

A SURVEY OF ROADSIDE CONSERVATION VALUES IN THE SHIRE OF KOJONUP



Declared Rare Flora, such as *Conostylis setigera subsp dasys* can be found along roadsides in the Shire of Kojonup.

AND ROADSIDE MANAGEMENT GUIDELINES

April 2003 – Roadside Conservation Committee



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1.0 INTRODUCTION

The Shire of Kojonup is located 255 km south east of Perth in Western Australia's great southern region. The major agricultural pursuits and industries in the area are sheep, wool, cattle, cereal, light industries, timber milling, transport and a canola mill. Tourism is also an important industry, with the area's spectacular wildflowers attracting large numbers of tourists in September and October every year.

The Shire covers an area of 2,937 square kms and supports a population of approximately 2,320 people. The area experiences a mediterranean climate with an average annual rainfall of 533 mm. Seasonal temperatures are characterised by warm summers, with maxima averaging from the mid to high twenties, and mild winters, with maxima in the mid teens. Mean daily maximum and minimum temperatures and rainfall statistics are shown below.

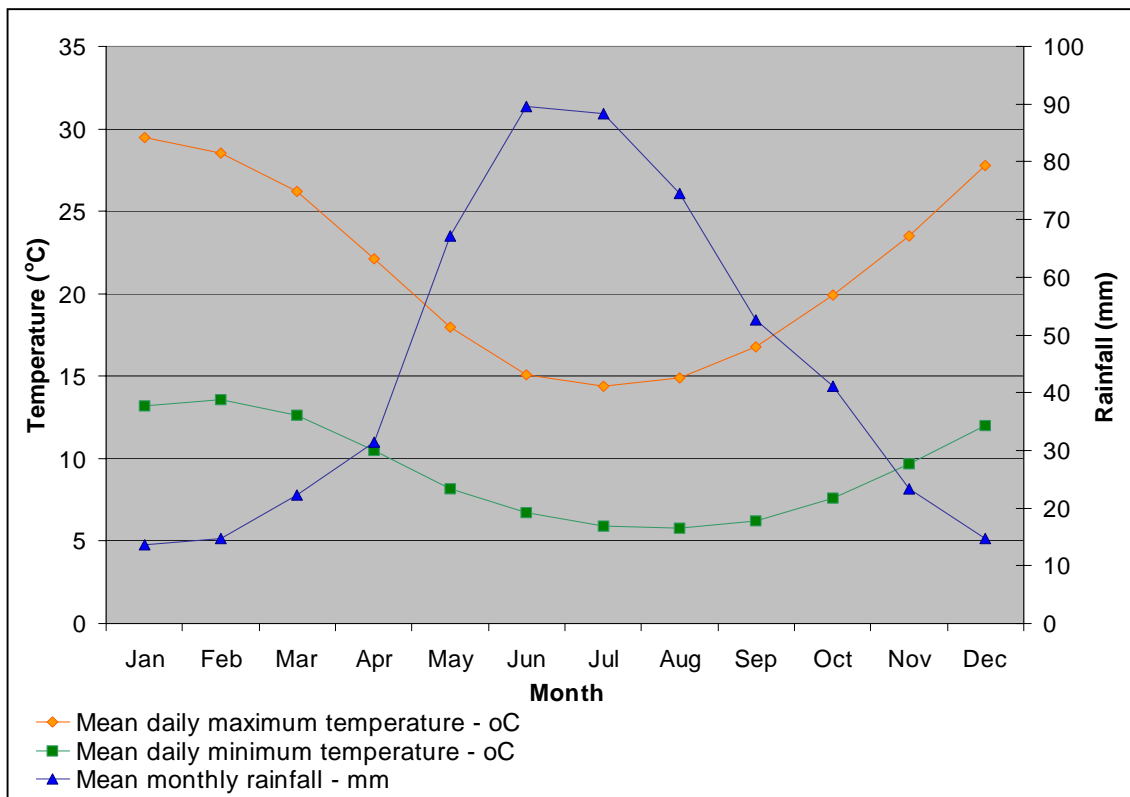


Figure 1 – Mean daily maximum and minimum temperature (°C) and rainfall (mm) in the Shire of Kojonup, based on climate averages from the Kojonup station 010582.

1.1 Flora and Fauna

650 different species of plants are recorded from the Shire of Kojonup (see Appendix 4) and these include: 34 *Acacia spp.*, 24 *Stylidium spp.*, 15 *Hibbertia spp.*, 29 *Caledonia spp.* and 22 *Eucalypt spp.*

Threatened fauna observed in the Shire of Kojonup, based on information from the Department of Conservation and Land Management, indicates that 11 species of threatened fauna have been sighted since 1990. It is important to note that one third of the sightings were within roadsides in the shire (marked with an *).

These include:

- Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*)
- Malleefowl (*Leipoa ocellata*)
- Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*)
- Chuditch (*Dasyurus geoffroii*)*
- Carpet Python (*Morelia spilota imbricata*)
- Snail (*Bothriembryon bradshawi*)
- Scorpion Fly (*Austromerope poultoni*)
- Red-Tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)*
- Brush-Tailed Phascogale (*Phascogale tapoatafa*)*



Carnaby's Black Cockatoo



Brush-tailed Phascogale

- Water Rat (*Hydromys chrysogaster*)*
- Western Brush Wallaby (*Macropus irma*)

1.2 Remnant Vegetation Cover

The Shire of Kojonup retains only 15.2 % of its original native vegetation and these are located in a variety of tenures, from nature and crown reserves to privately owned bush. As a consequence, the presence of remnant vegetation in transport corridors is of vital importance. The presence of bush corridors to connect these areas is paramount to the survival of our native flora and fauna. A comparison of vegetation remnants in Kojonup Shire with surrounding shires is seen in

Table 1 below. It will be noted that, with only a little over 15% of the natural cover remaining, every attempt should be made to retain vegetation wherever it is situated.

Shire	Percentage Vegetation Cover Remaining
Boyup Brook *	45%
Broomehill	9.0%
Cranbrook *	37.7%
Katanning	11.2%
Kojonup	15.2%
Tambellup	12.0%
West Arthur *	29.8%
Woodanilling	12.4%

Table 1. Remnant vegetation remaining in Kojonup and surrounding areas.

*denotes Shires where state forest has been included in the % remnant vegetation cover

The 15 vegetation associations known from the Shire of Kojonup, noted in Table 2 provide an indication of the assemblages of native vegetation present prior to European settlement. It should be noted that these assemblages are indicative of the Shire per se and not specifically representative of roadside remnants.

Kojonup Vegetation Association Types	% Remaining
Medium forest; jarrah-marri (3)	72.1
Medium woodland; marri and wandoo (4)	23.5
Low forest; jarrah (14)	76.1
Low woodland; paperbark (Melaleuca sp.) (27)	66.1
Sedgeland; reed swamps, occasionally with heath (51)	51.7
Bare areas; salt lakes (125)	89.8
Medium woodland; wandoo and yate (967)	22.3
Medium woodland; jarrah, marri and wandoo (968)	38.9
Medium woodland; jarrah and wandoo (987)	33.0
Medium forest; jarrah and wandoo (992)	22.4
Medium forest; jarrah, marri and wandoo (1003)	64.6
Shrublands; tea-tree thickets with scattered wandoo and yate (1051)	27.5
Medium woodland; wandoo and mallet (1073)	29.0
Medium woodland; york gum and yate (938)	17.8
Medium woodland; jarrah and river gum (1077)	41.7

Table 2. Vegetation association types and percentage remaining

Note: Numbers in brackets relate to the vegetation associations listed in Shepard, Beeston and Hopkins (2001)

Vegetation associations represented by less than 30% remnant cover are considered ecologically endangered and in need of protection and restoration wherever they are located. There are 7 vegetation associations below or near the 30% target of vegetation coverage in the Shire of Kojonup. National targets for biodiversity conservation (2001-2005) state the need to have protection measures in place for those vegetation associations that are below 30%. Vegetation associations with between 10–30% are considered vulnerable, between 30 to 50% are considered depleted and the least concern is given to vegetation associations with more than 50% of the pre 1750 extent (Platt and Lowe, 2002).

2.0 VALUES OF ROADSIDES

Since the settlement of Western Australia by Europeans, large areas of native vegetation in the south west of the state have been cleared for agriculture, roads, settlements, and other development. The fragmentation of the more or less continuous expanse of native vegetation communities by clearing has resulted in the isolation of plant and animal populations which have become severely disadvantaged by becoming isolated within a mosaic of man-made biogeographical islands of small native vegetation remnants. These are typically unreliable for sustaining wildlife due to food shortages, disease and reduced genetic diversity caused by a diminishing gene pool. Nevertheless, the presence of native vegetation along roadsides can often assist in alleviating this isolation effect by providing connectivity between bush remnants, thereby facilitating the movement of biota across the landscape.

Remnant vegetation includes more than just trees, comprising a diverse mix of trees, shrubs and ground covers (creepers, grasses and herbs) which when intact provide valuable food and shelter for local biodiversity. Existing native vegetation generally requires less maintenance if left undisturbed.

Remnants in transport corridors are also valuable because they:

- are often the only remaining example of original vegetation within extensively cleared areas;
- are easier to maintain and generally less fire prone than introduced vegetation;
- provide habitat for many native species of plants, mammals, reptiles, amphibians and invertebrates;
- provide wildlife corridors linking other areas of native vegetation;
- often contain rare and endangered plants and animals. Currently, roadside plants represent more than 80 per cent of the known populations of 40 of the declared rare species, and three of these are known only to exist in roadside populations;
- provide the basis for our important wildflower tourism industry. The aesthetic appeal of well-maintained roadsides should not be overlooked, and they have the potential to improve local tourism and provide a sense of place;
- often contain sites of historic or cultural significance;
- provide windbreaks and stock shelter areas for adjoining farmland by helping to stabilise temperature and reduce evaporation.
- assist with erosion and salinity control, and not only in the land adjoining the road reserve per se;

- are generally far less of a fire threat than annual weeds;
 - provide a benchmark for the study of soil change throughout the advancement of agriculture;
 - are a vital source of local seed for revegetation projects in the absence of other alternatives;
 - provide a valuable source of seed for regeneration projects. This is especially pertinent to shrub species, as clearing and grazing beneath farm trees often removes this layer;
- Approval of the local shire and a CALM permit are required prior to collection.**

In a time of rapid change, where the demands placed on the natural resources are numerous, it is vital that there is a coordinated management of lands across all tenures and boundaries to ensure the sustainability and integrity of the natural biota ecosystem processes, agricultural lands and service infrastructure.

