biodiversity land use. Tables 4.7 and 4.8 show the vertebrate pest risk assessment results.

Table 4.5   Weed risk assessment results table for biodiversity land use (* denotes reviewed in 2020)

Native Vegetation	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Acacia cyclops	7.3	3.2	8.0	185	High	6.0	2.1	4.5	57	Low
African boxthorn*	5.3	5.3	4.0	112	High	5.3	0.9	5.5	27	High
African feathergrass	6.0	2.1	4.0	51	Medium	3.3	0.1	3.6	1	Very High
African lovegrass	6.7	2.1	4.0	56	Medium	2.7	0.9	4.5	11	Very High
Agave	3.3	2.1	0.5	4	Negligible	7.3	0.0	7.3	0	Very High
Aleppo pine*	6.0	5.3	6.0	189	High	5.3	0.9	4.5	22	High
Apple of Sodom*	5.3	4.2	4.0	90	Medium	4.7	1.7	5.5	42	Medium
Arum lily*	4.7	2.6	0.5	6	Negligible	5.3	0.1	6.4	3	Very High
Asparagus fern*	6.0	3.2	4.0	76	Medium	6.0	0.4	5.5	14	Very High
Athel pine	4.7	1.6	1.0	7	Negligible	7.3	0.1	7.3	4	Very High
Azzarola	7.3	4.2	2.0	62	Medium	7.3	0.1	7.3	4	Very High
Bamboo	3.3	3.2	2.0	21	Low	6.0	0.9	7.3	40	Medium
Bathurst burr*	5.3	2.1	1.0	11	Negligible	4.7	8.3	5.5	212	Negligible
Blackberry*	7.3	4.2	4.0	124	High	6.0	0.9	5.5	30	High
Blackberry nightshade*	4.0	2.1	1.0	8	Negligible	5.3	1.8	6.4	59	Low
Berry heath/Erica*	6.0	3.7	4.0	88	Medium	6.7	0.1	6.4	4	Very High
Blue periwinkle	5.3	3.7	4.0	79	Medium	6.0	0.9	7.3	40	Medium
Blue psoralea	4.7	2.6	1.0	12	Negligible	5.3	0.1	6.4	3	Very High
Bluebell creeper*	8.0	5.3	2.0	84	Medium	7.3	0.1	9.1	6	Very High
Boneseed*	8.7	3.2	4.0	109	High	6.0	0.9	5.5	30	High
Bridal creeper	7.3	5.3	10.0	386	Very High	5.3	6.7	6.4	226	Negligible
Bridal creeper (Western Cape)*	7.3	5.3	6.0	232	Very High	6.0	0.4	7.3	18	High
Bridal veil*	7.3	5.3	6.0	232	Very High	6.0	0.1	7.3	4	Very High

Native Vegetation	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Bulbil watsonia	4.7	2.1	2.0	20	Low	6.7	1.7	3.6	40	Medium
Buffel grass*	7.3	6.3	4.0	185	High	6.7	0.1	4.5	3	Very High
Butterfly bush	4.7	2.1	1.0	10	Negligible	4.7	0.1	5.5	2	Very High
Cane needlegrass	6.7	4.2	2.0	56	Medium	4.0	0.0	6.4	0	Alert
Cape broom	4.7	2.6	2.0	25	Low	3.3	0.1	4.5	1	Very High
Cape tulip - 1 leaf	6.7	4.2	2.0	56	Medium	6.0	2.1	5.5	68	Low
Cape tulip - 2 leaf	6.7	4.2	2.0	56	Medium	6.0	2.1	5.5	68	Low
Carrot	7.3	2.6	2.0	39	Low	6.0	0.1	5.5	3	Very High
Chilean needlegrass*	5.3	1.6	2.0	17	Low	3.3	0.0	3.6	0	Alert
Coastal tea tree*	7.3	3.7	4.0	108	High	6.0	2.1	2.7	34	Medium
Coastal wattle	8.0	5.3	10.0	421	Very High	6.0	3.3	8.2	164	Negligible
Common lantana	8.0	5.3	10.0	421	Very High	6.0	3.3	8.2	164	Negligible
Coolatai grass*	5.3	1.6	4.0	34	Low	3.3	0.1	3.6	1	Very High
Cootamundra wattle	4.0	3.2	2.0	25	Low	4.7	0.1	6.4	2	Very High
Cotoneaster*	8.0	3.2	6.0	152	High	6.7	0.9	6.4	39	Medium
Desert Ash*	7.3	3.7	6.0	162	High	6.0	2.1	5.5	68	Low
Dodder (Chilean & red)	6.0	1.6	4.0	38	Low	4.7	0.9	5.5	23	High
Dog rose*	6.0	2.6	4.0	63	Medium	4.0	1.3	6.4	32	Medium
Dolichos pea*	7.3	5.8	2.0	85	Medium	6.0	0.4	7.3	18	High
Dune onion weed*	6.7	5.3	0.5	18	Low	6.7	0.0	5.5	0	Alert
English broom	5.3	5.8	1.0	31	Low	5.3	0.1	6.4	3	Very High
English oak	4.0	2.6	1.0	11	Negligible	5.3	0.1	6.4	3	Very High
Espartillo*	5.3	2.1	6.0	67	Medium	5.3	0.0	4.5	0	Alert
False caper*	5.3	1.6	6.0	51	Medium	6.0	3.3	4.5	91	Low
Fireweed*	4.0	2.6	4.0	42	Medium	4.7	0.0	7.3	0	Alert
Fountain grass*	8.0	3.2	6.0	152	High	6.0	0.1	4.5	2	Very High
Freesia	5.3	2.1	4.0	45	Medium	8.7	2.1	6.4	115	Negligible
Gazania*	6.7	2.6	4.0	70	Medium	3.3	1.8	4.5	27	High
Golden wreath wattle	6.7	3.2	6.0	126	High	6.7	2.5	7.3	121	Negligible

Native Vegetation	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Gorse/ Furze	4.7	5.8	2.0	54	Medium	6.7	0.1	6.4	4	Very High
Horehound	4.7	1.6	4.0	29	Low	6.0	2.5	6.4	95	Low
Italian Buckthorn*	8.0	3.2	6.0	152	High	6.7	2.1	3.6	51	Medium
Ivy (Cape & English)	3.3	4.2	1.0	14	Low	5.3	0.1	6.4	3	Very High
Marguerite daisy	2.0	1.6	4.0	13	Negligible	6.7	0.1	8.2	5	Very High
Maderia vine*	6.0	3.7	4.0	88	Medium	5.3	0.1	2.7	1	Very High
Marram grass	8.0	2.6	2.0	42	Medium	8.0	3.3	8.2	218	Negligible
May/ Hawthorn*	3.3	4.7	2.0	32	Low	5.3	0.9	5.5	27	High
Mexican feathergrass*	8.7	4.7	8.0	328	Very High	5.3	0.0	6.4	0	Alert
Mirror Bush*	6.0	3.2	2.0	38	Low	6.7	0.1	5.5	3	Very High
Olive*	6.0	3.7	8.0	177	High	7.3	0.9	6.4	43	Medium
Pampas grass/ Toe Toe*	6.7	4.7	6.0	189	High	4.7	0.1	8.2	3	Very High
Pepper tree	2.7	2.6	2.0	14	Low	4.7	1.8	6.4	52	Medium
Phalaris	6.0	4.2	4.0	101	High	6.7	5.0	6.4	212	Negligible
Pin cushion daisy	6.0	4.2	4.0	101	High	6.7	5.0	6.4	212	Negligible
Polygala*	6.7	4.2	4.0	112	High	6.7	0.9	5.5	33	Medium
Poplars spp.	4.7	4.2	4.0	79	Medium	6.7	2.1	6.4	88	Low
Prickly pear	5.3	4.7	1.0	25	Low	6.0	0.9	3.6	20	High
Pyp grass	6.7	4.7	6.0	189	High	6.0	5.0	3.6	109	Low
Radiata pine	6.7	4.7	4.0	126	High	6.0	0.9	3.6	20	High
Rhus tree	4.0	5.8	4.0	93	Medium	6.0	0.1	3.6	2	Very High
Sallow wattle*	8.0	5.3	10.0	421	Very High	5.3	2.5	4.5	61	Low
Sea spurge	4.0	2.6	2.0	21	Low	6.7	0.4	5.5	15	High
Sea wheatgrass	4.7	4.2	2.0	39	Medium	6.7	0.4	5.5	15	High
Serrated tussock	8.0	2.6	6.0	126	High	5.3	0.0	4.5	0	Alert
Skeleton weed	7.3	1.6	6.0	69	Medium	6.7	1.7	7.3	81	Low
Slender thistle	7.3	1.6	4.0	46	Medium	5.3	1.7	7.3	65	Low
South African weed orchid	6.7	1.1	8.0	56	Medium	8.0	3.3	4.5	121	Negligible
Spiny rush*	6.0	3.2	4.0	76	Medium	5.3	1.3	5.5	36	Medium

Native Vegetation	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Swamp oak	6.0	7.4	4.0	177	High	6.7	1.7	5.5	61	Low
Sweet briar*	6.0	2.6	4.0	63	Medium	4.7	2.1	4.5	44	Medium
Sweet pittosporum*	4.7	3.2	4.0	59	Medium	4.7	2.1	5.5	53	Medium
Tagasaste	5.3	3.7	4.0	79	Medium	4.7	2.5	6.4	74	Low
Tall wheatgrass	6.0	5.8	4.0	139	High	6.7	5.0	6.4	212	Negligible
Tamarisks*	4.7	5.3	4.0	98	Medium	0.0	7.3	0.1	0	Alert
Texas needlegrass*	5.3	3.7	4.0	79	Medium	5.3	0.1	8.2	4	Very High
Tree Heath*	4.7	2.1	4.0	39	Medium	4.7	0.0	4.5	0	Alert
Veldt grass	7.3	4.2	4.0	124	High	6.7	5.0	6.4	212	Negligible
Wandering jew	4.0	2.6	0.5	5	Negligible	5.3	0.1	6.4	3	Very High
White weeping broom*	8.0	3.7	6.0	177	High	4.7	0.1	7.3	3	Very High
White arctotis	5.3	2.1	2.0	22	Low	6.0	2.1	5.5	68	Low
Wild artichoke	3.3	3.2	2.0	21	Low	5.3	0.9	5.5	27	High
Wild oats	4.7	2.6	8.0	98	Medium	8.0	8.3	3.6	242	Negligible
Williams grass	4.7	2.6	8.0	98	Medium	8.0	8.3	3.6	242	Negligible
Yellow burrweed	5.3	4.2	1.0	22	Low	3.3	0.9	5.5	17	High

Table 4.6   Weed risk assessment matrix for biodiversity land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13	Bathurst burr	Blackberry nightshade			Agave Athel pine, Wandering jew, Arum lily, English oak, Butterfly bush
Low <39		Horehound, White arctotis	Bamboo, Bulbil watsonia, Pepper tree	Dodder (Chilean & red), May / Hawthorn, Prickly pear, Wild artichoke, Yellow burr weed, Sea spurge	Cape broom, Wild carrot, Coolatai grass, Cootamundra wattle, English broom, Mirror bush, Ivy, Blue psoralea
Medium <101	Freesia, Marram grass, South African weed orchid, Wild oats, William grass	Cape tulip 1 & 2 leaf, False caper, Poplars, Skeleton weed, Slender thistle, Tagasaste	Apple of Sodom, Blue periwinkle, Dog rose, Sweet briar, Spiny rush, Sweet pittosporum	Gazania, Dolichos pea, Sea Wheatgrass	African lovegrass, Asparagus fern, African feathergrass, Bluebell creeper, Erica, Maderia vine, Gorse, Texas needlegrass, Rhus tree
High <192	Golden wreath wattle, Phalaris, Pin cushion daisy, Tall wheatgrass, Veldt grass	Acacia cyclops, Desert ash, Swamp oak, Pyp grass	Coastal tea tree, Cotoneaster, Italian Buckthorn, Olive, Polygala	African boxthorn, Aleppo pine, Blackberry, Boneseed, Radiata pine	Fountain grass, Buffel grass, Pampas grass, White weeping broom
Very High >192	Bridal creeper, Coastal wattle, Marguerite daisy	Sallow wattle		Western cape bridal creeper	Bridal veil

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Table 4.7   Vertebrate pest risk assessment results table for biodiversity land use (* denotes reviewed in 2020)

NATIVE VEGETATION	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit	10.0	5.2	8.0	416	Very High	7.1	5.0	6.3	221	Negligible
Red fox	7.3	6.0	10.0	436	Very High	6.7	10.0	7.3	485	Negligible
Goat	8.2	4.8	8.0	314	Very High	6.7	1.3	3.6	30	High
Cat	8.2	5.6	10.0	458	Very High	9.3	10.0	7.3	679	Negligible
European hare	4.5	2.0	6.0	55	Medium	8.7	8.3	6.4	460	Negligible
House mouse	7.3	2.8	10.0	204	Very High	9.3	10.0	9.1	848	Negligible
Black rat	7.3	4.0	10.0	291	Very High	8.7	8.3	8.2	591	Negligible
Wild Dog/ Dingo	6.4	6.0	4.0	153	High	6.7	0.8	3.6	20	High
Hog deer	7.3	4.0	1.0	29	Low	8.0	0.9	5.5	40	Medium
Red & Wapiti deer	7.3	4.8	8.0	279	Very High	8.0	4.2	7.3	242	Negligible
Sambar, Chital & Rusa Deer	7.3	4.8	8.0	279	Very High	8.0	2.5	7.3	145	Negligible
Fallow deer	7.3	4.8	10.0	349	Very High	8.0	6.7	7.3	388	Negligible
Common starling	6.4	3.2	8.0	163	Very High	8.7	8.3	9.1	657	Negligible
Eurasian blackbird	6.4	1.2	6.0	46	Medium	7.3	8.3	9.1	556	Negligible
Mallard	9.1	1.2	0.5	5	Negligible	6.7	0.9	9.1	56	Low
Pig	7.3	4.8	1.0	35	Medium	7.3	0.0	4.5	1	Very High

Table 4.8   **Vertebrate pest risk assessment matrix for biodiversity land use**

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible <11		MALLARD			
Low 11-34			HOG DEER		
Medium 35-88	HARE BLACKBIRD				PIG
High 89-168				WILD DOG/ DINGO	
Very High >168	STARLING RUSA, CHITAL, SAMBAR RED & WAPITI DEER, CAT FOX, BLACK RAT, FALLOW DEER, RABBIT, MOUSE			GOAT	

4.2.4 Summary

Pest plants

Bridal veil assessed in native vegetation land use resulted as a very high weed risk and high feasibility of containment, thus the management action is to eradicate this species from the region.

Western Cape bridal creeper resulted in a very high weed risk and a high feasibility to control, in comparison, the common form of Bridal creeper had a very high risk assessment but the feasibility to control the weed was negligible. Therefore the management actions for both differ greatly. For common Bridal creeper efforts are to be directed in reducing the overall environmental impact it has through targeted management which includes the use of biological control.

Vertebrate pests

Due to the inaccessibility of potential wild populations of pest animals the feasibility of control is reduced, thus the management actions of some pest animals are different to other land uses. In table 4.7 the management action for Goats in native vegetation is assessed as Destroy Populations, which requires dramatically reducing the populations and limiting their spread to their areas.

Dingoes are widely accepted as having been on the Australian mainland for some 4000-5000 years. During this time, they assumed the role of the top-order mammalian predator, with both the Thylacine and Tasmanian devil becoming extinct after arrival of the Dingo. While some people consider the Dingo to be an alien species, there is greater scientific evidence emerging as to its likely benefit in helping maintain ecosystem balance in the presence of other threats - namely other more recently introduced predators such as foxes and cats. The evidence suggests that Dingoes actively maintain large home ranges, within which foxes and cats are either suppressed in density or even excluded. As the Dingo does not hunt as efficiently as the predators that it suppresses, a wide range of native small terrestrial vertebrates are actually found to be better represented in their presence, than from areas where the Dingo is absent. In this way, the decline of some of Australia's small mammals may be connected with the decline of the Dingo across a large part of the continent. While the Dingo (or wild dogs) are still considered by many people to be a pest, particularly from an agricultural point of view, the evidence does not support them being considered one in the environmental land use.

The efforts in controlling Dingoes according to the risk assessment should be aimed at preventing the ongoing spread of these species in the region, although in a regional context these species will be aimed at eradication due to their low populations.

4.3 CROPPING

4.3.1 Description

Predominant in the Upper Limestone Coast, surrounding Bordertown and Coonalpyn, dryland cropping is a lucrative industry that produces an annual income of approximately $122 million per year. Occupying around 9% or 256,414 hectares, there is clear delineation between the rainfall and temperature bands of the upper and lower areas of the region. In the north, wheat, barley, canola and oats are featured, while the southern area is the centre for the production of beans, peas and lupins. The range and distribution of pest species in cropping country is also severely affected by temperature and rainfall as well as the variety of crop species in production.

Crop species with higher water needs, such as lucerne are generally found under irrigated crops and pasture.

4.3.2 Assumptions

Pest plants

The majority of the pest plants of concern within a cropping situation are those that cannot be controlled through everyday weed management practices. Assumed management for cereals include pre-sowing cultivation or knockdown herbicides, pre-emergent sprayed at sowing for grasses and broadleaf weeds and one post-emergent broadleaf spray. Assumed management for pulse crops are same as above, but the post-emergent spray is for grasses rather than for broadleaf weeds.

Vertebrate pests

The majority of pests of concern within a cropping situation are herbivores. There is very little pest management undertaken within this land use. Some 1080 poisoned oats baiting may occur for rabbits in the late summer to lower numbers before the next crop is planted.

Figure 4.3   Map of cropping land use
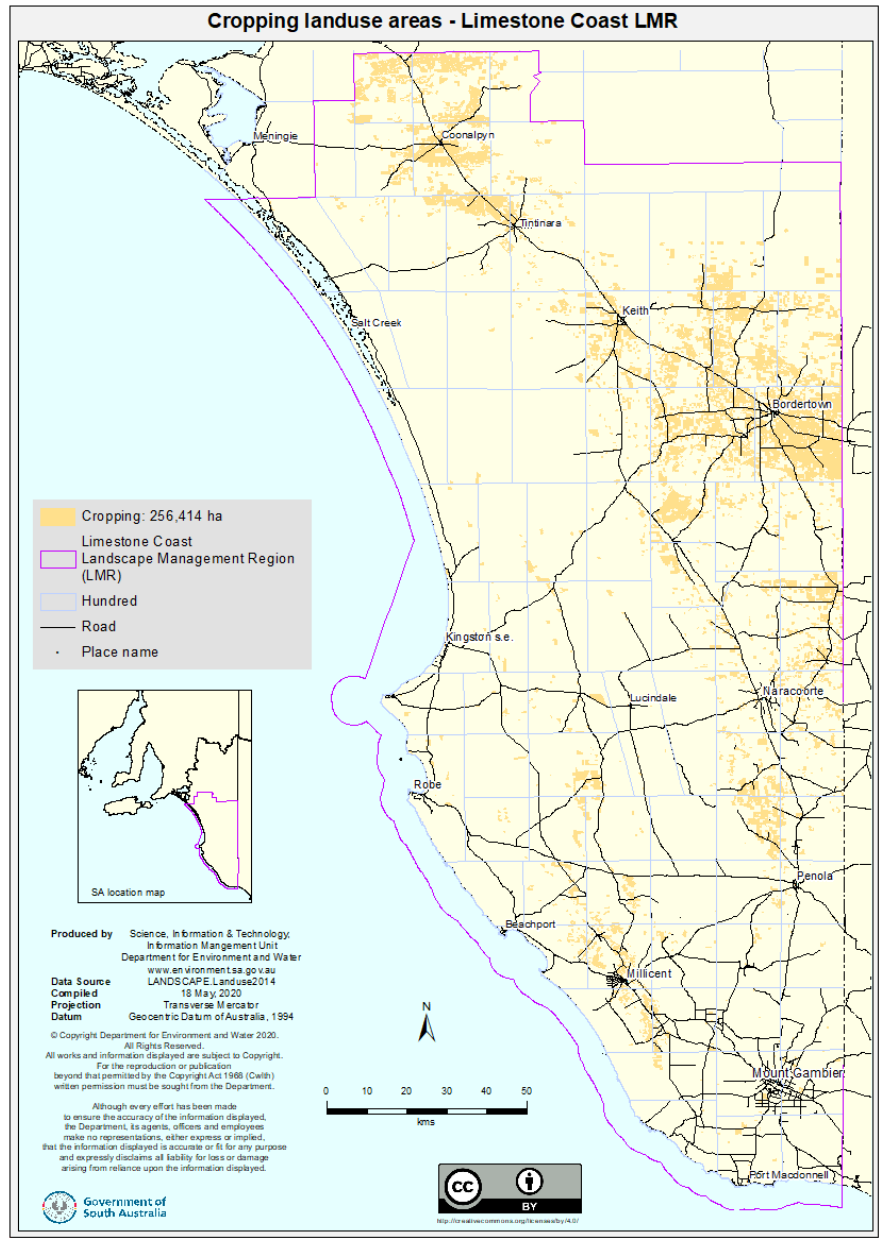
Cropping landuse areas - Limestone Coast LMR

4.3.3   Results

In tables 4.9 and 4.10 the weed risk assessment results are shown for the cropping land use. In tables 4.11 and 4.12 the results from the vertebrate pest risk assessment are shown.

Table 4.9   Weed risk assessment results table for cropping land use (* denotes reviewed in 2020)

Crop-Pasture Rotation	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Alkali sida	6.0	3.2	1.0	19	Low	2.7	0.0	6.4	0	Very High
Annual ryegrass	6.7	2.1	8.0	112	High	4.7	8.3	5.5	212	Negligible
Apple of Sodom*	4.0	3.7	4.0	59	Medium	4.0	2.1	4.5	38	Medium
Bathurst burr*	6.0	3.2	4.0	76	Medium	2.7	0.9	6.4	16	High
Bedstraw	5.3	2.6	1.0	14	Low	4.0	0.1	3.6	1	Very High
Bifora	5.3	2.6	1.0	14	Low	4.0	0.1	3.6	1	Very High
Bladder campion	5.3	2.6	1.0	14	Low	4.0	0.1	3.6	1	Very High
Blue mustard	5.3	2.6	1.0	14	Low	4.0	0.1	3.6	1	Very High
Broomrape	7.3	2.6	4.0	77	Medium	4.0	0.0	6.4	0	Very High
Buchan weed	6.0	2.6	1.0	16	Low	4.7	2.5	5.5	64	Low
Calomba daisy	6.0	2.6	4.0	63	Medium	4.0	0.4	6.4	11	Very High
Caltrop*	6.0	2.6	6.0	95	Medium	4.0	0.4	6.4	11	Very High
Capeweed	6.7	1.6	2.0	21	Low	3.3	3.3	3.6	40	Medium
Couch	8.0	2.6	6.0	126	High	4.0	3.3	6.4	85	Low
Creeping knapweed	3.3	3.7	6.0	74	Medium	5.3	0.1	4.5	2	Very High
Cutleaf mignonette*	5.3	2.1	4.0	45	Medium	3.3	2.1	3.6	25	High
Dock	8.0	2.6	4.0	84	Medium	4.0	3.3	5.5	73	Low
Field bindweed	6.7	1.6	4.0	42	Medium	0.0	3.3	3.3	30	High
Field garlic	4.7	1.6	2.0	15	Low	0.0	3.3	0.1	0	Very High
Fleabane	6.0	2.1	6.0	76	Medium	4.7	5.0	7.3	170	Negligible
Hoary cress*	5.3	2.1	6.0	67	Medium	2.7	0.8	5.5	12	Very High
Horehound	6.0	3.2	10.0	189	High	2.0	5.0	4.5	45	Medium

Crop-Pasture Rotation	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Innocent weed*	6.7	2.1	8.0	112	High	3.3	0.4	5.5	8	Very High
Lesser loosestrife	4.0	3.2	4.0	51	Medium	4.7	0.0	3.6	0	Very High
Lincoln weed	6.7	1.6	4.0	42	Medium	4.0	0.9	6.4	23	High
Muskweed	6.0	2.6	1.0	16	Low	1.3	0.4	2.7	2	Very High
Nightstock	4.7	1.1	1.0	5	Negligible	2.7	0.1	2.7	1	Very High
Pheasant's eye	3.3	2.6	2.0	18	Low	4.0	0.1	4.5	2	Very High
Salvation Jane	4.7	2.6	10.0	123	High	2.7	6.7	3.6	65	Low
Skeleton weed	8.0	1.6	6.0	76	Medium	5.3	1.7	7.3	65	Low
Silverleaf nightshade*	8.7	2.1	6.0	109	High	6.0	0.4	7.3	18	High
Soursob	5.3	1.1	8.0	45	Medium	2.7	3.3	7.3	65	Low
Tall wheatgrass	6.0	5.8	4.0	139	High	6.7	5.0	6.4	212	Negligible
Three-horned bedstraw	4.7	2.6	4.0	49	Medium	2.7	0.1	4.5	1	Very High
Variegated thistle	4.0	3.2	2.0	25	Low	2.7	0.9	4.5	11	Very High
Wild oats	7.3	3.2	8.0	185	High	2.0	8.3	3.6	61	Low
Wild radish	5.3	2.6	8.0	112	High	2.7	8.3	5.5	121	Negligible
Yellow burweed*	6.0	4.7	6.0	171	High	3.3	5.0	5.5	91	Low

Table 4.10   Weed risk assessment matrix for cropping land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13					
Low <39		Buchan weed	Capeweed		Bedstraw, Bladder campion, Field garlic, Variegated thistle
Medium <101	Fleabane	Dock, Skeleton weed, Soursob	Apple of sodom	Bathurst burr, Cutleaf mignonette, Field bindweed, Lincoln weed	Broomrape, Calomba Daisy, Caltrop, Creeping knapweed, Hoary cress, Three horned bedstraw
High <192	Annual ryegrass, Tall wheatgrass, Wild radish	Couch, Salvation Jane, Wild oats, Yellow burrweed	Horehound	Silverleaf nightshade	Innocent weed
Very High >192					

Table 4.11   Vertebrate pest risk assessment results table for cropping land use (* denotes reviewed in 2020)

CROPPING	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit	10.0	3.2	10.0	320	Very High	3.5	2.5	5.0	44	Medium
Goat	7.3	3.2	7.3	186	Very High	2.0	0.9	2.7	5	Very High
Pig	7.3	2.4	7.3	35	Medium	2.0	0.9	2.7	5	Very High
European hare	4.5	0.8	4.5	36	Medium	5.3	2.5	6.4	85	Low
House mouse	6.4	6.0	6.4	382	Very High	6.0	2.1	8.2	102	Low
Black rat	6.4	4.0	6.4	204	Very High	6.7	1.8	7.3	85	Low
Hog deer	6.4	2.0	6.4	51	Medium	2.7	0.9	3.6	8	Very High
Wapiti & Red deer	6.4	2.8	6.4	143	High	2.7	0.9	3.6	9	Very High
Rusa, Chital & Sambar deer	6.4	2.8	6.4	143	High	2.7	0.9	3.6	9	Very High
Fallow deer	6.4	2.8	6.4	143	High	2.7	2.1	3.6	20	High

Table 4.12   Vertebrate pest risk assessment matrix for cropping land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible <11					
Low 11-34					
Medium 35-88		HARE			HOG DEER PIG
High 89-168				FALLOW DEER	RED, WAPITI, RUSA, SAMBAR & CHITAL DEER
Very High >168	MOUSE	BLACK RAT	RABBIT		GOAT

4.3.4   Summary

Pest plants

For the cropping land use the management action for Innocent weed populations is targeted destruction and local eradication where feasible as the assessment recognised the very high risk and high feasibility for containment of this species.

Caltrop, Hoary cress, Three horned bedstraw, Silverleaf nightshade and Yellow burr weed are all categorised as Contain Spread, which aims to prevent the ongoing spread of the weed species in the management area through surveillance and mapping to locate all infested properties, control of all infestations and aiming for a significant reduction in weed density.

Vertebrate pests

For the cropping land use Red, Wapiti, Chital, Rusa and Sambar deer populations are to be targeted for destruction and local eradication where feasible, as the assessment has recognised that they pose a very high risk and still have a high feasibility for containment. However, Fallow and Hog deer are targeted for the control of all populations, aiming for a significant reduction in pest animal density through high-level initial control and sustained management. This is the same management action for Rabbits.

4.4   FORESTRY

4.4.1   Description

Forestry is an industry that supports extensive employment in the region, and is currently undergoing significant changes in species and management. Softwood plantations (Radiata pine) have dominated the landscape in the Lower Limestone Coast for many decades; however there has been recent and rapid expansion of hardwood plantations (predominantly Tasmanian Blue Gums). In 2020, forestry comprised 6% or 168,901 hectares in the higher rainfall areas south of Kingston and Lucindale.

### 4.4.2   Assumptions

Pest plants

The principle pest plant management effort (herbicides) is at pre-planting when the weeds compete with young seedlings for space and nutrients. Pest plant 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. Plantations are sometimes grazed.

Vertebrate pests

The main control effort is at pre-planting when the young seedlings are susceptible to grazing by herbivores. Access to sites for pest control is only possible within the first two years. Some 1080 fox baiting occurs in plantations where livestock are grazed once trees have established and as good neighbour policy.