Roadsides are the vital link and a priceless community asset.



3.0 LEGISLATION

Uncertainty often exists in the minds of many with regard to the 'ownership', control and management of 'the roadside'. This problem is also exacerbated by the multitude of legislative reference to activities within a transport corridor

The Department of Conservation and Land Management (DCLM) has the legislative responsibility to manage and protect all native flora and fauna in Western Australia. It is important to note that all flora and fauna is protected under provisions of the *Wildlife Conservation Act* 1950 and can not be taken unless it is taken in a lawful manner. In addition to the general provisions relating to protected flora under the *Wildlife Conservation Act*, special protection is afforded to flora that is declared as rare or threatened under section 23F of the *Wildlife Conservation Act*.

The legislation pertaining to the management of road reserves is complex and includes those listed below.

State legislation:

- *Aboriginal Heritage Act* 1972
- *Agriculture and Related Resources Protection Act* 1976
- *Bush Fires Act* 1954
- *Conservation and Land Management Act* 1984
- *Environmental Protection Act* 1986
- *Heritage of WA Act* 1990
- *Land Act* 1933
- *Local Government Act* 1995
- *Main Roads Act* 1930
- *Mining Act* 1978
- *Soil and Land Conservation Act* 1945
- *State Energy Commission Supply Act* 1979
- *Water Authority Act* 1987
- *Wildlife Conservation Act* 1950-1979

Commonwealth legislation:

- *Environment Protection and Biodiversity Conservation Act* 1999

It is recommended that a cautionary approach be taken when working within roadsides, and that the relevant authority be contacted if there is any doubt about the management or protection of heritage or conservation values present in the roadsides.

The Environmental Protection Amendment Bill 2002 is currently before parliament and it is envisaged that this will require greater adherence to legislative requirements before native vegetation is cleared. This legislation will provide for two types of permits which will provide for permission to clear native vegetation, however they will have certain conditions attached to them. One of these will be to prepare, implement and adhere to a roadside or specific tenure management plan. Before any native vegetation clearing is undertaken it is incumbent on the project manager or land manager to ensure that the proposed clearing is being carried out under the terms and conditions of the pending legislation as there are transitional provisions within it, which are retrospective from 26th June 2002.

4.0 ROADSIDE CONSERVATION IN THE SHIRE OF KOJONUP

4.1 Collection of native plant material from roadsides

The Shire of Kojonup does not allow the collection of seed from native plants within road reserves. Under the *Wildlife Conservation Act* the Department of Conservation and Land Management may issue a licence following Shire approval.

Collecting seed from a roadside may be the only option in cases where there are no other sources of seed for revegetation, although, it has the potential to impact negatively on the roadside flora. Collection of native plant material from roadsides:

- further depletes the already scarce resource,
- can detract from the integrity of the roadside,
- reduces the amount of seed available for natural regeneration,
- reduces the ability of the area to regenerate after disturbances such as fire, and
- threatens roadside plant communities with the potential introduction and spread of two major threats – *Phytophthora* dieback and weeds.

4.2 Declared Rare Flora (DRF)

Declared Rare Flora (DRF) refers to species, or populations of native plants that are of great significance and should be treated with special care when road and utility service, construction or maintenance is undertaken. Populations of DRF along roadsides are designated Special Environmental Areas (SEA's) and are marked out by yellow stakes with an identification plate welded on. See figures 10 and 11.

It is the responsibility of the road manager to ensure these markers are installed, and guides for this are outlined in 'Guidelines for Managing SEA's in transport corridors', available from the Roadside Conservation Committee. DRF sites in the Shire of Kojonup need to be checked for the presence of appropriate markers, and their locations be made known to all involved in the management and planning of works within the roadside environment.

Kojonup has seven populations of DRF species on roadsides, with five of these locations vested in the Shire. Species of DRF in the Shire of Kojonup include:

- *Conostylis drummondii*
- *Conostylis setigera* subsp. *dasy*
- *Nemcia lehmannii*



Conostylis drummondii



Nemcia lehmannii

- *Eucalyptus marginata* subsp. *elegantella*, and
- *Verticordia fimbriolepis* subsp. *fimbriolepis*

For more information regarding DRF it is advisable to contact the Conservation Officer (Flora) at the Katanning District Office (08) 9821 1296. If roadworks are to be carried out near DRF sites, or the yellow stakes have been disturbed, it is advisable to contact DCLM at least one week in advance.



Verticordia fimbriolepis subsp. *fimbriolepis*

4.3 High Conservation Value Roadsides as Flora Roads

A flora road is one which has special conservation value because of the vegetation contained within the road reserve. The managing authority may decide to declare a Flora Road based on the results of the survey of roadside conservation value.

Roadsides determined as having high conservation value in the Shire of Kojonup include:

- Darkan-Kojonup road
- Cherry Tree Pool road
- Qualeup South road
- Kojonup-Frankland road
- Lower Blackwood road
- Fisher road
- Scott Brook road
- Murrin Brook road
- Rosedale road
- Hart road
- White Elephant road
- Sexton road
- Armstrong road
- Kilcreggan Pallingup road
- Rocky Glen West road
- Donnybrook-Kojonup road
- Morley road

(not a complete list, consult the 2003 Roadside Conservation Value Map)

These roads may be investigated further to see if they warrant a declaration as a Flora Road. This has a twofold effect of drawing the attention of tourists to the high conservation value roadside and it also alerts all that work in the roadside environment that the marked section of roadside requires due care to protect the values present.



In order to plan roadworks so that important areas of roadside vegetation are not disturbed, road managers should know of these areas. It is suggested that the Shire establish a *Register of Roads Important for Conservation* (see section 7.5).

Management

Management objectives should involve disturbing the roadside flora as little as possible, consistent with the provision of a safe and efficient roadway. The management of Flora Roads should aim to:

- minimise disturbance,
- control weeds,
- encourage natural regeneration.

The techniques referred to in Section 7.0 of this report can be used to minimise disturbance to roadside vegetation. Most importantly, staff should be instructed and supervised so that incremental widening does not occur at every pass of the grader. Environmental assessments (pre-construction check-lists) should be completed prior to any upgrading work, to assist with planning for flora preservation. Fire management should be undertaken in such a way so as to take into account the ecological needs of the flora. Where rehabilitation is contemplated, local native species should always be used.

Tourism

Attractive roadside drives are an important drawcard in this, the "Wildflower State". Declared Flora Roads will, by their very nature, be attractive to tourists and would often be suitable as part of a tourist drive network..

Consideration should be given to:

- promoting the road by means of a small brochure or booklet,
- showing all Flora Roads on a map of the region or State,
- using specially designed signs to delineate the Flora Road section (contact the RCC).



Roadside are one of the most accessible places for tourists to view wildflowers.



4.4 Weeds

Weed invasion along roadsides is an important issue in the Shire of Kojonup as they impact on many aspects and values of the road reserve *per se*. Weeds are plants that are growing beyond their natural range and competing with native plants for nutrients, space, water and light. Weeds are often disturbance colonisers and as such invade roadsides often increasing the fire risk, degrading biodiversity values or interfering with the road and its infrastructure. The effect of weed infestations on native plant populations can be severe, often with flow on effects for native fauna such as diminished habitat or food resources.

Once weeds become established in an area, they become a long-term management issue, costing many dollars to control or eradicate. The Kojonup LCDC's and their associated Landcare groups have worked with the Shire on a number of natural resource management issues, particularly through the Weed Action Group and the *Kojonup Weed Strategy (2000)*.

The following weeds were identified in the Strategy as being an environmental threat, and posing a potential fire and disease hazard.

- Tagasaste (*Chamaecytisus proliferus*)
- Bridal Creeper (*Asparagus asparagoides*)
- Victorian Tea Tree (*Leptospermum laevigatum*)
- Soursob / 4o'Clock (*Oxalis spp.*)
- Watsonia (*Watsonia spp.*)
- Freesias (*Freesia*)
- Veldt grass (*Ehrharta spp.*)
- African Lovegrass (*Eragrostis curvula*)
- Wild Oats (*Avena fatua*)
- Radish (*Raphanus raphanistrum*)
- Dock (*Rumex spp.*)
- Melon (*Citrullus spp.*)
- Afghan Thistle (*Solanum hoplopetalum*)
- Caltrop (*Tribulus terrestris*)



Perennial Veldt grass



Caltrop

- Angels Trumpet (*Datura metel*)
- Pine Trees (*Pinus spp.*)

- Arum Lily (*Zantedeschia aethiopica*)
- Blackberry (*Rubus spp.*)
- Stink Wort (*Dimorphotheca graveolens*)
- Evening Primrose (*Oenothera spp.*)
- Sparaxis (*Sparaxis spp.*)
- Ixias (*Ixia spp.*)
- Eastern States Wattles (*Acacia spp.*)
- Phalaris (*Phalaris spp.*)



Sparaxis pillansii



Acacia decurrens

The *Kojonup Weed Strategy* included a reference to spraying practices in the road reserve environment. The Strategy also recommended that notification be given to key agencies and confirmation for chemical handling requirements of staff be carried out.

The control of declared weeds on roadsides is carried out by Agriculture Western Australia (AGWA) on behalf of the Shire of Kojonup. Spraying of weeds on the shoulder of the road is carried out by the Shire. Landowners are not encouraged to carry out any weed control on the roadside unless permission is given to them by AGWA as herbicide resistant weeds can occur if herbicide use is not managed. Weeds are generally sprayed except for Tagasaste which is dug out, and any seedlings that germinate from the weed seed left in the soil are then controlled by spraying. Roadsides containing a particularly high number of weed species can be seen in Table 3.