Figure 4.4   Map of forestry land use
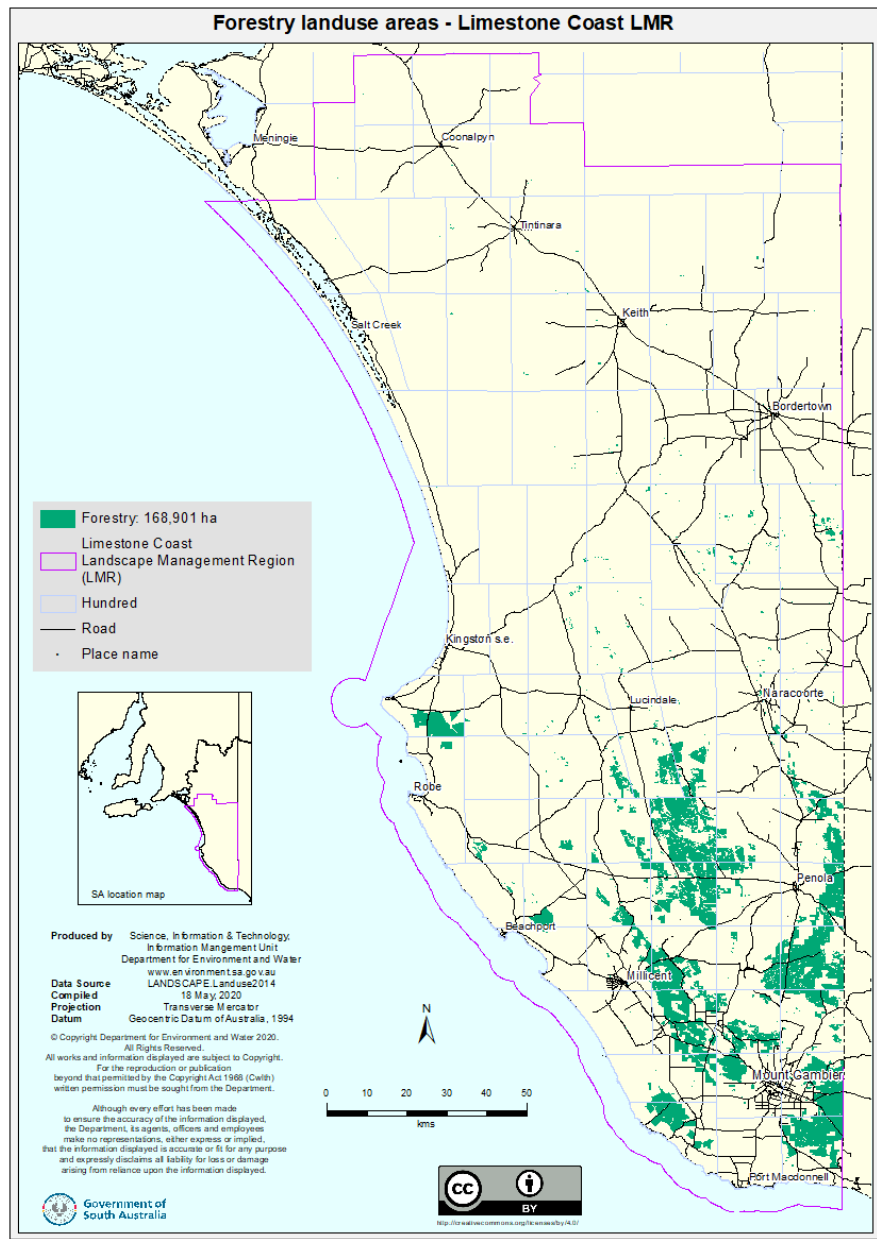
Forestry landuse areas - Limestone Coast LMR

4.4.3 Results

In tables 4.13 and 4.14 the results of the weed risk assessment are shown for the forestry land use. Tables 4.15 and 4.16 show the results of the vertebrate pest risk assessment.

Table 4.13   Weed risk assessment results table for forestry land use (* denotes reviewed in 2020)

Forestry	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
African boxthorn*	4.0	3.2	2.0	25	Low	5.3	0.9	4.5	22	High
African feathergrass	3.3	2.1	1.0	7	Negligible	3.3	0.1	5.5	2	Very High
Bathurst burr*	6.0	3.7	2.0	44	Medium	2.7	0.1	6.4	1	Very High
Blackberry*	7.3	2.6	6.0	116	High	4.7	0.4	6.4	12	Very High
Blue mustard	5.3	1.1	1.0	6	Negligible	4.0	0.1	3.6	1	Very High
Bluebell creeper*	6.0	2.1	8.0	101	High	3.3	1.3	8.2	34	Medium
Boneseed*	7.3	1.1	6.0	46	Medium	2.7	0.4	4.5	5	Very High
Bracken fern	6.7	3.2	6.0	126	High	2.7	5.0	6.4	85	Low
Bridal creeper	7.3	5.3	10.0	386	Very High	5.3	6.7	6.4	226	Negligible
Bridal veil	7.3	5.3	6.0	232	Very High	6.0	0.1	7.3	4	Very High
Cape broom	4.7	2.6	2.0	25	Low	3.3	0.1	4.5	1	Very High
Couch	6.7	2.6	6.0	105	High	4.0	2.1	6.4	53	Medium
Dock	4.0	0.5	6.0	13	Negligible	2.7	2.1	5.5	30	High
Fleabane	3.3	1.6	6.0	32	Low	3.3	6.7	5.5	121	Negligible
Gorse/ Furze	5.3	2.6	4.0	56	Medium	4.0	0.1	6.4	2	Very High
Innocent weed*	6.7	2.1	4.0	56	Medium	3.3	0.4	5.5	8	Very High
Kikuyu	6.0	2.6	6.0	95	Medium	3.3	1.8	7.3	42	Medium
Pampas grass*	4.0	2.1	6.0	51	Medium	3.3	0.1	5.5	2	Very High
Phalaris	5.3	4.2	6.0	135	High	3.3	6.7	7.3	162	Negligible
Sallow wattle*	8.0	5.3	10.0	421	Very High	5.3	2.5	4.5	61	Low
South African weed orchid	6.0	1.1	4.0	25	Low	7.3	0.9	7.3	49	Medium
White weeping broom*	8.0	3.7	6.0	177	High	5.3	0.1	7.3	3	Very High
Wireweed	4.0	2.1	6.0	51	Medium	3.3	5.0	4.5	76	Low

Table 4.14   Weed risk assessment matrix for forestry land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13				Dock	African feathergrass
Low <39	Fleabane		South African weed orchid	African boxthorn	Cape broom
Medium <101	Wireweed		Kikuyu		Bathurst burr, Boneseed, Gorse, Innocent weed, Pampas grass
High <192	Phalaris	Bracken fern	Bluebell creeper, Couch		Blackberry White Weeping Broom
Very High >192	Bridal creeper	Sallow wattle			Bridal veil

Table 4.15   Vertebrate pest risk assessment results table for forestry land use (* denotes reviewed in 2020)

FORESTRY	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit	10.0	2.8	10.0	224	Very High	5.9	3.3	6.3	123	Negligible
Red fox	7.3	1.6	7.3	116	High	6.0	8.3	5.5	273	Negligible
Goat	8.2	2.8	8.2	229	Very High	5.3	2.1	1.8	20	High
European hare	4.5	1.6	4.5	58	Medium	7.3	3.3	6.4	156	Negligible
Hog deer	7.3	2.4	7.3	70	Medium	6.0	0.8	2.7	14	High
Wapiti & Red deer	7.3	2.4	7.3	70	Medium	6.0	3.3	3.6	73	Low
Rusa, Chital & Sambar deer	7.3	2.4	7.3	70	Medium	6.0	1.7	2.7	27	High
Pig*	8.2	4.0	8.2	131	High	6.0	0.8	2.7	14	High
Fallow deer	7.3	2.4	7.3	70	Medium	6.0	3.3	3.6	73	Low

Table 4.16   Vertebrate pest risk assessment matrix for forestry land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible <11					
Low 11-34					
Medium 35-88	HARE	RED, WAPITI & FALLOW DEER		RUSA & HOG DEER, SAMBAR & CHITAL DEER	
High 89-168	FOX			PIG	
Very High >168	RABBIT			GOAT	

4.4.4 Summary

Pest plants

As shown in the forestry management matrix in table 4.14, Bridal veil has a very high weed risk and is very high in feasibility of containment. Thus it is recommended that all infestations are eradicated from the region. Bridal veil was also classified in this category in the native vegetation land use and as a result eradication efforts should be coordinated across these two land uses.

Blackberry and White Weeping Broom have been assessed to have a high risk to forestry operations, but also a high feasibility of containment, as such management actions should be focussed on destroying all infestations and aiming for eradication at localised sites.

Other pest plants which are very high in the feasibility of containment category are Bathurst burr, Boneseed, Gorse, Innocent weed, Pampas grass and Sallow wattle. These pest plants are classed as Contain Spread, thus aiming to prevent the ongoing spread of the weed species in the region.

Pest plants classed in the Limited Action category are Dock, Bridal creeper, Fleabane and South African weed orchid. These species have a low weed risk and/or low feasibility of containment thus any action would not be of significant benefit to the whole land use. 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 is minimal.

Bracken fern is a native plant in the Limestone Coast but has a significant impact on the establishment of tree seedlings; therefore it has been considered as a weed within this land use. As a native plant, Bracken fern is protected by the Native Vegetation Act 1991 and advice should be sought from the Native Vegetation Council before any clearance or control is undertaken.

Vertebrate pests

Goats pose the highest risk to the forestry land use (table 4.16). When management actions are undertaken in the native vegetation and grazing land uses they should also occur at similar levels in the forestry land use, as it could potentially provide harbour or refuge sites for many transient pest animals.

4.5   AQUATIC

4.5.1   Description

Historically, the majority of the Limestone Coast region was seasonally or permanently inundated with water due to low lying topography, soils prone to waterlogging and a lack of natural drainage. Since 1860's, the development of an extensive drainage network and changing climatic factors has resulted in very few intact wetlands remaining. For the purposes of this risk assessment, the inland aquatic land use category comprises approximately 2% of the region and includes wetlands, lakes, creeks and streams, drains and any area with permanent surface water.

4.5.2   Assumptions

Pest plants
There is no routine pest plant management in the land use due to the inaccessibility to most sites. Both environmental impacts and water quality issues were considered when undertaking the assessment. Species which occur in areas subject to flooding are also included in this landuse, for example Willows and Blackberry. In some cases livestock may have access to waterways.

Vertebrate pests
There is no routine pest animal management in the land use due to the inaccessibility to most sites and no viable option for poisons in wet areas. Shooting may occur in areas on private property.

Figure 4.5   Map of aquatic land use
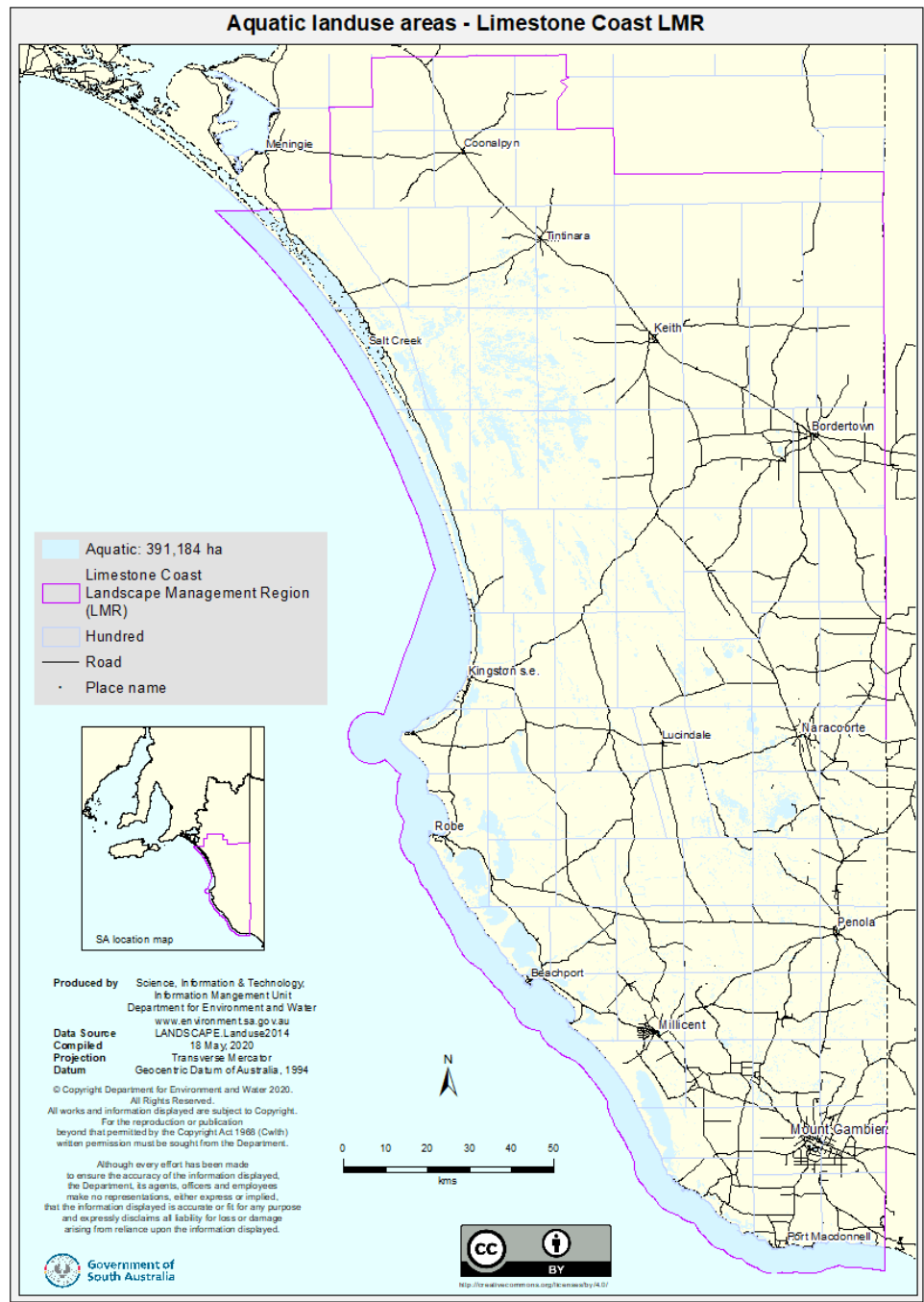
4.5.3 Results

In tables 4.17 and 4.18 the results of the weed risk assessment of the aquatic land use are shown. Tables 4.19 and 4.20 show the results for the vertebrate pest risk assessment.

Table 4.17   Weed risk assessment results table for aquatic land use (* denotes reviewed in 2020)

Aquatic	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Athel pine*	4.7	5.3	4.0	98	Medium	7.3	0.1	4.5	3	Very High
Arum Lilly*	6.0	4.2	2.0	51	Medium	4.7	1.3	3.6	21	High
Blackberry*	8.0	4.7	6.0	227	Very High	7.3	0.9	7.3	49	Medium
Desert Ash*	7.3	3.7	6.0	162	High	6.0	2.1	5.5	68	Low
Dodder (Chilean & red)	6.0	0.5	1.0	3	Negligible	6.0	0.1	7.3	4	Very High
Pepper tree	2.7	2.6	2.0	14	Low	4.7	1.8	6.4	52	Medium
Spiny rush*	6.0	3.2	8.0	152	High	5.3	1.3	5.5	36	Medium
Swamp oak*	6.0	7.4	6.0	265	Very High	6.7	1.7	5.5	61	Low
Willows - seeding	6.0	5.3	1.0	32	Low	6.0	0.1	5.5	3	Very High

Table 4.18   Weed risk assessment matrix for aquatic land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13					Dodder (Chilean & red)
Low <39			Pepper tree		Noogoora burr, Willows (seeding)
Medium <101				Arum Lily	Athel pine
High <192		Desert Ash	Spiny rush		
Very High >192		Swamp oak	Blackberry		

Table 4.19   Vertebrate pest risk assessment results table for aquatic land use (* denotes reviewed in 2020)

AQUATIC	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Black rat	7.3	5.2	8.0	303	Very High	7.3	3.3	6.4	156	Negligible
Pig*	7.3	6.8	8.0	396	Very High	4.7	0.9	1.8	7	Very High
Brown rat	7.3	5.2	4.0	151	High	6.0	0.9	3.6	20	High
Mallard	8.2	4.8	10.0	393	Very High	5.3	0.8	3.6	16	High
Carp	10.0	6.0	8.0	480	Very High	8.0	0.9	7.3	53	Medium
Carp gudgeon	10.0	2.8	8.0	224	Very High	10.7	3.3	7.3	259	Negligible
Gambusia	11.8	4.4	8.0	416	Very High	10.7	3.3	8.2	291	Negligible
Goldfish	10.0	4.0	8.0	320	Very High	8.7	1.3	7.3	79	Low
Marron	8.2	5.2	4.0	170	Very High	10.0	0.8	8.2	69	Low
Redfin	10.9	5.2	6.0	340	Very High	10.0	5.0	8.2	409	Negligible
Trout (Rainbow)	7.3	5.2	4.0	151	High	8.7	1.3	7.3	79	Low
Tench	8.2	3.2	2.0	52	Medium	9.3	0.9	5.5	47	Medium

Table 4.20   Vertebrate pest risk assessment matrix for aquatic land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible <11					
Low 11-34					
Medium 35-88			TENCH		
High 89-168		TROUT		BROWN RAT	
Very High >168	BLACK RAT, CARP GUDGEON, GAMBUSIA, REDFIN,	GOLDFISH, MARRON	CARP	MALLARD	PIG

4.5.4 Summary

Pest plants

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 Willow invasion, 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 (WoNS) list. Blackberry and Athel Pine are both also on the WoNS list and have been allocated to Contain Spread classification to prevent ongoing spread of these species in the region.