Road Name	Weeds observed	Length of roadside infestation (km)
Potts road	Wild oats, Veldt grass, Guildford grass	15.2
Ferguson road	Guildford grass, Veldt grass, Wild oats, Capeweed	3.3
Phillips road	Veldt Grass, Tagasaste, Guildford grass, Wildoats	3.2
Tambellup West road	Wild oats, African lovegrass, Dock, Bridal creeper	3.3
Pollard road	Dock, Guildford grass, Wild oats, Spear grass	5.3
Norrish road	Lupin, Vetch, Bridal creeper, Guildford grass, Dandelion, Freesia, Veldt grass	12.5
Yarranup road	Wild oats, Guildford grass, Radish, Vetch, Veldt grass, Dandelion, Asparagus	13.8
Scott Brook road	Wild oats, Guildford grass, Radish, Vetch, Veldt grass, Dandelion, Asparagus	5.7
Tenner road	Radish, Lupin, Wild oats, Guildford grass, Canola, Veldt grass, Vetch, African lovegrass	1.2
Donnybrook-Kojonup road	Guildford grass, Gladiolus, Tristuis, Veldt grass, Wild oats, Onion weed, Garlic weed, Tagasaste, Soursob	4.0
Parker road	Lupin, Capeweed, Guildford grass, Wild oats, Radish, Veldt grass, Dandelion, Vetch, Dock	7.0

Table 3 - Roadsides with extensive weed infestations in the Shire of Kojonup.

The location of various weed populations were recorded along roadsides in the Shire of Kojonup, as part of the roadside survey. The weeds with the highest occurrence were African lovegrass, Bridal creeper, Tagasaste, Dock, Guildford grass, Wild oats, Speargrass (ripgut), Lupins, Capeweed, Soursob, Veldt grass, Wild radish, Vetch and other grasses, see Figure 8.

4.5 Phytophthora Dieback

The *Phytophthora* species dieback is made up of several types of introduced fungi. About one third of native plants in Western Australia's south-west are susceptible, including species of Banksia, Hakea, Eucalyptus, Melaleuca, Verticordia, Acacia and Grevillea.

The *Phytophthora* fungus infects the roots and inhibits the uptake of water and nutrients, eventually causing death. It is more widespread and severe in the higher rainfall zone and waterlogged sites. The Shire of Kojonup is not a known *Phytophthora* dieback risk area, as it is in the less than 600mm rainfall zone. Despite this, with an average annual rainfall of 533mm, dieback occurrence should not be ruled out as a threat to roadside vegetation in the Shire of Kojonup. The road formation increases the amount of water runoff onto the roadside and therefore increases the habitat requirements for the fungus.

Phytophthora spreads by the movement of spores in water, or by the spread of infected soil. The spores can be introduced to uninfected areas by human activities, particularly through the soil carried on vehicle tyres or footwear.

Human activities have the potential to spread *Phytophthora* fungi. Currently, there is no practical method of eradicating *Phytophthora* once it is established in an area.



Impact of *Phytophthora* Dieback

The Dieback Working Group have published a booklet that provides detailed information on minimising the risk of introducing or spreading *Phytophthora*.

5.0 ASSESSMENT PROCESS

5.1 Methods

The methods to assess and calculate the conservation value of the roadside reserves are described in *Assessing Roadsides: A guide for Rating Conservation Value* (Jackson 2002) The process involves scoring a set of pre-selected attributes, which, when combined, represent a roadside's conservation status. A list of these attributes is presented on a standard survey sheet, see Appendix 2. This provides both a convenient and uniform method of scoring.

Ideally, the survey is undertaken by a group of local volunteers, who, aided by their knowledge of the area, are able to provide an accurate and cost effective method of data collection. Community participation also ensures a sense of ownership of the end product, which increases the likelihood of its acceptance and use by the local community and road managers (Lamont and Blyth, 1995).

The majority (917.35 km) of the Shire of Kojonup's 1250.5 km of roadsides were assessed for their conservation status and mapped. Fieldwork was carried out throughout September, October and December in 1998 and January and March in 1999. The Landcare groups and the Shire were interested to see what changes in roadside conservation values may have had occurred over time. As such, there is currently interest in undertaking the RCC roadside mapping program on a regular basis, eg every five years. The survey is also seen as an important tool in helping to identify areas to undertake future roadside vegetation projects, weed control and to identify areas to focus revegetation efforts on public reserves and private property

The enthusiastic efforts of the volunteer surveyors, project coordinators and the support provided by the Shire of Kojonup ensured that this project was successfully completed.

5.2 Quantifying Conservation Values

The following attributes were used to produce a quantitative measure of conservation value:

- native vegetation on roadside,
- extent of native vegetation along roadside,
- number of native species,
- weed infestation,
- value as a biological corridor, and
- predominant adjoining land use.

Each of these attributes was given a score ranging from 0 to 2 points. Their combined scores provided a conservation score ranging from 0 to 12. The conservation values, in

the form of conservation status categories, are represented by the following colour codes

Conservation Value	Conservation Status	Colour Code
9 – 12	High	Dark Green
7 – 8	Medium High	Light Green
5 – 6	Medium Low	Dark Yellow
0 – 4	Low	Light Yellow

Table 4: Colour codes used to depict the conservation status of roadsides.

The following attributes were also noted but did not contribute to the conservation value score:

- width of road reserve;
- width of vegetated roadside;
- presence of utilities/disturbances;
- dominant native species;
- dominant weeds;
- fauna observed;
- general comments.

It is felt that the recording of these attributes will provide a community database that would provide information useful in many spheres local government and community interest.

5.3 Mapping Conservation Values

A computer generated map (using a Geographic Information System, or GIS), depicting the conservation status of the roadside vegetation and the width of the road reserves within the Shire of Kojonup was produced at a scale of 1:100,000. The data used to produce both the map and the following figures and tables are presented in Appendix 3.

Data obtained from the Department of Conservation and Land Management, Main Roads WA and the Department of Agriculture was used in the base map, and depicts the location of remnant vegetation on both the Crown estate and privately owned land.

The roadside conservation values map initially provides an inventory of the *status quo* of the condition of the roadside vegetation. This is important as quality of roadside vegetation has far reaching implications for sustaining biodiversity, tourism and Landcare values. Moreover the data and map can be incorporated as a management and planning tool for managing the roadsides *per se*, as it enables the condition of roadside vegetation to be easily assessed. This information can then be used to identify

environmentally sensitive areas, high conservation roadsides or strategically important areas, and thus ensure their conservation. Conversely, it enables degraded areas to be identified as areas important for strategic rehabilitation or in need of specific management techniques and weed control programs.

The map can also be used as a reference to overlay transparencies of other information relevant to roadside conservation. This enables the roadside vegetation to be assessed in the context of its importance to the shire's overall conservation network. Other overlays, such as the degree of weed infestation, or the location of environmentally sensitive areas or future planned developments, could also be produced as an aid to roadside management.



Weed control along a roadside

As well as providing a road reserve planning and management tool, the survey data can also be used for:

- regional or district fire management plans;
- tourist routes - roads depicted as high conservation value would provide visitors to the district with an insight to the flora of the district;
- Landcare / Bushcare projects - would be able to incorporate the information from this survey into 'whole of' landscape projects.



The survey data and map can be used in developing regional or district fire management plans

6.0 SURVEY DATA RESULTS

A summary of the general roadside conditions in the Shire of Kojonup is presented in Table 5. The survey data has been combined to provide the total kilometres, and percentages, of roadside occupied by each of the conservation status categories and the attributes used to calculate the conservation values (see Table 5). As roadsides occur on both sides of the road, roadside distances (km) are equal to *twice* the actual distance of road travelled.

Summary Information: Shire of Kojonup									
Length of roadsides surveyed: 1834.7 km									
<u>Conservation Status</u>			<u>Native Vegetation on Roadsides</u>			<u>Weeds Infestation</u>			
	total km	%		total km	%		total km	%	
High (9-12)	549.2	29.9	2-3 vegetation layers	1245.6	67.9	Light	336.9	18.4	
Med-High (7-8)	728.6	39.7	1 vegetation layer	496.6	27.1	Medium	1004.9	54.8	
Med-Low (5-6)	349.8	19.1	0 vegetation layers	92.6	5.0	Heavy	483.3	26.3	
Low (0-4)	207.1	11.3				No data	9.5	0.5	
Total	1834.7	100.0	Total	1834.7	100.0	Total	1834.7	100.0	
<u>Conservation Values</u>			<u>Extent of Native Vegetation</u>			<u>Value as a Biological Corridor</u>			
	total km	%		total km	%		total km	%	
0	0.0	0.0	Over 80%	230.1	12.5	High	1220.5	66.5	
1	18.4	1.0	20% to 80%	1179.0	64.3	Medium	281.3	15.3	
2	42.3	2.3	Less than 20%	425.6	23.2	Low	333.0	18.2	
3	100.8	5.5	Total	1834.7	100.0	Total	1834.7	100.0	
4	45.6	2.5	<u>Number of Different Native Species</u>			<u>Adjoining Landuse</u>			
5	97.2	5.3		total km	%		total km	%	
6	252.6	13.8	Over 20	503.9	27.5	Cleared	591.4	32.3	
7	289.2	15.8	6 to 19	1054.7	57.5	Scattered	1154.4	62.9	
8	439.4	23.9	0 to 5	276.1	15.1	Uncleared	80.9	4.4	
9	230.5	12.6	Total	1834.7	100.0	Plantation	8.1	0.4	
10	170.1	9.3	<u>Width of Vegetated Roadside</u>			Urban	0.0	0.0	
11	100.6	5.5		total km	%	Railway	0.0	0.0	
12	48.0	2.6	1 to 5 m	1451.0	79.1	Drain	0.0	0.0	
Total	1834.7	100.0	5 to 20 m	269.0	14.7	Other	0.0	0.0	
			over 20 m	62.3	3.4	Total	1834.7	100.0	
			No data	52.5	2.8				
			Total	1834.7	100.0				

Data was collected in the Shire of Kojonup throughout 1998 and 1999

Table 5: Summary of the roadside conditions in the Shire of Kojonup.

Roadside sections of high conservation value covered 29.9% of the length of roadsides surveyed (549.2 km). Medium-high conservation value roadsides accounted for 39.7% of the total surveyed (728.6 km), medium-low conservation roadside covered 19.1% of the total surveyed (349.8 km). Areas of low conservation value occupied 11.3% of the roadside surveyed (207.1 km). (Table 5, Figure 2).

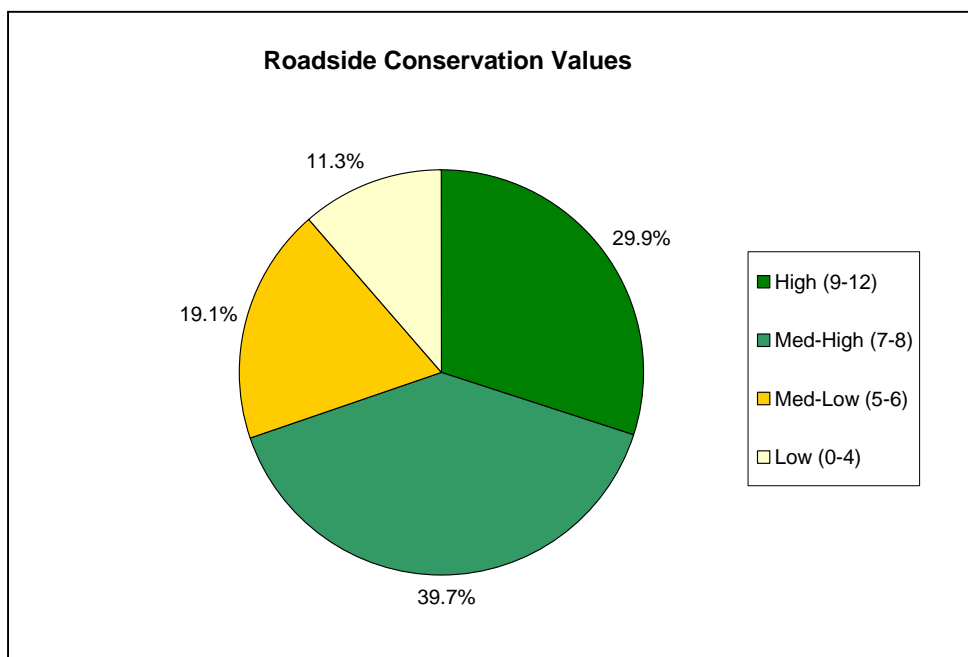


Figure 2 – Conservation status of roadsides in the Shire of Kojonup

The 'width of vegetated roadside' value provides an insight into the width of vegetation occurring along roadsides in the Shire of Kojonup. Roadside sections with more than 20m of native vegetation covered 3.4% of the Shire. 14.7% of roadsides supported vegetation between 5-20 m in width, and 79.1% of the roadsides surveyed contained native vegetation between 1-5 m in width (Table 5, Figure 3).

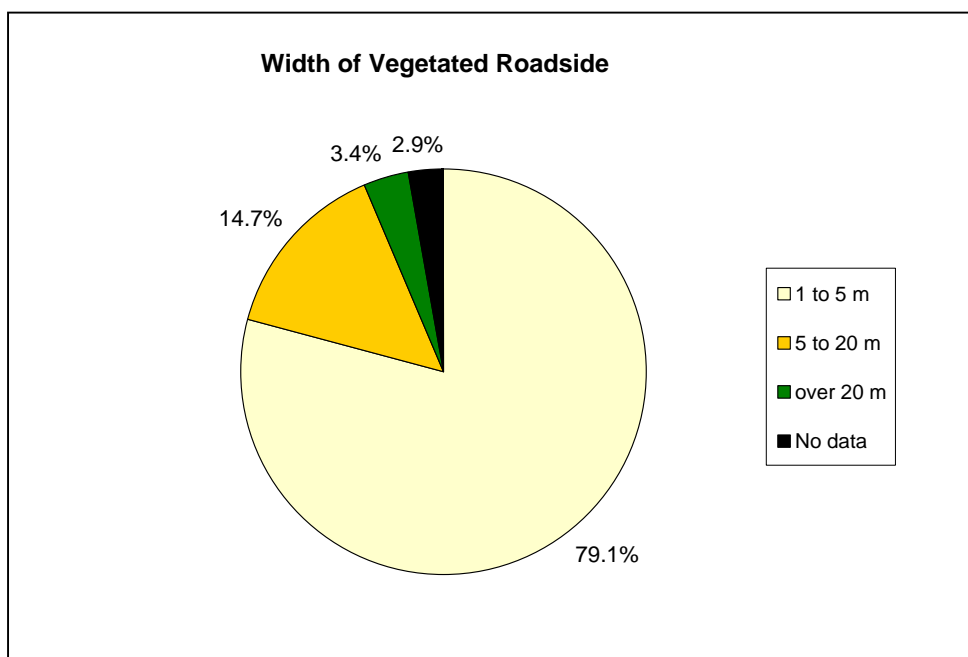


Figure 3 – Width of vegetated roadside

The number of native vegetation layers present, either the tree, shrub or ground layers determines the 'native vegetation on roadside' value. Sections with two to three layers of native vegetation covered 67.9% of the roadside. 27.1% had only one layer and 5.0% had no layers of native vegetation (Table 5, Figure 4).

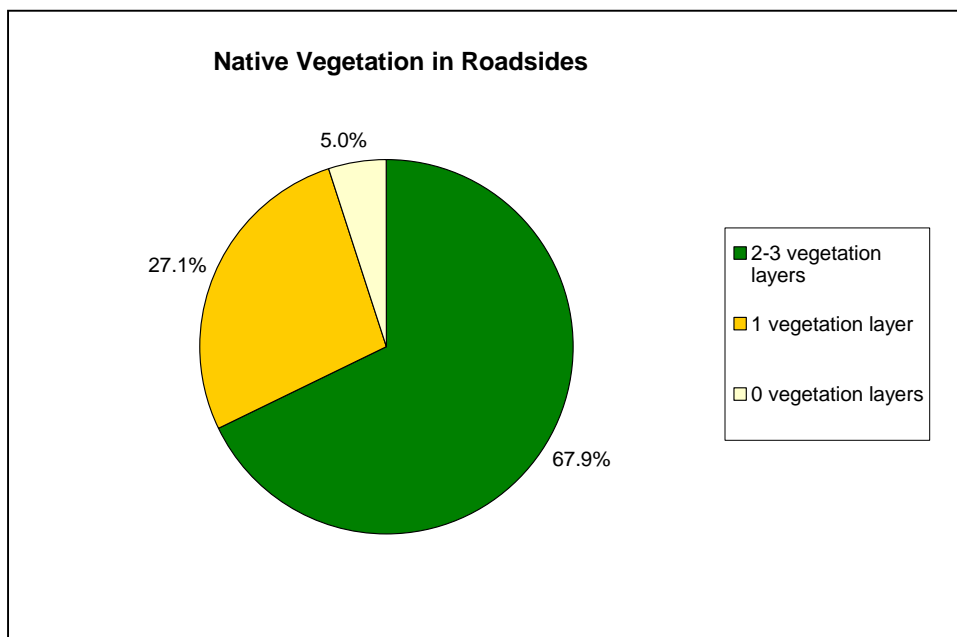


Figure 4 – Native vegetation on roadsides.

Roadside vegetation with extensive cover, i.e. greater than 80%, occurred along 12.5% of the length of road surveyed. Survey sections with 20% to 80% vegetation cover accounted for 64.3% of the roadsides. The remaining 23.2% had less than 20% native vegetation, and therefore, a low 'extent of native vegetation' value (Table 5, Figure 5).

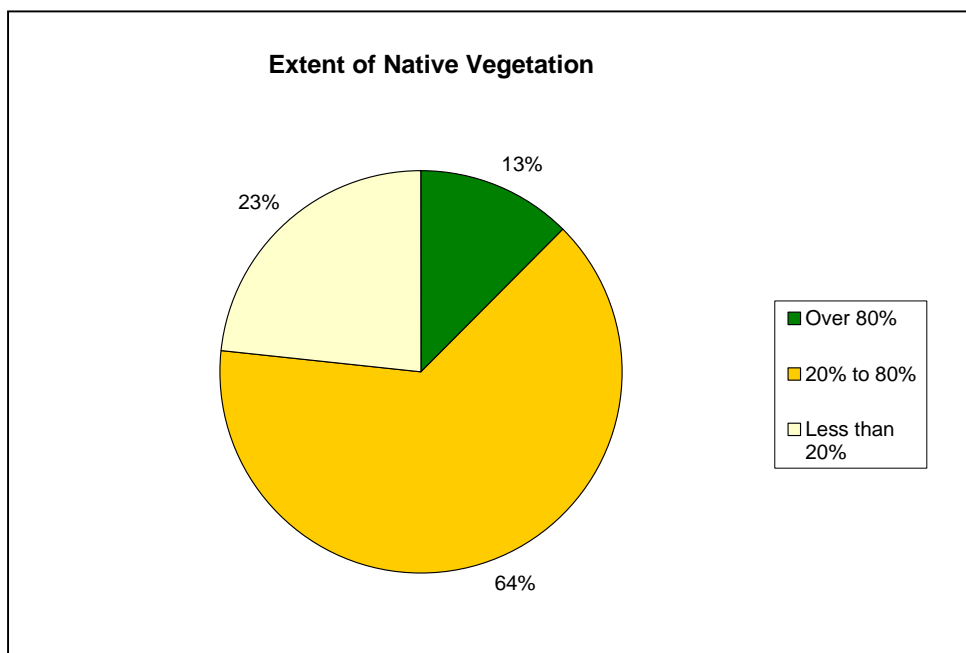


Figure 5 – Extent of native vegetation.

The 'number of native species' score provided a measure of the diversity of the roadside vegetation. Survey sections with more than 20 plant species spanned 503.9 km (27.5%) of the roadside. Roadside sections with 6 to 19 plant species accounted for 1054.7 km (57.5%) of the roadside. The remaining 276.1kms (15.1%) had less than 5 plant species. (Table 5, Figure 6).