Vertebrate pests

Pigs can have devastating impacts on aquatic environments. The assessment indicated that the "Eradicate from Region" action should be applied to any populations of feral or escaped domestic pigs. Mallard is located in the Destroy Infestations category, which aims to destroy all infestations in the region. Brown rat and Carp have been classified as Contain Spread which aims to contain the spread of pests in the region.
Although not declared under the Landscape SA Act 2019, freshwater fish have been assessed to identify the risk they pose to the aquatic land use in the Limestone Coast. Assessments were completed in 2009 on the advice of professionals in the field of freshwater fish ecology and biology.

4.6   URBAN

4.6.1   Description

In total, the Limestone Coast region consists of approximately 2.9 million hectares and supports a population of approximately 62,000 people. Of this regional population, half are located within the City of Mount Gambier and surrounding areas. This distribution limits the ability for individuals across the large, less populated rural areas to control and manage pest species. In urban areas, the focus for pest control and eradication is on maintaining public amenity and safety. Common areas for concern include sports fields and parks, as well as footpaths. Control methods may be limited in urban areas due to inability to use poisons or baits, combined with differing public perceptions.

4.6.2   Assumptions

Pest plants

Councils and landholders undertake regular mowing and irregular spot-spraying using broad spectrum herbicides such as Glyphosate. In the Limestone Coast most lawns and gardens are watered all year round.

Garden weeds or plants that are simply disliked because they are a nuisance are not considered in this assessment. Effects on quality of the land use are focused on damage to physical infrastructure (e.g. roads, paths, buildings) and the impact they may have on a person.

Vertebrate pests

Pest animal management is through trapping and habitat modification, and minimal use of poisoned baits where possible.

Figure 4.6   Map of urban land use
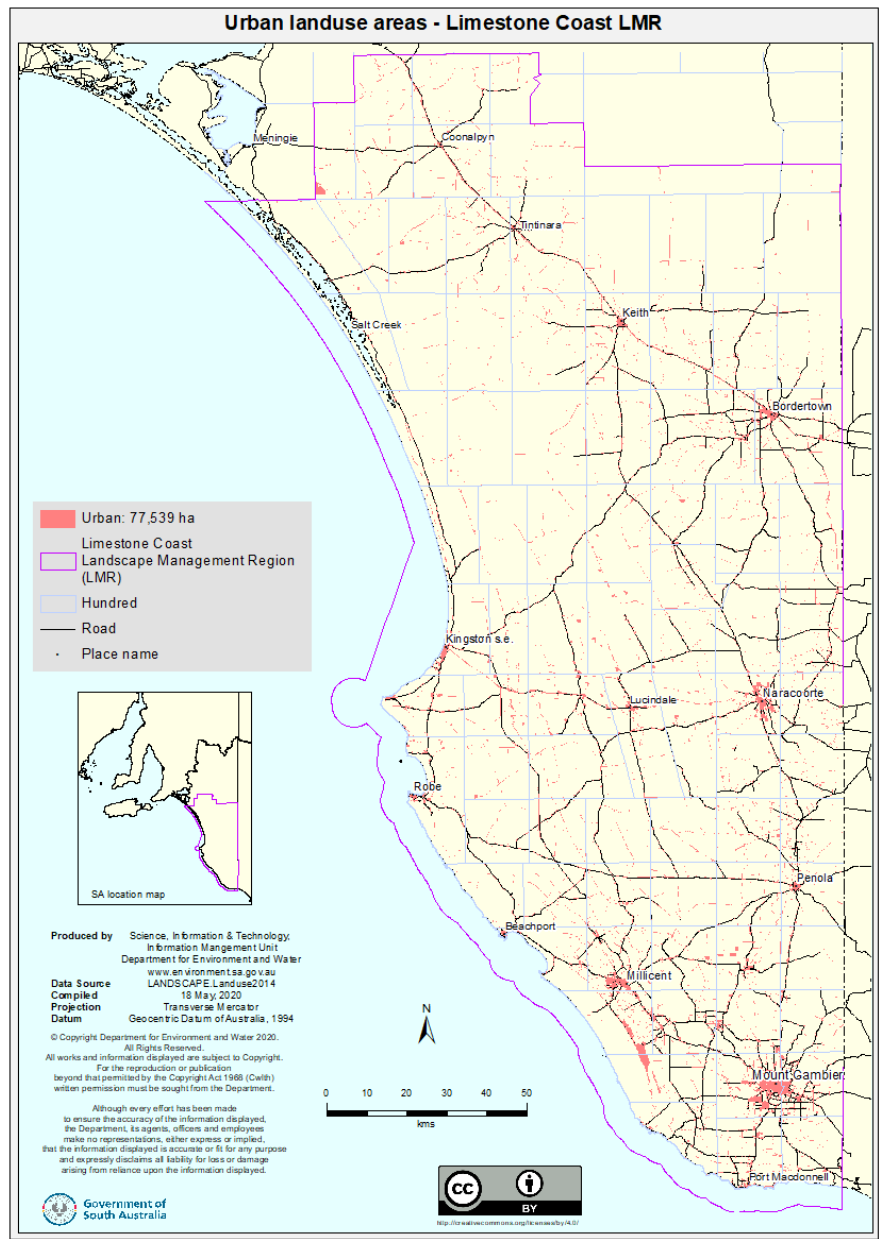
4.6.3 Results

Tables 4.21 and 4.22 show the results of the weed risk assessment for the urban land use. Tables 4.23 and 4.24 show the results for the vertebrate pest risk assessment.

Table 4.21   Weed risk assessment results table for urban land use (* denotes reviewed in 2020)

Urban	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
African boxthorn*	4.0	4.7	1.0	19	Low	2.7	0.9	4.5	11	Very High
Aleppo pine*	6.0	5.3	6.0	189	High	5.3	0.9	4.5	22	High
Apple of Sodom*	6.7	4.2	4.0	112	High	4.7	1.7	5.5	42	Medium
Athel pine	4.7	1.6	1.0	7	Negligible	0.0	7.3	0.1	0	Very High
Blackberry*	6.0	4.7	1.0	28	Low	3.3	0.1	5.5	2	Very High
Bridal creeper	7.3	5.3	10.0	386	Very High	5.3	6.7	6.4	226	Negligible
Caltrop*	6.0	4.7	4.0	114	High	4.7	0.9	3.6	16	High
Coolatai grass	5.3	1.6	2.0	17	Low	3.3	0.1	3.6	1	Very High
Couch	8.0	2.6	6.0	126	High	4.0	2.1	6.4	53	Medium
Desert Ash*	7.3	3.7	6.0	162	High	6.0	2.1	5.5	68	Low
False caper	5.3	4.7	1.0	25	Low	5.3	0.1	8.2	4	Very High
Gazania sp.	6.0	1.6	2.0	19	Low	6.0	0.1	6.4	3	Very High
Innocent weed*	6.7	4.7	1.0	32	Low	4.7	0.1	3.6	1	Very High
Khaki weed	6.0	4.7	4.0	114	High	4.7	0.1	4.5	2	Very High
Kikuyu	8.0	2.6	6.0	126	High	4.0	2.1	6.4	53	Medium
Pin cushion daisy	6.0	4.2	4.0	101	High	6.7	5.0	6.4	212	Negligible
Poa grass	6.0	2.1	8.0	101	High	6.7	5.0	6.4	212	Negligible
Prickly pear	5.3	4.7	4.0	101	High	6.0	0.9	3.6	20	High
Soursob	5.3	1.1	8.0	45	Medium	2.7	3.3	7.3	65	Low
Tree of heaven	6.0	5.8	4.0	139	High	6.0	0.0	3.6	0	Very High
Willows - seeding	6.0	5.3	1.0	32	Low	0.0	0.0	6.0	5	Very High

Table 4.22   Weed risk assessment matrix for urban land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible *>113*	*Low* *>56*	*Medium* *>31*	*High* *>14*	*Very High* *<14*
Negligible *<13*					Athel pine
Low *<39*					African boxthorn, Blackberry, Coolatai Grass, False caper, Gazania, Innocent weed, Willow (seeding)
Medium *<101*		Soursob			
High *<192*	Pin cushion daisy, Poa grass	Desert Ash	Apple of Sodom, Couch, Kikuyu	Aleppo pine, Caltrop, Prickly pear	Khaki weed, Tree of heaven
Very High *>192*	Bridal creeper				

Table 4.23   Vertebrate pest risk assessment results table for urban land use (* denotes reviewed in 2020)

URBAN	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit	10.0	3.2	4.0	128	High	5.9	2.5	6.3	92	Low
Red fox	7.3	4.8	8.0	279	Very High	10.0	5.0	7.3	364	Negligible
Cat	10.0	4.4	10.0	440	Very High	9.3	10.0	7.3	679	Negligible
European hare	4.5	1.2	2.0	11	Low	6.7	2.5	6.4	106	Low
House mouse	7.3	4.4	10.0	320	Very High	8.0	10.0	4.5	364	Negligible
Black rat	7.3	5.6	10.0	407	Very High	8.0	8.3	4.5	303	Negligible
Brown rat	6.4	4.0	2.0	51	Medium	8.0	0.8	4.5	31	High
Wild dog/ Dingo	6.4	4.8	2.0	61	Medium	7.3	0.9	1.8	12	Very High
Common starling	6.4	2.8	10.0	178	Very High	8.7	8.3	7.3	525	Negligible
Eurasian blackbird	6.4	3.2	10.0	204	Very High	8.7	10.0	7.3	630	Negligible
Domestic pigeon	10.0	4.4	10.0	440	Very High	8.7	6.7	7.3	420	Negligible
Mallard	9.1	1.2	0.5	5	Negligible	6.7	0.8	4.5	26	High

Table 4.24   Vertebrate pest risk assessment matrix for urban land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible <11				MALLARD	
Low 11-34		HARE			
Medium 35-88				BROWN RAT	WILD DOG/ DINGO
High 89-168		RABBIT			
Very High >168	BLACK RAT, MOUSE, CAT STARLING, FOX BLACKBIRD, PIGEON				

4.6.4 Summary

Pest plants

The majority of the pest plants in the urban land use are feasible to control; this is due to the accessibility to infestations and the small size of current distributions. Khaki weed was classed in the Destroy Infestations category which aims to significantly reduce the extent of the weed in the region. Caltrop, another burr weed of the urban land use, whose management action aims to contain the spread of the weed in the region. Areas where Caltrop is known to be found in the region include ovals, footpaths and other public amenity areas. Other management actions for Caltrop include control of new outbreaks to reduce spread.

Vertebrate pests

Wild dog and Brown rat should have enforced control of all populations, aiming for a significant reduction in pest animal density through high level initial control and sustained management.

4.7   IRRIGATED CROPS AND PASTURE

4.7.1   Description

One of the unique features of the Limestone Coast region is the availability of good quality underground water that is suitable for stock, domestic and agricultural use. This supports irrigated cropping and grazing across the region, with dairying, fat lambs and annual horticulture such as potatoes in the Lower Limestone Coast. In the Upper Limestone Coast, most irrigation is focused on lucerne and small seed production (e.g. clover). There are two main types of irrigation used for crops and pasture, spray (centre pivot) and flood irrigation, dependant largely on the quality of water available, appropriate delivery systems and external factors such as presence of large red gums (*Eucalyptus camaldulensis*). Drip irrigation is limited mainly to perennial horticulture (e.g. fruit trees and grape vines).

4.7.2   Assumptions

Pest plants

The main pest plant control occurs 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 2,4D, 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.

Vertebrate pests

The assumption of this land use is that there is very little pest animal control conducted by landowners. The main method of control is conducting 1080 baiting programs during lambing seasons.

Figure 4.7   Map of irrigated crops and pastures land use
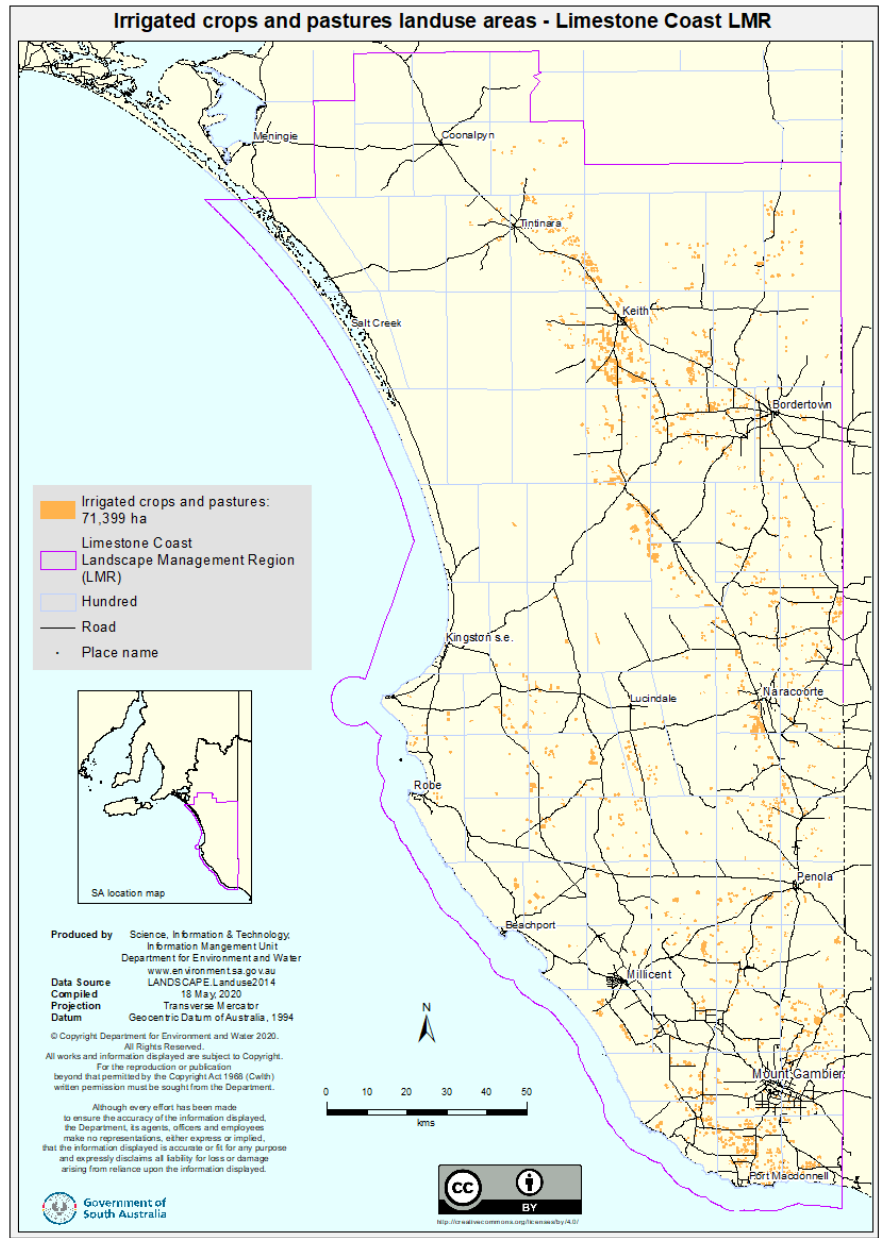
4.7.3 Results

In tables 4.25 and 4.26 the results are presented from the weed risk assessment for the irrigated crops and pasture land use. Tables 4.27 and 4.28 show the results for the vertebrate pest risk assessment.

Table 4.25   Weed risk assessment results table for irrigated crops and pastures land use (* denotes reviewed in 2020)

Irrigated Crops and Pastures	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Alkali sida	6.0	3.2	1.0	19	Low	2.7	0.0	6.4	0	Alert
Bathurst burr*	6.0	2.6	4.0	63	Medium	4.0	0.1	6.4	2	Very High
Blackberry*	7.3	2.6	6.0	116	High	4.7	0.4	6.4	12	Very High
Blackberry nightshade	4.0	2.1	1.0	8	Negligible	5.3	1.8	6.4	59	Low
Bladder campion	5.3	2.6	1.0	14	Low	4.0	0.1	3.6	1	Very High
Broomrape	7.3	2.6	4.0	77	Medium	4.0	0.0	6.4	0	Alert
Buchan weed	6.7	4.2	2.0	56	Medium	5.3	2.5	6.4	85	Low
Caltrop*	6.7	3.2	6.0	126	High	4.0	0.9	6.4	23	High
Capeweed	6.7	1.6	2.0	21	Low	3.3	3.3	3.6	40	Medium
Carrot	7.3	2.6	2.0	39	Low	6.0	0.1	5.5	3	Very High
Couch	6.7	2.6	10.0	175	High	6.7	3.3	6.4	141	Negligible
Creeping knapweed	3.3	3.7	6.0	74	Medium	5.3	0.1	4.5	2	Very High
Cuteaf mignonette*	4.7	1.1	6.0	29	Low	4.0	0.9	5.5	20	High
Dock	4.7	2.1	8.0	79	Medium	5.3	5.0	5.5	145	Negligible
Dodder (Chilean & red)	6.0	0.5	1.0	3	Negligible	6.0	0.1	7.3	4	Very High
False caper	6.0	2.6	4.0	63	Medium	4.0	1.3	6.4	32	Medium
Fat hen	7.3	3.2	8.0	185	High	5.3	5.0	5.5	145	Negligible
Field bindweed	6.7	1.6	4.0	42	Medium	0.0	3.3	3.3	30	High
Fleabane	3.3	1.6	6.0	32	Low	3.3	6.7	5.5	121	Negligible
Golden dodder*	8.7	3.7	8.0	255	Very High	8.0	0.9	5.5	15	High
Innocent weed*	5.3	2.6	4.0	56	Medium	3.3	0.1	5.5	2	Very High
Khaki weed	5.3	2.6	8.0	112	High	3.3	0.0	5.5	0	Alert

Irrigated Crops and Pastures	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Kikuyu	8.0	2.6	6.0	126	High	4.0	2.1	6.4	53	Medium
Lincoln weed	6.7	1.6	4.0	42	Medium	4.0	0.9	6.4	23	High
Noogoora burr complex	5.3	2.6	4.0	56	Medium	2.7	0.1	6.4	1	Very High
Ox tongue	5.3	1.1	6.0	34	Low	4.7	5.0	6.4	148	Negligible
Parramatta grass	6.7	2.6	4.0	70	Medium	4.0	2.5	5.5	55	Medium
Poa grass	6.0	4.2	4.0	101	High	6.7	5.0	6.4	212	Negligible
Salvation Jane	5.3	4.7	8.0	202	Very High	3.3	2.5	5.5	45	Medium
Skeleton weed	8.0	1.6	6.0	76	Medium	5.3	1.7	7.3	65	Low
Slender thistle	4.7	3.2	8.0	118	High	3.3	2.5	4.5	38	Medium
Silverleaf nightshade*	8.0	2.6	6.0	126	High	6.0	0.4	7.3	18	High
Soldier thistle	5.3	3.7	6.0	118	High	3.3	2.5	4.5	38	Medium
Sorrell	3.3	2.1	4.0	28	Low	3.3	6.7	4.5	101	Low
Spear thistle	5.3	3.7	6.0	118	High	3.3	2.5	4.5	38	Medium
Three cornered jack	6.7	3.7	4.0	98	Medium	3.3	0.1	5.5	2	Very High
Variegated thistle	3.3	3.7	4.0	49	Medium	3.3	0.1	4.5	1	Very High
Willow herb	5.3	3.2	6.0	101	High	2.7	8.3	5.5	121	Negligible
Wireweed	4.0	2.1	6.0	51	Medium	3.3	5.0	4.5	76	Low
Yellow burweed*	5.3	4.7	6.0	152	High	3.3	4.2	5.5	76	Low

Table 4.26 **Weed risk assessment matrix for irrigated crops and pastures land use**

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13		Blackberry nightshade			Dodder (Chilean & red)
Low <39	Fleabane Ox tongue	Sorrel	Capeweed	Cutleaf mignonette	Bladder campion, Carrot,
Medium <101	Dock	Buchan weed, Skeleton weed, Wireweed	False caper, Parramatta grass	Field bindweed, Lincoln weed	Bathurst burr, Broomrape, Creeping knapweed, Innocent weed, Noogoora burr, Three corner jack, Variegated thistle
High <192	Couch, Fat hen, Poa grass	Yellow burr weed	Kikuyu, Slender thistle, Soldier thistle, Spear thistle	Caltrop, Silverleaf nightshade,	Blackberry, Khaki weed
Very High >192			Salvation Jane	Golden dodder	

Table 4.27   Vertebrate pest risk assessment results table for irrigated crops and pastures land use (* denotes reviewed in 2020)

Irrigated Crops and Pastures	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit	10.0	5.2	8.0	416	Very High	7.1	5.0	6.3	221	Negligible
Red fox	7.3	6.0	10.0	436	Very High	6.7	10.0	7.3	485	Negligible
Goat	8.2	4.8	8.0	314	Very High	6.7	1.3	3.6	30	High
European hare	4.5	2.0	6.0	55	Medium	8.0	5.0	8.2	327	Negligible
House mouse	6.4	3.2	4.0	81	Medium	6.0	2.1	8.2	102	Low
Black rat	6.4	4.0	8.0	204	Very High	6.7	1.8	7.3	85	Low
Brown rat	7.3	5.2	4.0	151	High	6.0	0.8	3.6	18	High
Dingo, Wild dog	6.4	6.0	10.0	382	Very High	7.3	0.0	3.6	0	Very High
Hog deer	6.4	3.2	8.0	163	Very High	6.7	0.8	2.7	15	High
Pig*	7.3	4.8	8.0	279	Very High	7.3	0.0	4.5	0	Very High
Red & Wapiti deer	7.3	3.6	10.0	262	Very High	6.0	3.3	3.6	73	Low
Rusa, Chital & Sambar deer	7.3	3.6	10.0	262	Very High	6.0	1.3	2.7	20	High
Fallow deer	7.3	3.6	10.0	262	Very High	6.0	3.3	3.6	73	Low

Table 4.28   Vertebrate pest risk assessment matrix for irrigated crops and pastures land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible <11					
Low 11-34					
Medium 35-88	HARE	MOUSE			
High 89-168				BROWN RAT	
Very High >168	RABBIT, FOX	BLACK RAT, RED, WAPITI & FALLOW DEER		GOAT, HOG DEER, CHITAL, RUSA & SAMBAR DEER	, WILD DOG/ DINGO PIG

4.7.4 Summary

Pest plants

In 2009, Golden dodder was categorised in the "Eradicate from Region" management action, the 2020 assessment review has seen Golden Dodder shift to the "Destroy infestations" category, principally reflecting the wider known current distribution. This management action still recommends that all infestations are destroyed and aim for eradication at the localised level which continues to reflect the current policy for this pest. This pest is a parasitic plant with long lived seed that utilises a host plant to survive. The recorded infestations within the Limestone Coast have been within irrigated lucerne crops.

Vertebrate pests

In table 4.28 Wild dog/ dingo and feral pigs are to be eradicated from the region, while Brown rat, Goat, Hog, Sambar, Rusa and Chital deer should have management actions targeted toward reducing their populations and limiting their spread.

4.8   PERENNIAL HORTICULTURE

4.8.1   Description

Perennial horticulture in the Limestone Coast region is dominated by the viticulture industry in several areas located across the region. The main wine growing areas are Coonawarra and Padthaway, Wrattonbully, Cape Jaffa, Mt Benson and the Robe / Kingston area. This land use also includes stone fruits, pome fruit (e.g. apples) and citrus which are grown in small pockets. The total area of this land use is approximately 22,069 hectares or 1% of the region.

#### 4.8.2   Assumptions

Pest plants

In some cases an annual or perennial cover crop is grown between rows of vines to prevent weed growth. A pre-emergent and knock down herbicide is also used around trees/vines. In addition a knockdown herbicide is generally used every 4-6 weeks and a pre-emergent herbicide is used twice a year. There may be some overhead sprinkler or under tree/ vine drip/micro-jet irrigation.

Vertebrate pests

Pest animal management is through the use deterrent devices such as bird scarers and pest proof fencing, 1080 poisoned baits and shooting. An annual or perennial cover crop is grown between rows and grazing by livestock may occur.

Figure 4.8   Map of perennial horticulture land use
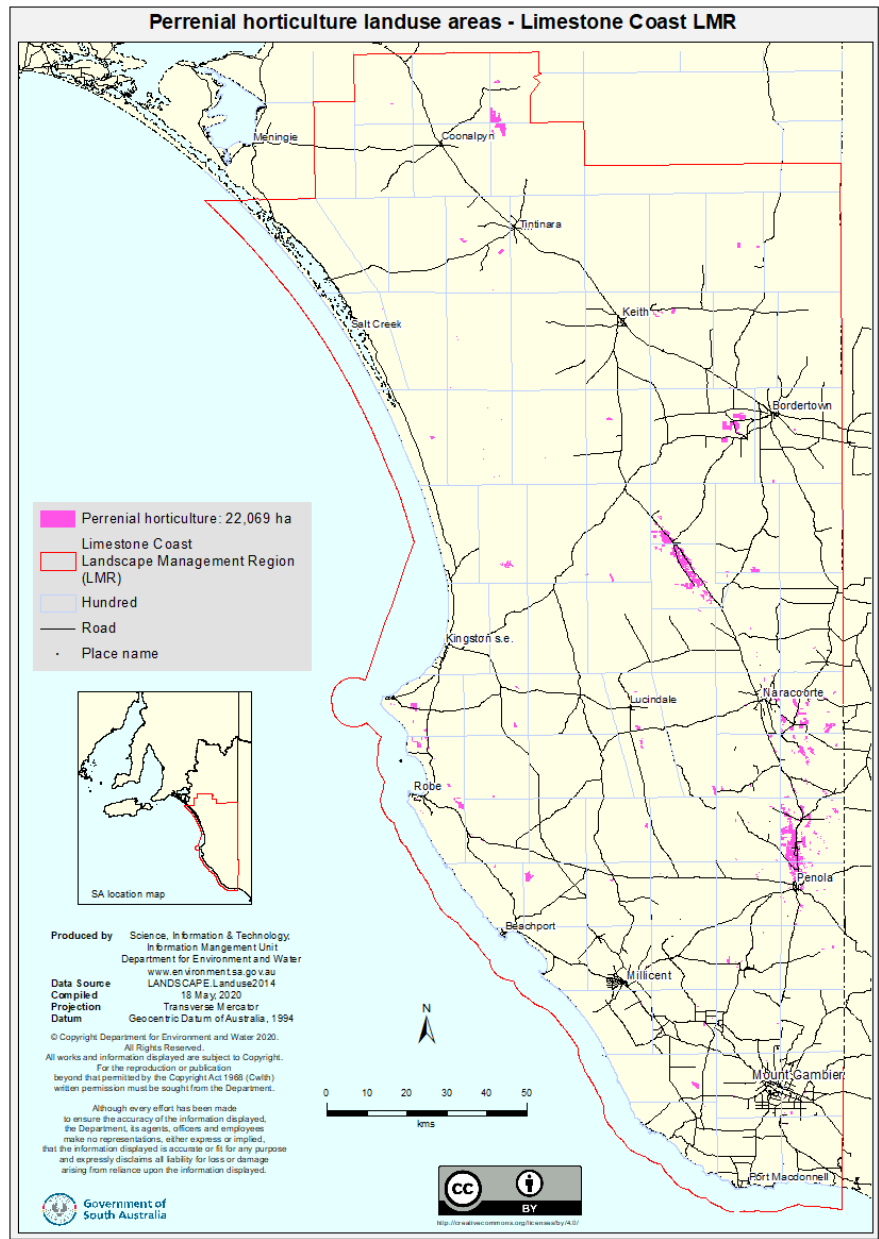
4.8.3   Results

In tables 4.29 and 4.30 the weed risk assessment results for the perennial horticulture land use are shown. Tables 4.31 and 4.32 show the results for the vertebrate pest risk assessment.