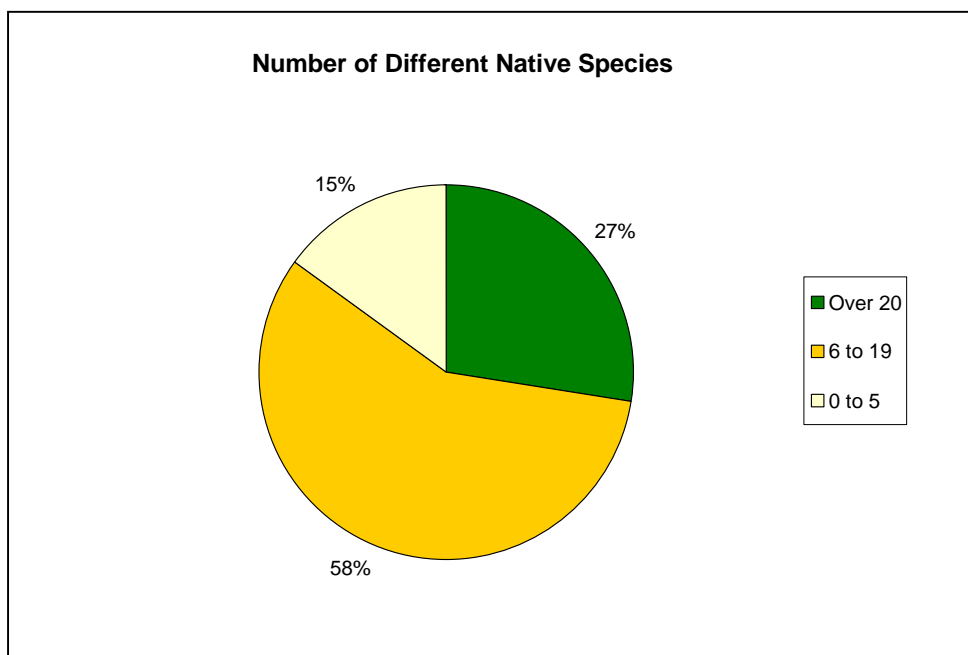


Figure 6 – Number of native species.

Roadsides determined to have high value as biological corridors (as determined by the roadside surveyors) were present along 66.5% (1220.5 km) of the roadside, medium value made up 15.3% (281.3 km), and roadsides with low value as a biological corridor occurred along 18.2% (333.0 km) of the roadsides surveyed (Table 5, Figure 7).

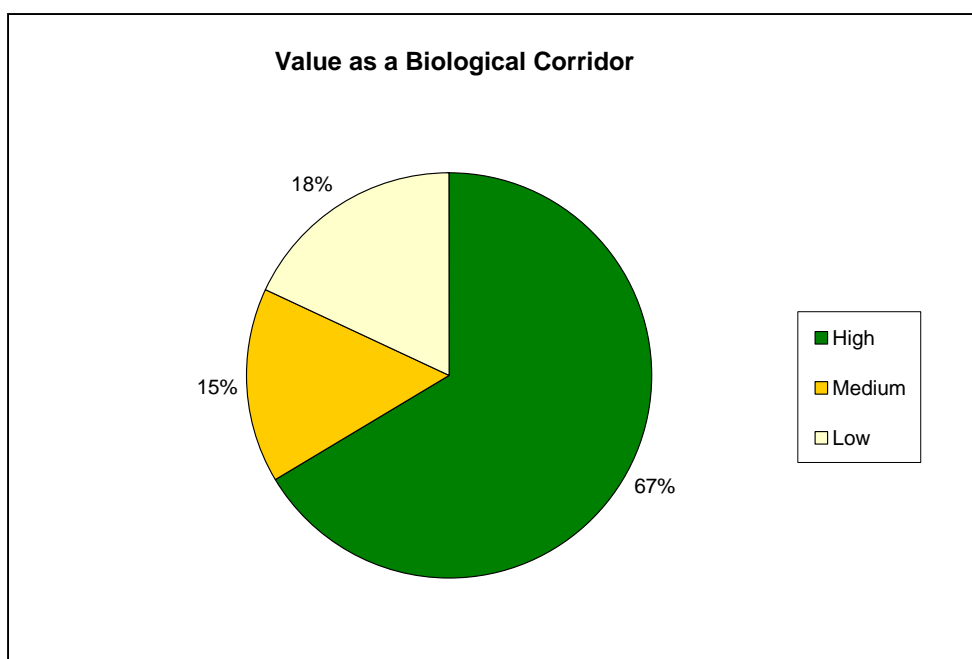


Figure 7 – Value as a biological corridor.

18.4% (336.9 km) of the roadsides surveyed were only lightly infested by weeds, medium level weed infestation occurred on 54.8% (1004.9 km) of the roadsides. 26.3% (483.3 km) were heavily infested with weeds. (Table 5, Figure 8).

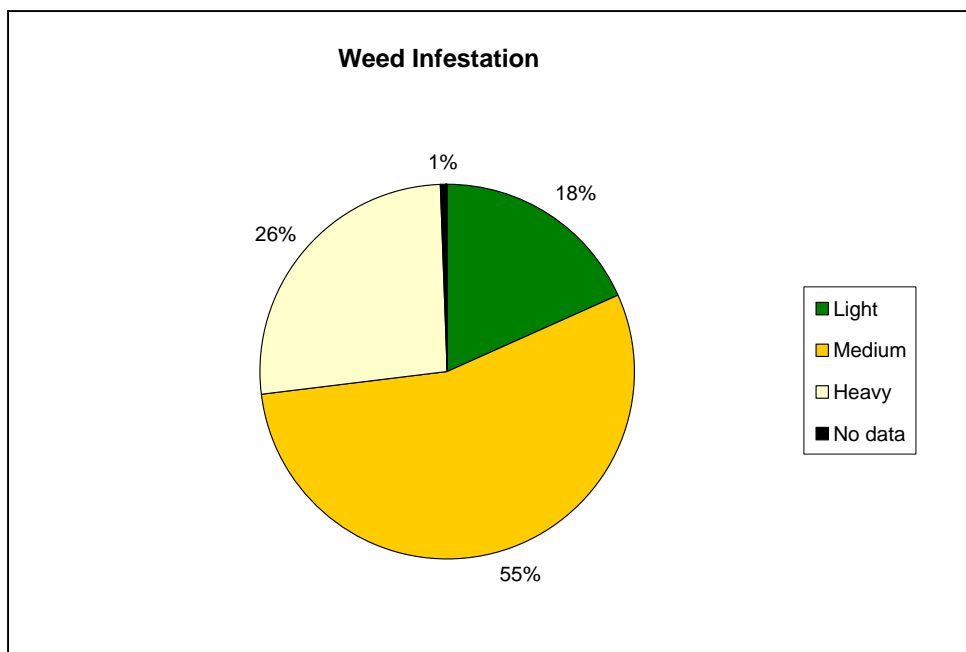


Figure 8 – Weed infestation. Light weed infestation = weeds less than 20% of total plants. Medium weed infestation = weeds 20 to 80% of the total plants. Heavy infestation = weeds more than 80% of the total plants.

A scattered distribution of native vegetation was present on 62.9% of the land adjoining roadsides, whilst 4.4% of roadsides surveyed were adjoined by land that had not been cleared. 32.2% of the roadsides surveyed were bordered by land that had been totally cleared of vegetation. Plantations adjoined 0.4% of the roadsides surveyed. (Table 5, Figure 9).

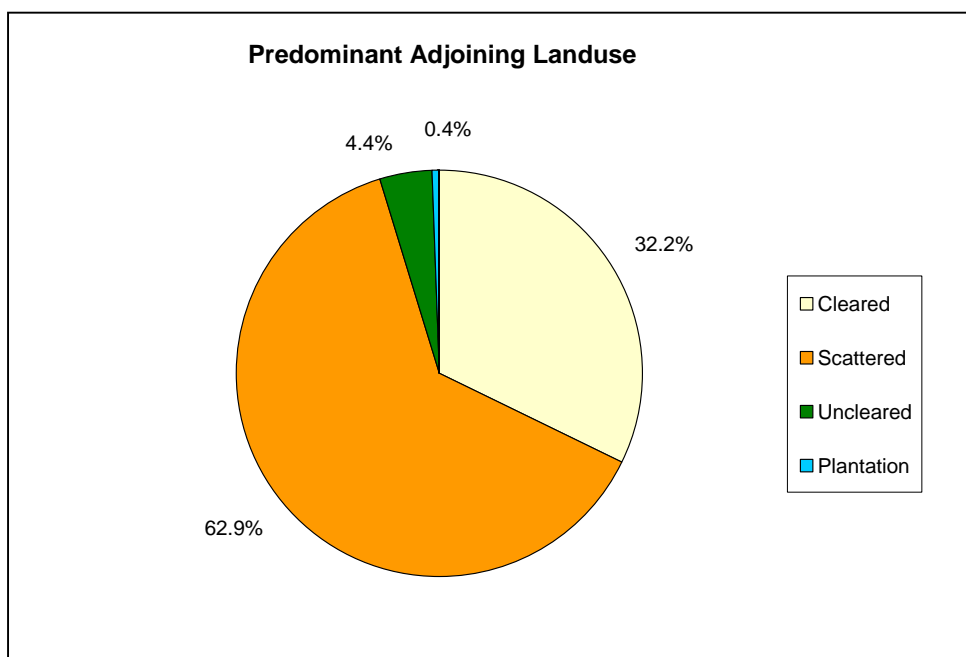


Figure 9 – Predominant adjoining land use.

Wild oats was present along 348.8 kms of the roadsides surveyed (19%), whilst Guildford grass was recorded along 219.7 kms of roadside (12%). Veldt grass was the next most commonly recorded weed, occurring along 214.2kms (11.7%), Bridal creeper was present along 80.4 kms (4.4%), African Lovegrass 68.2 kms (3.7%), Tagasaste 39kms (2.1%), Dock 36.1 kms (2%), Vetch 34.8 kms (1.9%), Spear Grass 26.7 kms (1.5%), Lupins 24.3 kms (1.3%), Radish 22.3 kms (1.2%), Capeweed 17 kms (1%) and Soursob 14.2 kms (0.8%) of the roadsides surveyed. Other weeds were present along 127 kms of roadside (7%) (See Figure 10).