Table 4.29   Weed risk assessment results table for perennial horticulture land use (* denotes reviewed in 2020)

Perennial Horticulture	Invasiveness	Impacts	Potential Distribution	Comparative Weed Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
Bathurst burr*	6.7	1.1	6.0	42	Medium	3.3	0.9	4.5	14	Very High
Bridal creeper	7.3	5.3	10.0	386	Very High	5.3	6.7	6.4	226	Negligible
Caltrop*	5.3	2.1	6.0	67	Medium	3.3	0.9	4.5	27	Very High
Couch	8.0	2.6	6.0	126	High	4.0	5.0	6.4	127	Negligible
Cutleaf mignonette	5.3	2.1	4.0	45	Medium	3.3	2.5	3.6	30	High
Fat hen	7.3	3.2	8.0	185	High	5.3	5.0	5.5	145	Negligible
Field bindweed	6.7	1.6	4.0	42	Medium	3.3	3.3	2.7	30	High
Fleabane	3.3	1.6	6.0	32	Low	6.7	6.7	5.5	121	Negligible
Golden dodder	8.7	3.7	8.0	255	Very High	4.0	0.1	5.5	2	Very High
Innocent weed*	6.7	3.2	4.0	84	Medium	4.7	0.1	4.5	2	Very High
Khaki weed	5.3	2.6	8.0	112	High	3.3	0.1	5.5	2	Very High
Olive	6.0	3.7	4.0	88	Medium	7.3	0.9	6.4	43	Medium
Skeleton weed	8.0	1.6	6.0	76	Medium	5.3	1.7	7.3	65	Low
Silverleaf nightshade*	8.0	1.6	6.0	76	Medium	6.0	0.4	7.3	18	High
Soursob	5.3	1.1	8.0	45	Medium	2.7	3.3	7.3	65	Low
Texas needlegrass*	6.7	3.2	4.0	84	Medium	4.7	0.1	6.4	2	Very High
Wireweed	4.7	0.5	4.0	10	Negligible	4.0	1.8	1.8	32	Medium

Table 4.30   Weed risk assessment matrix for perennial horticulture land use

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13			Wireweed		
Low <39	Fleabane				
Medium <101		Skeleton weed, Soursob	Olive	Cutleaf mignonette, Field bindweed Silverleaf nightshade	Bathurst burr Caltrop, Innocent weed Texas Needlegrass
High <192	Couch, Fat hen				Khaki weed
Very High >192	Bridal creeper				Golden dodder

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Table 4.31   Vertebrate pest risk assessment results table for perennial horticulture land use (* denotes reviewed in 2020)

Perennial Horticulture	Invasiveness	Impacts	Potential Distribution	Comparative Pest Risk	CWR	Control Costs	Current Distribution	Persistence	Feasibility of Containment	FOC
European rabbit	9.1	2.4	2.0	44	Medium	5.9	2.1	7.5	92	Low
Red fox	7.3	2.8	10.0	204	Very High	6.7	8.3	7.3	404	Negligible
Goat	7.3	3.6	0.5	13	Low	4.0	0.9	1.8	6	Very High
European hare	4.5	2.4	8.0	87	High	6.0	8.3	8.2	409	Negligible
House mouse	6.4	2.8	8.0	143	High	8.7	6.7	8.2	473	Negligible
Black rat	6.4	2.4	6.0	92	High	8.0	5.0	7.3	291	Negligible
Hog deer	6.4	2.0	0.5	6	Negligible	4.7	0.9	1.8	7	Very High
Rusa, Chital & Sambar deer	6.4	2.4	0.5	8	Negligible	4.7	0.9	1.8	7	Very High
Red & Wapiti deer	6.4	2.4	0.5	8	Negligible	4.7	1.8	1.8	15	High
Fallow deer	6.4	2.4	0.5	8	Negligible	4.7	1.8	1.8	15	High
Common starling	6.4	3.6	10.0	229	Very High	5.3	8.3	9.1	404	Negligible
Eurasian blackbird	6.4	1.6	10.0	102	High	6.7	8.3	9.1	505	Negligible

Table 4.32   Vertebrate pest risk assessment matrix for perennial horticulture land use

COMPARATIVE PEST RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >111	Low 111-55	Medium 31-54	High 13-30	Very High <13
Negligible <11				RED, WAPITI & FALLOW DEER	HOG, CHITAL, SAMBAR & RUSA DEER
Low 11-34					GOAT
Medium 35-88		RABBIT			
High 89-168	HARE, BLACK RAT, BLACKBIRD MOUSE				
Very High >168	STARLING FOX				

4.8.4   Summary

Pest plants

Golden dodder has been classified into the highest management category of Eradicate from region within the perennial horticulture land use. Therefore when implementing control activities, a whole of region approach should be taken to ensure all infestations are destroyed, with areas managed to prevent spread and ensuring seed banks are exhausted to prevent the infestation from reoccurring i.e. eradicated from the region.

Burr weeds like Bathurst burr, Caltrop and Innocent weed are prevalent in perennial horticulture and are easily spread due to the high human and vehicle traffic in plantations. Management of these weeds should be aimed at containing the spread within this land use, and controlling current infestations.

Vertebrate pests

In table 4.32 Goat was categorised in the Protect Sites management action which aims to prevent spread of the pest animal species to key sites/assets of high economic, environmental and/or social value. Hare, Black rat, Mouse, Blackbird, Starling and Fox species are classified in the Manage Pest Populations action.

4.9 COMBINED RISK ASSESSMENT RESULTS

The attribute scores for the pest plant and pest animal threats assessed in this project have been averaged across the whole of the region and each land use outlines key assumptions that have been applied to the assessment.

The assessment of the pest plant and animals has shown species have varying control actions between each land use, i.e. one species can be categorised into multiple management actions e.g. goat is Eradicate from the region in cropping land use, Destroy Infestations in grazing land use and Protect Sites in perennial horticulture land use (refer to table 4.33 below).

Table 4.33   Weed species versus management actions (*denotes reviewed in 2020)

Landuse		Grazing	Biodiversity Areas	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	Eradication from Region (Red)									
2	Destroy Infestations (Orange)									
3	Contain Spread (Yellow)									
4	Protect Sites (Green)									
5	Manage Weed (Light Blue)									
6	Manage Sites (Dark Blue)									
7	Monitor (Purple)									
8	No Action (Grey)									
	Not Present/ Alert Species									
WEEDS:										
African boxthorn*	*Lycium ferocissimum*	4	3		7		4			3
African feathergrass	*Cenchrus macrourum*	3	3		7					3
African lovegrass*	*Eragrostis curvula*	3	3							4
African rue	*Peganum harmala*									
Agave	*Agave americana*		7							7
Aleppo pine*	*Pinus halepensis*		3				3			3
Alisma	*Alisma lanceolatum*									
Alkali sida	*Malvella leprosa*									
Alligator weed	*Alternanthera philoxeroides*									
Annual ryegrass	*Lolium rigidum*			5						5
Apple of Sodom*	*Solanum hermannii*	4	6	6			4			4
Arrowhead	*Sagittaria montevidensis*									
Arum lilly*	*Zantedeschia aethiopica*		7			4				7
Asparagus fern*	*Asparagus scandans*		3							3
Athel Pine	*Tamarisk aphylla*		7			4	7			4
Azzarola	*Crataegus sinaica*									
Bamboo	*Arundo donax*		8							8
Bathurst burr*	*Xanthium spinosum*	3	8	4	3			3	3	3
Bedstraw	*Galium sp.*			4						4

	Landuse	Grazing	Biodiversity Areas	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	Eradication from Region (Red)									
2	Destroy Infestations (Orange)									
3	Contain Spread (Yellow)									
4	Protect Sites (Green)									
5	Manage Weed (Light Blue)									
6	Manage Sites (Dark Blue)									
7	Monitor (Purple)									
8	No Action (Grey)									
	Not Present/ Alert Species									
Bifora	Bifora testiculata									
Blackberry*	Rubus fruticosus	3	3		2	3	4	2		2
Blackberry nightshade	Solanum nigrum		8					8		8
Bladder campion	Silene vulgaris	4		4				4		4
Blue mustard	Chorispora tenella									
Blue periwinkle	Vinca major		6							6
Blue psoralea	psoralea pinnata		4							4
Bluebell creeper*	Sollya heterophylla		3		4					3
Boneseed*	Chrysanthemoides monilifera		3		3					3
Bracken fern	Pteridium esculentum	8			5					5
Bridal creeper	Asparagus asparagoides		5		5	5			5	5
Bridal creeper* (Western Cape form)	Asparagus asparagoides		2							2
Bridal veil*	Asparagus declinatus		1		1					1
Broadkernel espartillo	Achnatherum caudatum									
Broomrape	Orobanche ramosa			3				3		3
Buchan weed	Hirschfeldia incana	8		8				6		6
Buffel grass*	Cenchrus ciliaris & pennisetiformis		2	2						2
Bulbil watsonia	Watsonia meriana var. bulbillfera		8							8
Butterfly bush	Buddleja davidii		7							7
Cabomba	Cabomba caroliniana									
Calomba daisy	Oncosiphon suffruticosum	3		3						3
Caltrop*	Tribulus terrestris	3		3			3	3	4	3
Cane needlegrass	Nassella hyaline									
Cape broom	Genista monspessulana		4		4					4
Cape tulip - one leaf	Moraea flaccida	3	6							3
Cape tulip - two leaf	Moraea miniata	3	6							3
Capeweed	Arctotheca calendula	5		8				8		5

	Landuse	Grazing	Biodiversity Areas	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	**Eradication from Region (Red)**									
2	**Destroy Infestations (Orange)**									
3	**Contain Spread (Yellow)**									
4	**Protect Sites (Green)**									
5	**Manage Weed (Light Blue)**									
6	**Manage Sites (Dark Blue)**									
7	**Monitor (Purple)**									
8	**No Action (Grey)**									
	Not Present/ Alert Species									
Carrot	*Daucus carota*		4					4		4
Chilean needlegrass	*Nassella neesiana*									
Coastal tea tree*	*Leptospermum laevigatum*	4	4							4
Coastal wattle	*Acacia sophorae*		5							5
Common lantana	*Lantana camara*		5							5
Coolatai grass*	*Hyparrhenia hirta*	3	4				4			3
Cootamundra wattle	*Acacia baileyana*		4							4
Cotoneaster	*Cotoneaster spp.*		4							6
Couch	*Cynondon dactylon*			5	4		4	5	5	4
Creeping knapweed	*Acroptilon repens*	3		3				3		3
Cutleaf mignonette*	*Reseda lutea*	4		4				7	4	4
Desert Ash*	*Fraxinus angustifolia sup. angustifolia*		5			5	5			5
Distichlis	*Distichlis spicata*									
Dock	*Rumex crispus*	8		6	8			6		6
Dodder Red & Chilean	*Cuscuta spp*	7	7			7		7		7
Dog rose*	*Rosa canina*	7	6							6
Dolichos pea*	*Dipogon lignosus*		4							4
Dune Onion weed	*Trachyandra divaricata*									
Elodea	*Elodea canadensis*									
English broom	*Cytisus scoparius*		4							4
English Oak	*Quercus robur*		7							7
Erica/ Berry Heath*	*Erica baccans & lusitanica*		3							3
Eurasian watermilfoil	*Myriophyllum spicatum*									
False caper*	*Euphorbia terracina*	6	6				4	6		4
Fat hen	*Chenopodium album*							5	5	5
Field bindweed	*Convolvulus arvensis*			4				4	4	4
Field garlic	*Allium vineale*									
Fleabane	*Conyza spp.*			6	8			8	8	6
Fountain grass*	*Cenchrus setaceum*		2							2

	Landuse	Grazing	Biodiversity Areas	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	**Eradication from Region (Red)**									
2	**Destroy Infestations (Orange)**									
3	**Contain Spread (Yellow)**									
4	**Protect Sites (Green)**									
5	**Manage Weed (Light Blue)**									
6	**Manage Sites (Dark Blue)**									
7	**Monitor (Purple)**									
8	**No Action (Grey)**									
	Not Present/ Alert Species									
Freesia	*Freesia hybrids*		6							6
Gazania spp.	*Gazania spp.*		4				4			4
Giant Reed	*Arundo donax*									
Golden dodder*	*Cuscuta campestris*							2	1	1
Golden wreath wattle	*Acacia saligna*		5							5
Gorse/ Furze	*Ulex europaeus*	3	3		3					3
Hoary cress*	*Cardaria draba*	4		3				3		3
Horehound	*Marrubium vulgare*	4	8	4						4
Horsetail	*Equisetum hyemale*									
Hydrocotyle	*Hydrocotyle ranunculoides*									
Italian Buckthorn*	*Rhamnus alaternus*		4							4
Innocent weed*	*Cenchrus incertus/longispinus*	3		2	3		4	3	4	2
Ivy (Cape & English)*	*Hendera helix*		4							4
Khaki weed	*Alternanthera pungens*	2					2	2	2	2
Kikuyu	*Pennisetum clandestinum*				6		4	4		4
Lagarosiphon	*Lagarosiphon major*									
Leafy elodea	*Egeria densa*									
Lincoln weed*	*Diplotaxis tenuifolia*	4		4				4		4
Madeira vine*	*Anredera cordifolia*		3							3
Marguerite daisy	*Argyranthemum frutescens*		7							7
Marram grass	*Ammophila arenaria*		6							6
May/ Hawthorn*	*Crataegus monogyna*		7							7
Mexican feathergrass	*Nassella tenuissima*									
Mirror Bush	*Coprosma repens*		4							4
Muskweed	*Myagrum perfoliatum*									
Nightstock	*Matthiola longipetala*									
Noogoora burr complex	*Xanthium strumarium spagg.*	4				4		3		3
Olive*	*Olea europaea*		4						6	4
Onion grass	*Romulea rosea var. australis*	6								6

	Landuse	Grazing	Biodiversity Areas	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	**Eradication from Region (Red)**									
2	**Destroy Infestations (Orange)**									
3	**Contain Spread (Yellow)**									
4	**Protect Sites (Green)**									
5	**Manage Weed (Light Blue)**									
6	**Manage Sites (Dark Blue)**									
7	**Monitor (Purple)**									
8	**No Action (Grey)**									
	Not Present/ Alert Species									
Onion weed	*Asphodelus fistulosus*	6								6
Ox tongue	*Picris echioides*							8		7
Pampas grass / Toe toe*	*Cortaderia spp.*		2		3					2
Paramatta grass	*Sporobolus africanus*	6						6		6
Parrots feather	*Myriophyllum aquaticum*									
Pepper tree	*Schinus molle var. areira*		8			8				4
Perennial thistle	*Cirsium arvense*	6								6
Phalaris	*Phalaris aquatica*		5		5					5
Pheasant's eye	*Adonis microcarpa*									
Pin cushion daisy	*Scabiosa atropurpurea*		5					5		5
Plumerillo	*Jarava plumose*									
Poa grass	*Poa annua*							5	5	5
Poison buttercup	*Ranunculus sceleratus*									
Polygala*	*Polygala myrtifolia*		4							6
Poplars	*Populus spp.*		6							6
Prickly acacia	*Acacia nilotica subsp. Indica*									
Prickly pear	*Opuntia spp*		7					3		3
Primrose willow	*Ludwigia peruviana*									
Pyp grass	*Ehrharta villosa var maxima*		5							5
Radiata pine	*Pinus radiata*		3							3
Ragwort	*Senecio jacobaea*									
Rhus tree	*Toxicodendron succedaneum*									
Sagittaria	*Sagittaria graminea*									
Sallow wattle*	*Acacia longifolia*		4		5					4
Salvation Jane	*Echium plantagineum*	4		5				3		3
Salvinia	*Salvinia molesta*									
Sea spurge	*Euphorbia paralias*		7							7
Sea Wheatgrass	*Thinopyrum junceiforme*		4							4
Senegal tea plant	*Gymnocoronis spilanthoides*									

	Landuse	Grazing	Biodiversity Areas	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	Eradication from Region (Red)									
2	Destroy Infestations (Orange)									
3	Contain Spread (Yellow)									
4	Protect Sites (Green)									
5	Manage Weed (Light Blue)									
6	Manage Sites (Dark Blue)									
7	Monitor (Purple)									
8	No Action (Grey)									
	Not Present/ Alert Species									
Serrated tussock	*Nassella trichotoma*									
Silver grass	*Vulpia bromoides*	6								6
Silverleaf nightshade*	*Solanum elaeagnifolium*	2		3				3	4	2
Skeleton weed	*Chondrilla juncea*	6	6	6				6	6	6
Slender thistle	*Carduus tenuiflorus*	5	6					4		4
Soldier thistle	*Picnomon acarna*	5						4		4
Sorrell	*Rumex acetosella*	8						8		8
Soursob	*Oxalis pes-caprae*	8		6			6		6	6
South african weed orchid	*Disa bracteata*		6		8					6
Spear thistle	*Cirsium vulgare*	5						4		4
Spiny rush*	*Juncus acutus*	4	6			4				4
Swamp Oak*	*Casuarina glauca*	4	5			4				4
Sweet briar*	*Rosa rubiginosa*		6							6
Sweet pittosporum*	*Pittosporum undulatum*		6							6
Tagasaste	*Chamaecytisus palmensis*		6							6
Tall wheatgrass	*Thinopyrum ponticum*		5	5						5
Texas needlegrass	*Nassella leucotricha*	2							3	2
Three corner jack	*Emex spp.*	3						3		3
Three horned bedstraw	*Galium tricornutum*			3						3
Tree heath	*Erica arborea*									
Tree of heaven	*Ailanthus altissima*						2			2
Variegated thistle	*Silybum marianum*	3		4				3		3
Veldt grass	*Ehrharta calycina*		5							5
Wandering jew	*Tradescantia albiflora*		7							7
Water caltrop	*Trapa natans*									
Water dropwort	*Oenanthe pimpinelloides*									
Water hyacinth	*Eichhornia crassipes*									
water primrose	*Ludwigia peploides spp montividensis*									
Water soldier	*Stratiotes aloides*									

	Landuse	Grazing	Biodiversity Areas	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	**Eradication from Region (Red)**									
2	**Destroy Infestations (Orange)**									
3	**Contain Spread (Yellow)**									
4	**Protect Sites (Green)**									
5	**Manage Weed (Light Blue)**									
6	**Manage Sites (Dark Blue)**									
7	**Monitor (Purple)**									
8	**No Action (Grey)**									
	Not Present/ Alert Species									
Western coastal wattle	*Acacia cyclops*		5							5
White arctotis (African daisy)	*Arctotis stoechadifolia*		8							8
White weeping broom*	*Retama raetam*		2		2					2
Wild artichoke	*Cynara cardunculus*	7	7							7
Wild oats	*Avena fatua*		6	5						5
Wild radish	*Raphanus raphanistrum*			5						5
Williams grass	*Festuca arundinacea*		6							6
Willow herb	*Epilobium billardieranum*									
Willow spp.	*Salix spp.*					4	4			4
Wireweed	*Polygonum aviculare*				6			6	8	6
Yellow burrweed	*Amsinckia spp.*	5	7	5				5		3

Table 4.34   Vertebrate pests versus management actions

Land Management Action	Land use	Grazing	Biodiversity areas	Cropping	Forestry	Aquatic	Urban	Irrigated Crop & Pastures	Perennial Horticulture	Highest Management Class
1	Eradication from Region (Red)									
2	Destroy Infestations (Orange)									
3	Contain Spread (Yellow)									
4	Protect Sites (Green)									
5	Manage Weed (Light Blue)									
6	Manage Sites (Dark Blue)									
7	Monitor (Purple)									
8	No Action (Grey)									
Black rat	*Rattus rattus*		5	4		5	5	4	5	4
Brown rat	*Rattus norvegicus*					3	4	3		3
Cat	*Felis catus*		5				5			5
Carp	*Cyprinus carpio*					3				3
Carp gudgeon	*Hypseleotris compressa*					5				5
Chital (axis) deer, Rusa, Sambar	*Axis axis, Cervus timorensis, Cervus unicolor*	2	5	2	4			2	7	2
Common starling	*Sturnus vulgaris*		5				5		5	5
Dingo/ Wild Dog	*Canis lupus dingo/ Canis lupus familiaris*	1	2				3	1		1
Domestic pigeon	*Columba livia*						5			5
European rabbit	*Oryctolagus cuniculus*	5	5	3	5		5	5	6	3
European hare	*Lepus europaeus*	6	6	6	6		8	6	6	6
Eurasian blackbird	*Turdus merula*		6				5		5	5
Feral pig*	*Sus scrofa*	1	3	3	3	1		1		1
Fallow deer	*Dama dama*	4	5	3	6			4	8	3
Goat	*Capra hircus*	2	2	1	2			2	4	1
Goldfish	*Carassius auratus*					4				4
Gambusia	*Gambusia holbrooki*					5				5
House mouse	*Mus musculus*		5	5			5	6	5	5
Hog deer	*Axis porcinus*	2	8	3	4			2	7	2
Marron	*Cherax cainii*					4				4
Mallard	*Anas platyrhynchos*		8			2				1
Red fox	*Vulpes vulpes*	5	5		5		5	5	5	5
Redfin	*Perca fluviatilis*					5				5
Trout						5				5
Tench	*Tinca tinca*					6				6
Wapiti & Red deer	*Cervus canadensis & elaphus*	4	5	2	6			4	8	2

5 ALERT LIST

Table 5.1 lists alert species which are pest plants and pest animals that may pose a threat to primary industries and biodiversity in the Limestone Coast region. These species are not present in the region but from investigations into their biology and ecology they may be suited to the Limestone Coast region, thus they are automatically categorised into the highest management action of the risk assessment process. The following points are guiding principles for alert species:

- Prevention of entry to region through education and awareness activities.
- The eradication of any pest species that may enter the region
- Investigations into reported sightings of the pest and detailed surveillance and mapping to locate all populations
- Destruction of all populations including juveniles

Table 5.1 Alert species

Management Action	Declared Species		Non declared species
	Pest plants	**Pest animals**	
Alert List *Species that are not known to be present in the region and which represent a significant threat. Aims to prevent the species arriving and establishing in the management area*	Alisma Alkali sida Alligator weed Arrowhead Broadkernel espartillo Broomrape Cabomba Calomba daisy Cane needlegrass Chilean needlegrass Distichlis Dune onion weed Elodea Eurasian watermilfoil Horsetail Hydrocotyle Lagarosiphon Lantana Leafy elodea Mexican feathergrass Nightstock Parrot's feather Plumerillo Poison buttercup Poison Ivy Primrose willow Ragwort Rhus tree Sagittaria Salvinia Senegal tea plant Serrated tussock Tree Heath Water caltrop Water dropwort Water hyacinth Water soldier	Cane toad Common myna House crow Indian ringneck Laughing dove Red-eared slider Red-whiskered bulbul Song thrush Tree sparrow Water buffalo	Blue mustard Pheasant's eye Water primrose

6 PRIORITY PEST PLANT AND PEST ANIMAL SPECIES

In a regional context the highest management action is applied to the pest plant and pest animal species to achieve the best possible outcome of control for all land uses. In table 6.1 a list of the priority agricultural and environmental pest plants and pest animals is shown.

Table 6.1   Priority pest plant and pest animal list

Class	Environmental		Agricultural	
	Priority pest plants	Priority pest animals	Priority pest plants	Priority pest animals
Eradicate from region	Bridal veil	Dingo/ Wild dog Feral pig	Golden dodder	Dingo/ Wild dog Feral Pig Goat
Destroy Infestations	Western Cape Bridal Creeper Buffel grass Fountain grass Pampas grass White weeping broom	Goat Mallard	Blackberry Buffel grass Innocent weed Khaki weed Silverleaf nightshade Texas needlegrass White weeping broom	
Contain Spread	African boxthorn Aleppo pine Asparagus fern Blackberry Bluebell creeper Boneseed Dolichos pea Erica Gorse Madeira vine Radiata pine		African feathergrass African lovegrass Bathurst burr Caltrop Cape tulips Creeping knapweed Gorse Hoary Cress Salvation Jane Three corner jack Three horned bedstraw	Deer (all species) Rabbit

6.1.1   Regional priorities

It is important to remember that the resulting list of high priority pest plants and pest animals described through this assessment have been determined at the regional scale. This context may result in the exclusion of some pest plants and animals that are a high priority at the local level. Local priorities can still be addressed as policies and management plans which can recognise local issues among regional priorities.

The assessment procedure compares the threat of the pest plants and pest animals to the feasibility of controlling them. This process has resulted in some species that many people consider to be a high priority or have serious impact, to not make it to the priority list. Bridal creeper is a good example of this. Whilst Bridal creeper poses a very high risk to the environment and some primary industries it is simply not feasible to undertake control at a regional scale. This can be due to a number of reasons such as the cost of control techniques, the accessibility to populations and the current high distribution across the region. Control techniques as outlined in the management actions should be aimed at protecting key assets and using integrated control techniques such as biological control agents.

Foxes are an example of a pest animal that presents a very high risk to primary industry and native vegetation, but it is simply not feasible to undertake eradication actions at the regional scale. This

can be due to a number of reasons such as the cost of control techniques, the accessibility to populations, the current high distribution across the region and a foxes' ability to avoid detection.

7   DISCUSSION

7.1   CONFLICT OF INTEREST

There are a number of conflicts of interests for pest plant and pest animal species across land uses. What is grown as a production/ agricultural species in one land use may be a significant pest plant or pest animal in another land use. For example, Radiata pine is the major forestry species in the Limestone Coast but is a high priority pest plant in biodiversity areas. The same applies to Veldt grass, Tall wheat grass and Phalaris. All were planted as pasture grasses but now threaten biodiversity areas. 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 land uses as pest plants. The conflict here is that both species are locally-indigenous native plants, and as such are protected by the Native Vegetation Act 1991 which prevents clearance without a permit, except in certain circumstances. This report does not condone the unlimited control of Bracken fern or Coastal wattle across all land uses. Each situation must be assessed and it is recommended that land managers seek the advice of the Native Vegetation Council before undertaking any control measures.

There are a number of conflicts of interests for pest animal species across land uses. What is farmed as a livestock species, or kept as a pet may become a pest if uncontrolled. For example deer are farmed for their meat, velvet and sometimes kept as pets but if not managed appropriately i.e. behind adequate fencing they can escape and become a pest across multiple land uses in the region.

7.2   LIMITATIONS AND INTERPRETATION OF RISK ASSESSMENT RESULTS

The outcomes of the procedure should be regarded as the *minimum* level of management that should be applied at the regional level. If a higher accuracy of priorities is required, the risk assessment process may be undertaken at a smaller scale (e.g. sub-regional landscape group level), if data permits. In this case, local level plans and policies may identify the need for higher levels of management due to specific local circumstances.

The pest plant and pest animal risk assessment distribution results reported in this plan are based on data obtained from regional Authorised Officers. From the local data collected, averages were calculated allowing each pest plant and pest animal to be assessed in a regional context.

The prioritisation of pest plant and animal species utilising the risk assessment model is limited by the lack of readily available information on distribution, species characteristics and best practice management actions. These are common knowledge gaps (not limited to the SE LANDSCAPE region) and highlight the need for improvements in ongoing mapping and monitoring of pest plant and animal species, research into biological and ecological characteristics and the communication and refinement of current best practice management options.

Fresh water fish were assessed in this project, although the vertebrate pest risk assessment was not designed for their assessment. The results obtained from the assessment were seen to be creditable from various professionals, therefore have been reported in this plan.

Invertebrates are not currently included within the scope of this strategy

8 RECOMMENDATIONS

The results of this project are a thoroughly assessed regional summary of pest plant and pest animal recommended management actions. All stakeholders considering targeted pest plant and animal control activities and determining priorities for on-ground works can use these results. It is anticipated that this report will provide the background information for determining the regional pest plant and animal policies of the Limestone Coast Landscape Board.

Interpreting this pest plant and pest animal 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 Landscapes Officer for specific local context information.

The management actions recommended within the matrices should not be taken literally for every situation, however they provide solid guiding principles for the effective management of pest plant and animal species within the region. Other information to be considered when deciding on management actions should include, although not limited to, the current distribution of the pest plant and animal, local issues such as climatic conditions e.g. drought, the proximity to other land uses which may be affected and the resources available to undertake control activities.

In a biodiversity context the species based approach (that the weed risk assessment (WRA) process uses) while useful in some instances (e.g. Bridal Veil), is not commonly used by agencies to prioritise regional environmental works programs. The asset based approach (eg. E-Weed MAT) that protects biodiversity at the site or patch scale is more often used for prioritising limited resources for the protection of biodiversity assets in a highly fragmented landscape. Each method has its place - particularly as the asset based approach often means working on species to protect high priority patches against invasive weeds (e.g. Bridal creeper) that the WRA gives the impression of being a low priority for action in the region.

The pest plant and pest animals on the alert list have not been individually assessed for their risk level. As part of Chapter 4 of this strategy a regional incursion management plan will be drafted in consultation with Landscape Board staff to determine the risk level of pest plants and animals that are currently not present in the region and develop a response strategy for potential introduction of new pest plant and animal species.

Commented [HA(1): Leave in or take out?

Current pest plant and animal control programs are briefly mentioned in this report. A thorough summary of such activities should be compared against the results of this pest plant and animal assessment to determine gaps in control programs for the highest priority species. 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 pest plant and pest animal control legislation

As further knowledge concerning an individual species' attributes such as the biology, ecology, control methods, current/potential distribution and climate change influences become known, they can be easily fed into the risk assessment model and assist in strengthening and refining the management actions. It is therefore suggested that the assessment is reviewed on a minimum 3-5 yearly basis.

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SA WEED RISK MANAGEMENT GUIDE
February 2008

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INTRODUCTION

The SA Weed Risk Management System was 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 **land uses**, so that the most important weeds of different land uses can be identified.

The System was originally devised for Animal & Plant Control Boards in South Australia (now integrated into Natural Resource Management Boards). However, it can be broadly applied to many geographic scales (replace the term 'Board' with a more relevant one) and for any land use.

Use this guide when filling out the accompanying scoresheet. The questions can apply to any type of weed in any land use. 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 land use.

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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Government
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See the following references for example uses of the SA Weed Risk Management System:

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LAND USES

Different types of weeds are important in different land uses. 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 land uses, then you would also need to compare the importance of the land uses themselves. This is too difficult to do (i.e. you need $/ha values for each land use). An easier approach is to compare weeds within land uses only. Animal and Plant Control/Natural Resource Management Boards can then decide for themselves the amount of time and resources devoted to protecting each land use from weeds.

The following land uses 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, land uses 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 land use.*** For example, the typical *crop/pasture rotation* land use 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 land use.*** For example, the *perennial horticulture* land use 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 land uses apply to your Board. Then decide which weeds cause problems in which land uses. There is no need (and it makes little sense) to assess every weed in every land use. The idea is simply to determine the important weeds of each land use.

Assumptions about a land use 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 land use. It takes account of how well the weed can establish, reproduce and disperse. Answer all questions with the land use in mind, except for question 5(a).

1. What is the weed's ability to establish amongst existing plants?		*SCORE*
☐ very high	"Seedlings" readily establish within dense vegetation, or amongst thick infestations of other weeds.	*3*
☐ high	"Seedlings" readily establish within more open vegetation, or amongst average infestations of other weeds.	*2*
☐ 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*
☐ 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*
☐ don't know		*?*

Ignore any weed control practices for this question. Depending on the land use, "vegetation" may be crops, pastures, lawns and/or native vegetation. Weeds that invade well-managed land uses (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" <u>includes</u> growth from dispersed vegetative propagules (e.g. broken fragments of couchgrass stems or silverleaf nightshade roots) and spores, in addition to seeds. "Seedlings" <u>does not include</u> 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 land use?		SCORE
☐ very high	Over 95% of weeds survive commonly used weed management practices.	3
☐ high	More than 50% of weeds survive.	2
☐ medium	Less than 50% of weeds survive.	1
☐ low	Less than 5% of weeds survive.	0
☐ 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 land use. 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 land uses (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 land use.