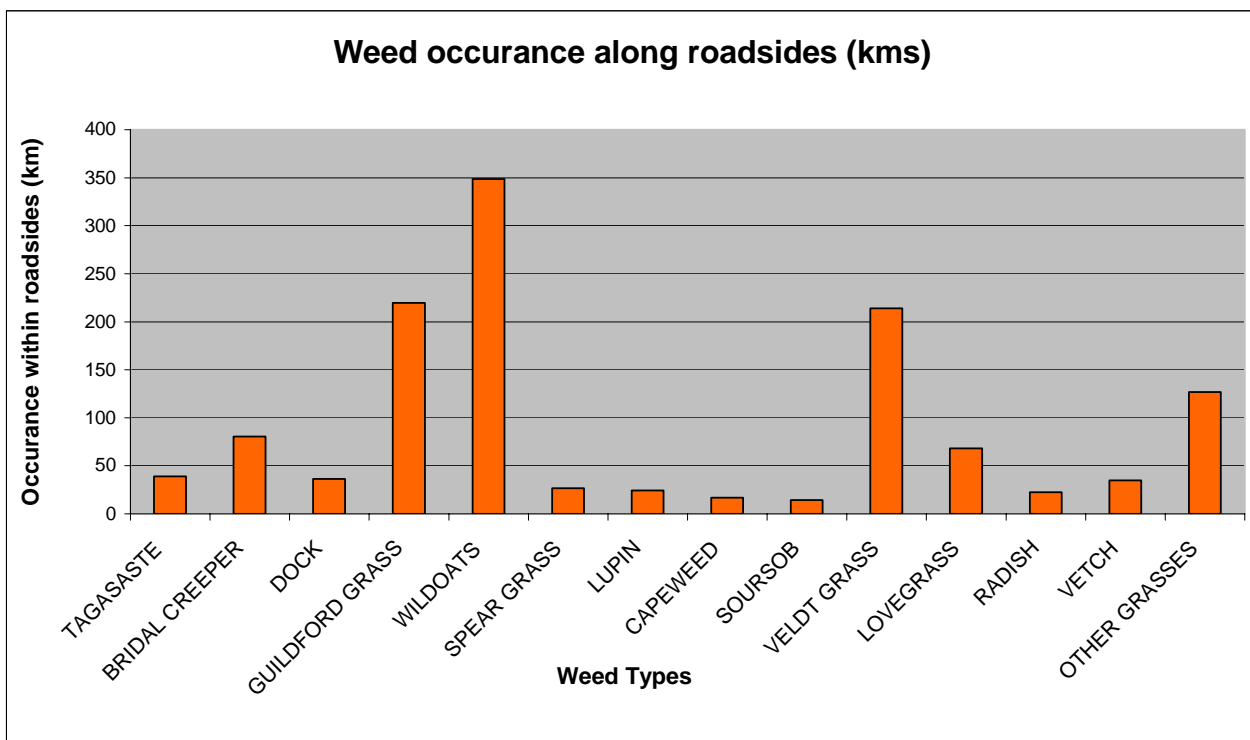




Figure 10 – Occurrence of nominated weeds along roadsides in the Shire of Kojonup

7.0 MANAGEMENT TECHNIQUES

The following section provides management recommendations that will assist in retaining and enhancing roadside conservation value. These guidelines are taken from the Roadside Conservation Committee's Roadside Manual and or the Roadside Handbook. The Executive Officer of the Roadside Conservation Committee is also available to assist on all roadside conservation matters, and can be contacted on (08) 9334 0423. The primary aim of road management is the creation and maintenance of a safe, efficient road system. However, the following management procedures should be adopted.

High Conservation Value Roadsides



Management Goal		Maintain and enhance the native plant communities.
Management Guidelines		Minimal disturbance to existing vegetation. Disturbance leads to weed invasion, which downgrades the conservation value, and increases the fire threat.

Minimal disturbance can be achieved by:



- adopting a road design that occupies the minimum space;
- diverting the line of a table drain to avoid disturbing valuable flora;
- pruning branches, rather than removing the whole tree or shrub;
- not dumping spoil on areas of native flora;
- observing dieback control measures as required;
- apply the Fire Threat Assessment (Roadside Manual) before burning roadside vegetation;
- use methods other than fuel reduction burns to reduce fire threat; if roadside burning must be undertaken, incorporate it into a district fire management program;
- encourage adjacent landholders to set back fences to allow roadside vegetation to proliferate;
- encourage adjacent landholders to plant windbreaks or farm tree lots adjacent to roadside vegetation to create a denser windbreak or shelterbelt;
- encourage revegetation projects by adjacent landholders.

The *Roadside Handbook* (Lamont 1998) provides a very useful guide to all who are interested in sustainable roadside vegetation practice.

Medium Conservation Value Roadsides

Management Goal		Maintain native vegetation wherever possible, and encourage its regeneration.
Management Guidelines		Minimise disturbance to existing vegetation.

Low Conservation Value Roadsides

Management Goal		Retain remnant trees and shrubs and encourage their regeneration. Encourage revegetation projects using indigenous plants.
Management Guidelines		Minimise soil disturbance to reduce weed invasion. Encourage revegetation projects by adjacent landholders.

7.1 Code of Practice

A Code of Practice has been developed through collaboration with Main Roads Western Australia, the Western Australian Local Government Association and the Roadside Conservation Committee. It is anticipated that this document will be accepted as an industry standard for all working or interested in roadside conservation. This document provides defined parameters for all roadside management works and also provides the local community with an overview of management practices that will ensure the sustainability of native roadside vegetation. Please contact the Roadside Conservation Committee on 9334 0423 for further information.

7.2 Tree Roads

Tree roads are defined as those roadsides with a sufficient density of mature trees to create an attractive tunnel effect. Besides the aesthetic benefits, these areas also provide valuable habitat for birds and other arboreal fauna. Since mature trees are slow growing and hard to replace, care should be taken to conserve these avenues wherever possible. The following points should be considered when working on tree roads:

- prune offending branches rather than remove the whole tree;
- cut branches off close to limb or tree trunk;
- divert line of table drain to avoid disturbing tree roots;
- import fill to build up formation, rather than using side-borrow from roadside;
- when using herbicide for weed control on the roadside do not use a soil residual type, such as Simazine or Atrazine. Eucalypts are especially sensitive to these;
- encourage the adjoining landholders to plant shelter belts on their property that will complement the roadside vegetation.

7.3 Special Environment Areas

A Special Environmental Area is a section of roadside, which has such significance that it requires special protection. Reasons for establishing Special Environmental Areas can include:

- protection of rare or threatened species of native plants;
- protection of sites that have other high conservation, scientific or aesthetic values;
- Protection of Aboriginal or European cultural sites.

Special Environmental Areas can be delineated by the use of site markers. See Figures 11 and 12 for design and placement of SEA markers. Workers who come across a 'Special Environmental Area' marker in the field should not disturb the area between the markers unless specifically instructed. If in doubt, the Supervisor, Shire Engineer or CEO should be contacted.

Western Power and West Net rail also have systems for marking sites near power or rail lines. Examples of these are seen in the figure below.

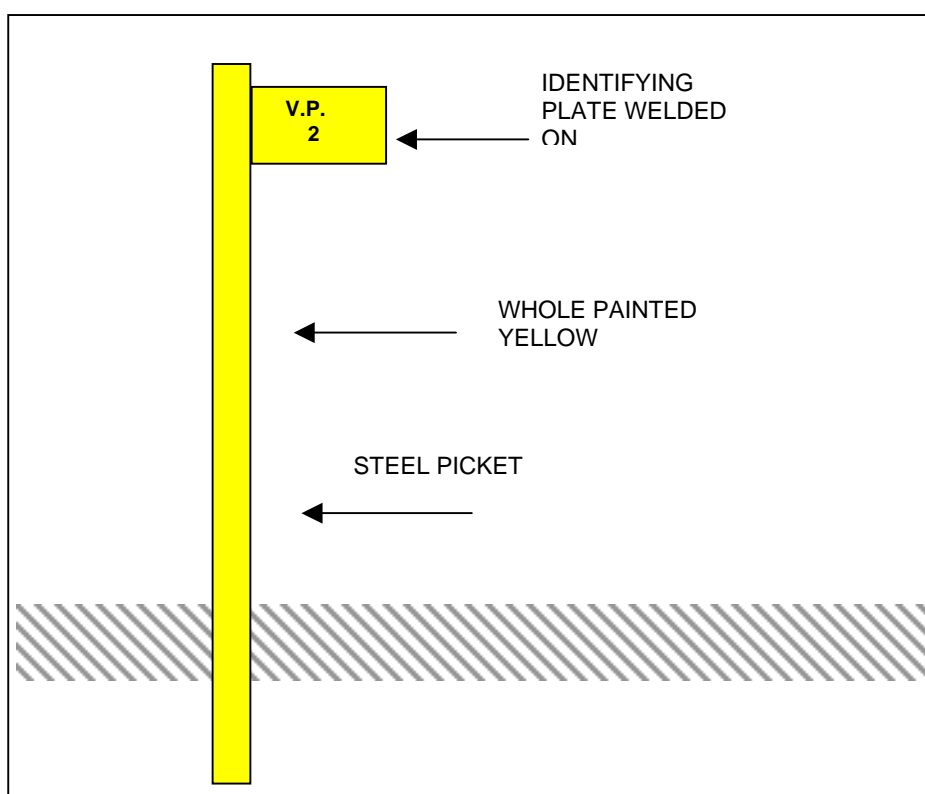


Figure 11 - Special Environmental Area site marker.

7.4 Special Environmental Area Register

To ensure that knowledge of rare flora and other sites does not get lost due, perhaps, to staff changes, a Local Authority should establish a Special Environmental Area Register. This should outline any special treatment, which the site should receive, and be consulted prior to any work being initiated in the area.

The following guidelines should be considered prior to establishing this registrar.

- the roadside must contain a significant population of native vegetation (introduced trees and grasses are not important for conservation),
- the native vegetation must be in as near to its natural condition as possible,
- in undisturbed vegetation, several layers of plants occur, i.e. trees, shrubs and ground covers (herbs or native grasses). If one or more of the expected layers are missing, the conservation value is reduced,
- the roadside may be the only remaining example of original vegetation within a cleared area. It thus assists in vegetation mapping and distribution studies, provides a benchmark for study of soil change during agricultural development, may provide a source of local seed for revegetation projects and acts as wildlife habitat , protecting fauna,
- rare or endangered plants and animals may occur on the roadside,
- it may provide nest sites and refuges for native animals. Dense vegetation provides habitat for avifauna and invertebrates.