3. What is the reproductive ability of the weed in the land use?				Total (a+b+c)	SCORE
(a) Time to seeding	*(b) Seed set*	*(c) Vegetative reproduction*	☐ high	5 or 6	3
☐ 1 year 2	☐ high 2	☐ fast 2	☐ medium-high	3 or 4	2
☐ 2-3 yrs 1	☐ low 1	☐ slow 1	☐ medium-low	1 or 2	1
☐ >3 yrs/never 0	☐ none 0	☐ none 0	☐ low	0	0
☐ don't know ?	☐ don't know ?	☐ don't know ?	☐ 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 land use then it will score 0. Three factors are considered in scoring the weed:
(a) Time to seeding is the time from establishment (from seed or vegetative propagule) to seed production.
(b) 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^2. Your answer to question 2 may influence seed set.
(c) 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 land uses 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
(a) Flying birds ☐ common 2 ☐ occasional 1 ☐ unlikely 0 ☐ don't know ?	**(b) Other wild animals** ☐ common 2 ☐ occasional 1 ☐ unlikely 0 ☐ don't know ?	6, 7 or 8 3, 4 or 5 1 or 2 0	3 2 1 0 ?
(c) Water ☐ common 2 ☐ occasional 1 ☐ unlikely 0 ☐ don't know ?	**(d) Wind** ☐ common 2 ☐ occasional 1 ☐ unlikely 0 ☐ 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 <u>flying birds</u> and <u>other wild animals</u> (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 <u>water</u> 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 <u>wind</u> 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
(a) Deliberate spread by people ☐ common 2 ☐ occasional 1 ☐ unlikely 0 ☐ don't know ?	**(b) Accidentally by people and vehicles** ☐ common 2 ☐ occasional 1 ☐ unlikely 0 ☐ don't know ?	6, 7 or 8 3, 4 or 5 1 or 2 0	3 2 1 0 ?
(c) Contaminated produce ☐ common 2 ☐ occasional 1 ☐ unlikely 0 ☐ don't know ?	**(d) Domestic/farm animals** ☐ common 2 ☐ occasional 1 ☐ unlikely 0 ☐ 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?

<u>Deliberate</u> human spread includes weeds which have been planted for use in agriculture, forestry, horticulture, amenity, windbreaks and/or soil protection. Those which are or have been widely planted have greater potential for dispersal due to many introduction points. **Ignore the land use for this question.** *Examples include olives, African lovegrass and Aleppo pine. <u>Deliberate</u> 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 <u>accidental people and vehicle dispersal</u> 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 <u>contaminated produce</u> 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 <u>domestic/farm animals</u> (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 land use 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 land use.***

1. Does the weed reduce the establishment of desired plants?		*SCORE*
☐ >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*
☐ 10-50% reduction	The weed stops the establishment of between 10% and 50% of desired plants.	*2*
☐ <10% reduction	The weed stops the establishment of less than 10% of desired plants.	*1*
☐ none	The weed does not affect the germination and seedling survival of desired plants.	*0*
☐ 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 phlaris and watsonia in native vegetation.

2. Does the weed reduce the yield or amount of desired vegetation?		*SCORE*
☐ >50% reduction	The weed reduces crop, pasture or forestry yield, or the amount of mature native vegetation by over 50%.	*4*
☐ 25-50% reduction	The weed reduces yield or amount of desired vegetation by between 25% and 50%.	*3*
☐ 10-25% reduction	The weed reduces yield or amount of desired vegetation by between 10% and 25%.	*2*
☐ <10% reduction	The weed reduces yield or amount of desired vegetation by up to 10%.	*1*
☐ 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*
☐ 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 land use. 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 land use?		SCORE
☐ high	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 **native vegetation**, the weed severely reduces biodiversity (plants and animals) such that it is not suitable for nature conservation and/or nature-based tourism. For **urban** areas, the weed causes severe structural damage to physical infrastructure such as buildings, roads and footpaths.	3
☐ medium	The weed substantially reduces product quality such that it is sold at a much lower price for a low grade use. For **native vegetation**, the weed substantially reduces biodiversity such that it is given lower priority for nature conservation and/or nature-based tourism. For **urban** areas, the weed causes some structural damage to physical infrastructure such as buildings, roads and footpaths.	2
☐ low	The weed slightly reduces product quality, lowering its price but still passing as first grade product. For **native vegetation**, the weed has only marginal effects on biodiversity but is visually obvious and degrades the natural appearance of the landscape. For **urban** areas, the weed causes negligible structural damage, but reduces the aesthetics of an area through untidy visual appearance and/or unpleasant odour.	1
☐ none	The weed does not effect the quality of products or services.	0
☐ don't know		?

This question looks at whether the weed effects the quality of products or services obtained from a land use. 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.

4. Does the weed restrict the physical movement of people, animals, vehicles, machinery and/or water?		SCORE
☐ high	Weed infestations are impenetrable throughout the year, preventing the physical movement of people, animals, vehicles, machinery and/or water.	3
☐ medium	Weed infestations are rarely impenetrable, but do significantly slow the physical movement of people, animals, vehicles, machinery and/or water throughout the year.	2
☐ low	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 or provide a minor obstruction throughout the year.	1
☐ none	The weed has no effect on physical movement.	0
☐ don't know		?

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.

5. Does the weed affect the health of animals and/or people?		SCORE
☐ high	The weed is highly toxic and frequently causes death and/or severe illness in people, stock, and/or native animals.	3
☐ medium	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
☐ low	The weed can cause slight physical injuries or mild illness in people, stock, and/or native animals, with no lasting effects.	1
☐ none	The weed does not affect the health of animals or people.	0
☐ don't know		?

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.

6. Does the weed have major, positive or negative effects on environmental health?				
	☐ major positive effect	☐ major negative effect	☐ minor or no effect	☐ don't know
scoring for (a) - (f):	−1	1	0	?
(a) food/shelter ?	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.			
(b) fire regime?	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.			
(c) increase nutrient levels?	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.			
(d) soil salinity?	Are the leaves of the weed high in salt? Leaf decomposition may increase salinity at the soil surface. Example plants are iceplant and tamarix.			
(e) soil stability?	Does the weed increase soil erosion, or silting of waterways?			
(f) soil water table?	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.			
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 land use'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 <u>proportion</u> of a land use 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 land use also need to be considered. For example in the perennial horticulture land use, 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, land use 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 land use that is suitable for the weed:

1. Map the land use in your Board. If you do not have a land use 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 land use to which the weed is suited. Lay a sheet of plastic over the land use map, and shade the areas of the land use which are suitable for the weed.

3. Compare the weed's map to the land use map to estimate the percentage of the land use which is suitable for the weed. Answer as follows:

In the Board, what percentage area of the land use is suitable for the weed?		SCORE
☐ > 80% of land use	The weed has a potential to spread to more than 80% of the land use in the Board.	10
☐ 60-80% of land use	The weed has a potential to spread to between 60% and 80% of the land use in the Board.	8
☐ 40-60% of land use	The weed has a potential to spread to between 40% and 60% of the land use in the Board.	6
☐ 20-40% of land use	The weed has a potential to spread to between 20% and 40% of the land use in the Board.	4
☐ 10-20% of land use	The weed has a potential to spread to between 10% and 20% of the land use in the Board.	2
☐ 5-10% of land use	The weed has a potential to spread to between 5% and 10% of the land use in the Board.	1
☐ 1-5% of land use	The weed has a potential to spread to between 1% and 5% of the land use in the Board.	0.5
☐ unsuited to land use	The weed is not suited to growing in any part of the land use in the Board.	0
☐ don't know		?

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.

Comparative Weed Risk = Invasiveness × Impacts × Potential distribution

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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+	*Very high*
60 - 80%		< 192	*High*
40 - 60%		< 101	*Medium*
20 - 40%		< 39	*Low*
0 - 20%	(bottom 20% of possible scores)	< 13	*Negligible*

Do not compare scores between land uses. Land uses differ in their value and this is hard to measure. Also, average weed risk scores may be lower in agricultural land uses compared to other land uses. 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:

  Impact   ×   Potential Distribution   ×   Invasiveness

  $ / hectares / year   hectares   hectares(current year) / hectares (previous year)

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 land use at risk, so that its score can be directly compared to the weed risk score from the same land use 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 land use 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
(a) Height at maturity		**(b) Shoot growth present**		7 or 8	3
☐ <0.5 m	2	☐ <4 months	2	5 or 6	2
☐ 0.5-2 m	1	☐ 4-8 months	1	3 or 4	1
☐ >2 m	0	☐ >8 months	0	0, 1 or 2	0
☐ don't know	?	☐ don't know	?		?
(c) Distinguishing features		**(d) Pre-reproductive height in relation to other vegetation**			
☐ non-descript	2	☐ below canopy	2		
☐ sometimes distinct	1	☐ similar height	1		
☐ always distinct	0	☐ above canopy	0		
☐ don't know	?	☐ 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 land use then the canopy will be the height of the crop.

What is general accessibility of known infestations?		SCORE
☐ low	Most infestation sites difficult to access	2
☐ medium	Most infestation sites readily accessible	1
☐ high	All infestation sites readily accessible	0
☐ not present	Not known to be present in Board	0
☐ 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.

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

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

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

What is the likely level of cooperation from landholders within the land use at risk?		SCORE
☐ low	Weed control is rarely undertaken in the land use. Cost of control is beyond the financial and technical capacity of landholders.	2
☐ 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
☐ high	Control of the weed will require minimal change in existing weed management practices.	0
☐ 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 land uses, 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 land use. It considers the proportion of the land use infested, and the overall pattern of infestations.

What percentage area of the land use is currently infested by the weed?		SCORE
☐ >80% of land use	The weed infests more than 80% of the land use in the Board.	10
☐ 60-80% of land use	The weed infests between 60% and 80% of the land use.	8
☐ 40-60% of land use	The weed infests between 40% and 60% of the land use.	6
☐ 20-40% of land use	The weed infests between 20% and 40% of the land use.	4
☐ 10-20% of land use	The weed infests between 10% and 20% of the land use.	2
☐ 5-10% of land use	The weed infests between 5% and 10% of the land use.	1
☐ 1-5% of land use	The weed infests between 1% and 5% of the land use.	0.5
☐ <1% of land use	The weed is present in the land use but infests less than 1%.	0.1
☐ 0% of land use but in 20-40% of Board	The weed is not known to be present in the land use but does infest between 20% and 40% of the Board area.	2
☐ 0% of land use but in 10-20% of Board	The weed is not known to be present in the land use but does infest between 10% and 20% of the Board area.	1
☐ 0% of land use but in 5-10% Board	The weed is not known to be present in the land use, but does infest between 5% and 10% of the Board.	0.5
☐ 0% of land use but in 1-5% Board	The weed is not known to be present in the land use, but does infest 1-5% of Board.	0.1
☐ 0% of land use but <1% of Board	The weed is not known to be present in the land use, but does infest <1% of Board. Or the species is not naturalised in the Board but is cultivated (e.g. olives).	0.05
☐ 0% of Board	The species is not known to be present in the Board.	0
☐ don't know		?

The aim of containment is to prevent weed spread to a susceptible land use. The greater the area of land use 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 land use.

What is the pattern of the weed's distribution across the Board area?		SCORE
☐ widespread	The weed occurs in large and small infestations across most of the Board area.	2
☐ evenly scattered	The weed occurs as discrete, mainly small infestations across much of the Board area.	1
☐ restricted	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
☐ not present	The species is not known to be present in the Board.	0
☐ don't know		?

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.

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

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)*

What is the minimum time period for reproduction of sexual or vegetative propagules?		SCORE
☐ <1 month	Minimum generation time <1 month.	3
☐ <1 year	Minimum generation time 1-12 months.	2
☐ <2 years	Minimum generation time 12-24 months.	1
☐ >2 years	Minimum generation time >24 months.	0
☐ don't know		?

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.

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

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

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

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.

To calculate manually, adjust the raw scores as follows:

<u>Control costs:</u>   Divide by 15 and multiply by 10. Round off to one decimal place.

<u>Current distribution:</u> Divide by 12, and multiply by 10. Round off to one decimal place.

<u>Persistence:</u>   Divide by 11, and multiply by 10. Round off to one decimal place.

Feasibility of Containment = Control Costs × Current Distribution × Persistence

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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:

Control Costs	×	**Current Distribution**	×	**Duration of Control**
$ / hectares / year		*hectares*		*years*

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.

3) DETERMINING PRIORITIES

The following matrix gives guidance on appropriate strategic, weed management actions. Different weed species will appear in different positions on the matrix, based on their risk and feasibility of containment scoring. Each land use will have a separate matrix.

WEED RISK	FEASIBILITY OF CONTAINMENT				
	Negligible >113	Low >56	Medium >31	High >14	Very High <14
Negligible <13	LIMITED ACTION	LIMITED ACTION	LIMITED ACTION	LIMITED ACTION	MONITOR
Low <39	LIMITED ACTION	LIMITED ACTION	LIMITED ACTION	MONITOR	MONITOR
Medium <101	MANAGE SITES	MANAGE SITES	MANAGE SITES	PROTECT SITES	CONTAIN SPREAD
High <192	MANAGE WEED	MANAGE WEED	PROTECT SITES	CONTAIN SPREAD	DESTROY INFESTATIONS
Very High >192	MANAGE WEED	PROTECT SITES & MANAGE WEED	CONTAIN SPREAD	DESTROY INFESTATIONS	ERADICATE

ALERT

Following are guiding principles for each of the management categories in the matrix. At a landscape scale these principles need to be interpreted in terms of different outcomes per land use for different weeds. For example, a weed may rank as "destroy infestations" in one land use and "limited action" in others. In this case coordinated control may still be required in the latter land uses to enable protection of the former land use.

The term "management area" can be used below to apply to a range of spatial scales (e.g. LANDSCAPE Board, sub-regional, land use)

ALERT
Species that are not known to be present in the management area and which represent a significant threat. Such species would score "0" in Feasibility of Containment due to their absence. Aims to prevent the species arriving and establishing in the management area
- Prevention of entry to management area
- Ongoing surveillance for incursions of the species (e.g. nursery inspections)
- Training and awareness activities for the community to enable early detection

ERADICATE
Aims to remove the weed species from the management area
- Detailed surveillance and mapping to locate all infestations
- Destruction of all infestations including seedbanks
- Prevention of entry to management area and movement and sale within
- Must not grow 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 management area
- Detailed surveillance and mapping to locate all infestations
- Destruction of all infestations, aiming for local eradication at feasible sites
- Prevention of entry to management area and movement and sale within
- Must not grow
- Monitor progress towards reduction

CONTAIN SPREAD
Aims to prevent the ongoing spread of the weed species in the management area
- Surveillance and mapping to locate all infested properties
- Control of all infestations, aiming for a significant reduction in weed density
- Prevention of entry to management area and movement and sale within
- Must not allow to spread from cultivated plants (if grown)
- Monitor change in current distribution

PROTECT SITES
Aims to prevent 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 industries/habitats (higher weed risk).
- Surveillance and mapping to locate all infested areas
- Identification of key sites/assets in the management area
- 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 management area
- 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
- Research and develop integrated weed management (IWM) packages for the species, including herbicides and biological control where feasible

- Promote IWM packages to landholders
- Monitor decrease in weed impacts with improved management
- Identify key sites/assets in the management area and ensure adequate resourcing to manage the weed species

MANAGE SITES

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

- 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 management area and ensure adequate resourcing to manage these to maintain their values
- Broaden focus beyond weeds to all threatening processes

MONITOR

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

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

LIMITED ACTION

The weed species would only be targeted for coordinated control in the management area if its local presence makes it likely to spread to land uses where it ranks as a higher priority.

- Undertake control measures if required for the benefit of other land uses at risk
- Otherwise limited advice to land managers if required