The Special Environmental Area Register should be consulted by the appropriate person prior to starting work on any particular road, to ensure that inadvertent damage does not occur. All Special Environment Area sites should be marked on the Shire map, which records Roadside Conservation Value

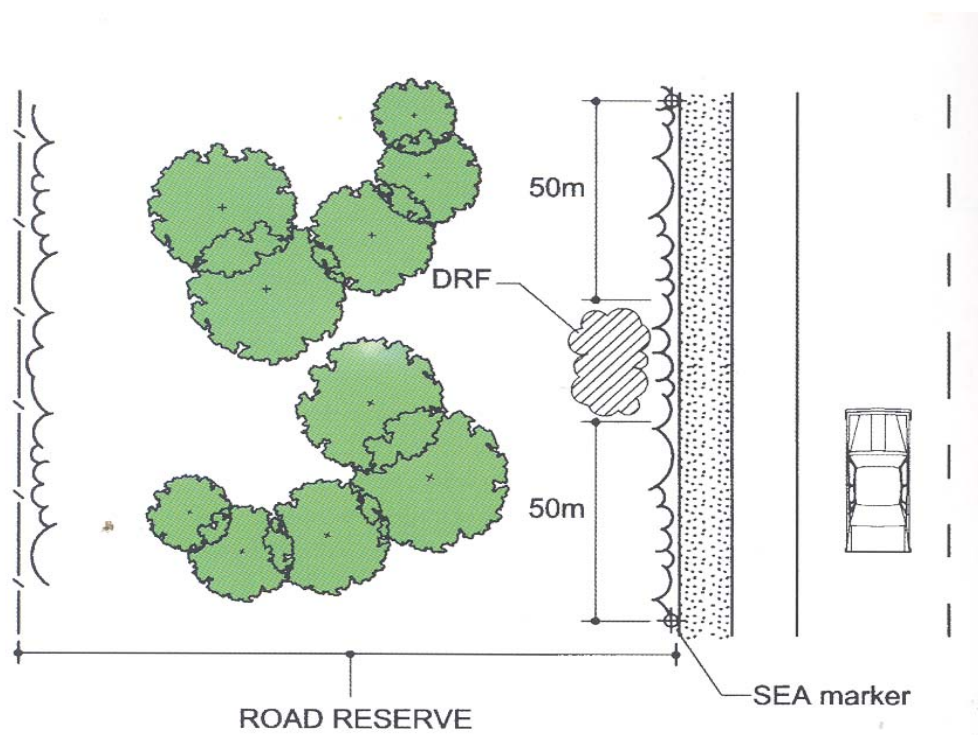


Figure 12 - Marking Special Environment Area (SEA) sites in the field. In this case, a declared rare flora (DRF) site has been marked.

Local Government is encouraged to permanently mark Special Environmental Areas to prevent inadvertent damage to the rare flora or other values being protected. Markers of a uniform shape and colour will make recognition easier for other authorities using road reserves.

When notified of a population needing marking, the Local Authority should contact the appropriate Department of Conservation and Land Management Regional or District office for assistance to ensure the exact site location and correct positioning of marker posts, as per Flora Roads.

8.0 ROADSIDE PLANNING, STRATEGIES AND ACTION PLANS

8.1 Planning

The RCC is able to provide good models of Roadside Management Plans and encourages all shires to adopt this practice of planning for roadside conservation. The following actions greatly enhance likelihood of a plan that changes behaviour and results in on-ground actions:

- ❖ community support encourage ongoing community involvement and commitment by establishing a local Roadside Advisory Committee or working group within the Shire Environmental Committee;
- ❖ contract specifications maintain roadside values by developing environmental specifications for inclusion in all tender documents or work practices;
- ❖ community education use of innovative and pertinent material can increase community understanding of roadside values;
- ❖ training promote local roadside planning initiatives and gain acceptance and understanding by involving shire staff, contractors, utility provider staff and the community in workshops, seminars or training days. The Roadside Conservation Committee can provide this training.

Training develops recognition and understanding of roadside values and highlights best work practices. Workshops are developed to ensure that local issues and environments are dealt with and they include site visits to high conservation remnants, current projects and works.

The objective of all roadside management planning should be to:

- **Protect**
 - native vegetation
 - rare or threatened flora or fauna
 - cultural and heritage values
 - community assets from fire
- **Enhance**
 - indigenous vegetation communities
 - fauna habitats and corridors
- **Maintain**
 - safe function of the road
 - native vegetation communities

- fauna habitats and corridors
- visual amenity and landscape qualities
- water quality
- **Minimise**
 - land degradation
 - spread of weeds and vermin
 - spread of soil borne pathogens
 - risk and impact of fire
 - disturbance during installation and maintenance of service assets

8.2 Strategies

The development of a strategy enables potentially competing uses to coexist and ensures that roadsides are managed in a coordinated approach. When producing regional strategies the RCC suggests that:

- organisational support from local government is essential from the outset;
- strategies should take no longer than 12 months to produce (including a period for community comment);
- communities need to be provided with background information to make formal decisions.

Management strategies should be produced to address local issues, rather than be to a standard format. Issues can be categorised as:

❖ **Functional**

- | | |
|--------------------------------------------|-------------------------------------|
| - Fire prevention | - Stockpile and dumpsite management |
| - Installation and maintenance of services | - Vegetation removal |
| - Road construction and maintenance | - Vehicle and machinery activity |
| | - Water supply catchments |

❖ **Cultural and Recreational**

- | | |
|--------------------------------|---------------------------------------|
| - Cultural and heritage values | - Visual amenity and landscape values |
| - Horse riding | - Wayside stops |

❖ **Landcare**

- | | |
|----------------|----------------------------------------|
| - Apiculture | - Ploughing, cultivating or grading |
| - Insect Pests | - Revegetation and site rehabilitation |
| - Pest animals | - Weeds |

❖ Conservation

- Protecting and conserving remnant native vegetation
- Rare, threatened or significant flora and fauna
- Regeneration of native plant communities
- Roadside marking of special environmental areas
- Unused road reserves
- Wetlands
- Wildlife habitat
- Wildlife corridors

8.3 Roadside Action Plans

A Roadside Action Plan is prepared for an individual road and contains a works program that will enable conservation values and other road uses to be managed compatibly.

Roadside Action Plans are based on the guidelines that are produced as part of the roadside strategy.

The RCC suggests that Roadside Action Plans be:

- short term documents (to be reviewed within 2 years);
- prepared on a need basis;
- prepared after consultation with major stakeholders;
- a maximum of 2 pages per road;
- names a person or agency responsible for implementing the management recommendations.

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Appendix

1

APPENDIX 1

Definitions of Remnant Vegetation Types, Beeston et al (1993).

Vegetation classed as "**remnant vegetation**" has one or more of the following characteristics:

- * Most closely reflects the natural state of vegetation for a given area.
- * Has an intact understorey (if forest or woodland).
- * Has minimal disturbance by agents of human activity.

Vegetation classed as "**modified vegetation**" has one or more of the following characteristics:

- * Degraded understorey (i.e. reduction in the number of native species, includes weeds).
- * Obvious human disturbance, i.e. clearing, mining, grazing, weeds.
- * Affected by salt.
- * Narrow corridors of vegetation (usually along roads and railway lines or windbreaks), which are more likely to be affected by edge effects.

Vegetation classed as "**scattered vegetation**" has:

- * No understorey
- * Parkland cleared i.e. scattered single trees.
- * No significant signs or chance of regeneration.

Appendix

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Appendix

3

Appendix

4

APPENDIX 4

Plant species in the Shire of Kojonup (not a definitive list)

* denotes a weed species

Acacia acuminata subsp. acuminata ms	*Agrostis preissii
Acacia ataxiphylla subsp. ataxiphylla ms P3	Agrostocrinum scabrum
Acacia browniana	Allocastrum huegeliana
Acacia browniana var. intermedia	Allocastrum humilis
Acacia crispula	Allocastrum lehmanniana subsp. lehmanniana
Acacia cupularis	Allocastrum thuyoides
Acacia cyclops	Alopecurus myosuroides
*Acacia decurrens	*Amaranthus albus
Acacia drummondii subsp. drummondii	Amphipogon amphipogonoides
Acacia extensa	Amyema miquelii
Acacia grisea P4	*Anagallis arvensis
Acacia huegelii	Andersonia brevifolia
Acacia insolita	Andersonia caerulea
Acacia insolita subsp. insolita	Angianthus drummondii
Acacia loricata var. loricata	Angianthus preissianus
Acacia lasiocarpa var. bracteolata	Anigozanthos bicolor subsp. decrescens
Acacia lasiocarpa var. sedifolia	Anigozanthos humilis
Acacia leptospermoides subsp. leptospermoides	Anigozanthos humilis subsp. humilis
Acacia lullfitziorum ms P3	Anigozanthos manglesii
Acacia mimica var. mimica	Anigozanthos manglesii subsp. manglesii
Acacia nervosa	Aotus genistoides
Acacia pentadenia	Argentipallium niveum
Acacia pulchella	*Asparagus asparagoides
Acacia pulchella var. glaberrima	*Asparagus officinalis
Acacia pulchella var. pulchella	Asteridea asteroides
Acacia pulviniformis	Asteridea nivea
Acacia pycnantha	Astroloma baxteri
Acacia pycnocephala	Astroloma cataphractum ms
Acacia squamata	Astroloma compactum
Acacia stenoptera	Astroloma drummondii
Acacia sulcata	Astroloma macrocalyx
Acacia sulcata var. planoconvexa	Astroloma pallidum
Acacia urophylla	Astroloma serratifolium
Acacia varia var. parviflora	Austrodanthonia acerosa
Acacia willdenowiana	Austrodanthonia caespitosa
*Acaena echinata	Austrostipa campylachne
*Acaena echinata var. retrorsumpilosa	Austrostipa elegantissima
	Austrostipa mollis

<i>Austrostipa semibarbata</i>	* <i>Bromus alopecuroides</i>
<i>Austrostipa tenuifolia</i>	<i>Burchardia monantha</i>
* <i>Avena barbata</i>	<i>Burchardia multiflora</i>
* <i>Avena fatua</i>	<i>Caladenia brownii</i> ms
<i>Baeckea astarteoides</i>	<i>Caladenia caesarea</i> subsp. <i>caesarea</i> ms
<i>Baeckea camphorosmae</i>	<i>Caladenia cairnsiana</i>
<i>Baeckea preissiana</i>	<i>Caladenia chapmanii</i> ms
<i>Baeckea pygmaea</i>	<i>Caladenia dilatata</i>
<i>Banksia attenuata</i>	<i>Caladenia discoidea</i>
<i>Banksia gardneri</i> var. <i>gardneri</i>	<i>Caladenia dorrienii</i> R
<i>Banksia meisneri</i> subsp. <i>meisneri</i>	<i>Caladenia falcata</i>
<i>Banksia sphaerocarpa</i> var. <i>caesia</i>	<i>Caladenia flava</i> subsp. <i>flava</i> ms
<i>Banksia victoriae</i>	<i>Caladenia flava</i> subsp. <i>sylvestris</i> ms
* <i>Bartsia trixago</i>	<i>Caladenia footeana</i> ms
<i>Beaufortia micrantha</i> var. <i>puberula</i>	<i>Caladenia hirta</i> subsp. <i>rosea</i> ms
<i>Billardiera bicolor</i>	<i>Caladenia integra</i> P4
<i>Billardiera bicolor</i> var. <i>bicolor</i>	<i>Caladenia latifolia</i>
<i>Billardiera drummondiana</i>	<i>Caladenia longicauda</i> subsp. <i>eminens</i> ms
<i>Billardiera drummondiana</i> var. <i>drummondiana</i>	<i>Caladenia longiclavata</i>
<i>Billardiera laxiflora</i>	<i>Caladenia macrostylis</i>
<i>Billardiera lehmanniana</i>	<i>Caladenia marginata</i>
<i>Billardiera sericea</i>	<i>Caladenia pectinata</i>
<i>Billardiera variifolia</i>	<i>Caladenia polychroma</i> ms
<i>Boronia capitata</i> subsp. <i>clavata</i>	<i>Caladenia radiata</i>
<i>Boronia fastigiata</i> subsp. <i>fastigiata</i> ms	<i>Caladenia reptans</i>
<i>Boronia ramosa</i> subsp. <i>anethifolia</i>	<i>Caladenia saccharata</i>
<i>Boronia spathulata</i>	<i>Caladenia splendens</i> ms
<i>Boronia subsessilis</i>	<i>Caladenia uliginosa</i> subsp. <i>uliginosa</i> ms
<i>Borya scirpoidea</i>	<i>Caladenia vulgata</i> ms
<i>Borya sphaerocephala</i>	<i>Caladenia x cala</i> ms
<i>Bossiaea eriocarpa</i>	<i>Caladenia x ericksoniae</i>
<i>Bossiaea linophylla</i>	<i>Caladenia xantha</i> ms
<i>Bossiaea ornata</i>	<i>Calectasia arnoldii</i> ms R
<i>Bossiaea rufa</i>	<i>Callistemon phoeniceus</i>
<i>Bossiaea spinescens</i>	<i>Calothamnus lateralis</i>
<i>Brachypodium distachyon</i>	<i>Calothamnus lehmannii</i>
<i>Brachyscome glandulosa</i>	<i>Calothamnus preissii</i>
<i>Brachyscome iberidifolia</i>	<i>Calytrix asperula</i>
<i>Brachysema celsianum</i>	<i>Calytrix flavescens</i>
<i>Brachysema latifolium</i>	<i>Calytrix leschenaultii</i>
<i>Brachysema melanopetalum</i>	<i>Calytrix tetragona</i>
<i>Brachysema praemorsum</i>	<i>Carex preissii</i>
<i>Brachysema sericeum</i>	<i>Cassytha flava</i>

Cassytha racemosa forma *racemosa*
Caustis dioica
Caustis pentandra
Caustis sp. *Boyanup* (G.S. McCutcheon 1706) P1
Cenchrus longispinus
Centrolepis aristata
 **Chamaecytisus proliferus*
Chamaescilla corymbosa
Chamaescilla corymbosa var. *corymbosa*
Chamaexeros serra
Chamelaucium pauciflorum
Chamelaucium pauciflorum subsp. *pauciflorum* ms
Chloanthes coccinea
Choretrum glomeratum var. *chrysanthum*
Choretrum glomeratum var. *glomeratum*
Chorizandra enodis
Chorizema aciculare
Chorizema aciculare subsp. *aciculare*
Chorizema dicksonii
Chorizema glycinifolium
Chrysocephalum apiculatum
Chrysocoryne drummondii
 **Citrullus* spp.
Comesperma calymega
Comesperma ciliatum
Comesperma polygaloides
Comesperma virgatum
Comesperma volubile
Conospermum caeruleum subsp. *spathulatum*
Conospermum stoechadis subsp. *stoechadis*
Conospermum triplinervium
Conostylis aculeata subsp. *aculeata*
Conostylis drummondii R
Conostylis laxiflora
Conostylis petrophiloides
Conostylis pusilla
Conostylis serrulata
Conostylis setigera subsp. *dasys* R
Conostylis setigera subsp. *setigera*
Corymbia calophylla
 **Cotula coronopifolia*
Cotula cotuloides
Craspedia variabilis
Crassula decumbens
Cryptandra arbutiflora var. *arbutiflora*
Cryptandra nutans
Cryptandra pungens
Cyanicula gemmata ms
Cyanicula ixiooides subsp. *candida* ms P2
Cyanicula sericea ms
Cyathochaeta avenacea
 **Cynara cardunculus*
Cyrtostylis robusta
Dampiera alata
Dampiera fasciculata
Dampiera lavandulacea
Dampiera linearis
Darwinia vestita
 **Datura metel*
Daucus glochidiatus
Daviesia cardiophylla
Daviesia decurrens
Daviesia flexuosa
Daviesia hakeoides subsp. *subnuda*
Daviesia longifolia
Daviesia mollis
Daviesia oppositifolia
Desmocladius asper
Desmocladius asper ms
Desmocladius flexuosus ms
Dianella revoluta
Dianella revoluta var. *divaricata*
Dichelachne crinita
Dichopogon capillipes
Dillwynia divaricata
Dillwynia sp. A Perth Flora (R. Coveny 8036)
 **Dimorphotheca graveolens*
Diplolaena microcephala
Diuris aff. *corymbosa*
Diuris corymbosa
Dodonaea ceratocarpa
Dodonaea humifusa
Dodonaea pinifolia
Drakaea glyptodon
Drakonorchis barbarossa ms
Drosera erythrorhiza subsp. *erythrorhiza*

Drosera gigantea subsp. *gigantea*
Drosera glanduligera
Drosera macrantha
Drosera macrantha subsp. *macrantha*
Drosera menziesii subsp. *menziesii*
Drosera rosulata
Drosera stolonifera subsp. *compacta*
Drosera subhirtella
Dryandra columnaris P3
Dryandra formosa
Dryandra fraseri var. *fraseri*
Dryandra lindleyana subsp. *sylvestris*
Dryandra mucronulata subsp. *retrorsa* P1
Dryandra nivea subsp. *nivea* ms
Dryandra porrecta P4
Dryandra preissii P4
Dryandra sessilis var. *sessilis*
Dryandra squarrosa subsp. *squarrosa*
Dryandra stuposa
Dryandra tenuifolia var. *reptans*
**Ehrharta calycina*
**Ehrharta erecta*
Elymus scaber
Elythranthera brunonis
Elythranthera emarginata
**Eragrostis cilianensis*
**Eragrostis curvula*
Eriochilus scaber subsp. *scaber* ms
Eryngium pinnatifidum
Eucalyptus aff. *latens*
Eucalyptus angustissima
Eucalyptus aspera
Eucalyptus aspersa P4
Eucalyptus astringens subsp. *astringens*
Eucalyptus conglobata
Eucalyptus decipiens subsp. *chalara*
Eucalyptus decurva
Eucalyptus erectifolia P4
Eucalyptus falcata
Eucalyptus incrassata
Eucalyptus lehmannii
Eucalyptus marginata subsp. *elegantella* P2
Eucalyptus marginata subsp. *marginata*
Eucalyptus occidentalis
Eucalyptus pachyloma
Eucalyptus phaenophylla subsp. *interjacens*
Eucalyptus pleurocarpa
Eucalyptus pluricaulis subsp. *porphyrea*
Eucalyptus rudis
Eucalyptus uncinata
Eucalyptus wandoo subsp. *wandoo*
Eutaxia densifolia
**Festuca pratensis*
Franklandia fucifolia
**Freesia*
Gahnia aristata
Galium murale
Gastrolobium bilobum
Gastrolobium calycinum
Gastrolobium crassifolium
Gastrolobium glabratum ms P4
Gastrolobium ovalifolium P4
Gastrolobium pusillum
Gastrolobium spinosum
Gastrolobium spinosum var. *spinosum*
Gastrolobium tomentosum P4
Gastrolobium trilobum
Gastrolobium truncatum
Gastrolobium villosum
Geranium solanderi
Glischrocaryon aureum
Glischrocaryon roei
Gnephosis drummondii
Gompholobium aff. *confertum*
Gompholobium baxteri
Gompholobium knightianum
Gompholobium marginatum
Gompholobium ovatum
Gompholobium polymorphum
Gompholobium preissii
Gompholobium tomentosum
Gompholobium venustum
Gompholobium villosum
Goodenia caerulea
Goodia medicaginea
Grevillea centristigma

Grevillea cirsiifolia P4
 Grevillea fasciculata
 Grevillea leptobotrys
 Grevillea pilulifera
 Grevillea pulchella subsp. ascendens ms
 Grevillea teretifolia
 Grevillea trifida
 Grevillea tripartita
 Grevillea uncinulata subsp. uncinulata
 Gyrostemon subnudus
 Haemodorum discolor
 Haemodorum simplex
 Haemodorum simulans
 Haemodorum spicatum
 Hakea corymbosa
 Hakea incrassata
 Hakea lehmanniana
 Hakea lissocarpha
 Hakea marginata
 Hakea prostrata
 Hakea ruscifolia
 Hakea varia
 Halosarcia lepidosperma
 Hardenbergia comptoniana
 Helichrysum leucopsidium
 Hemarthria uncinata var. uncinata
 Hemiandra pungens
 Hemigenia incana
 Hibbertia acerosa
 Hibbertia commutata
 Hibbertia cunninghamii
 Hibbertia enervia
 Hibbertia gracilipes
 Hibbertia hypericoides
 Hibbertia inconspicua
 Hibbertia microphylla
 Hibbertia polystachya
 Hibbertia quadricolor
 Hibbertia recurvifolia
 Hibbertia rhadinopoda
 Hibbertia rupicola
 Hibbertia spicata
 Hibbertia subvaginata
 Homalosciadium homalocarpum
 *Homeria flaccida
 Hordeum marinum
 Hovea chorizemifolia
 Hovea pungens
 Hovea trisperma
 Hyalosperma cotula
 Hyalosperma simplex subsp. graniticola
 Hybanthus floribundus subsp. floribundus
 Hydrocotyle alata
 Hydrocotyle callicarpa
 Hydrocotyle diantha
 Hypocalymma angustifolium
 Hypocalymma sp. Scott River (A.S. George 11773) P4
 Hypoxis occidentalis var. quadriloba
 *Iaxia spp.
 *Ipheion uniflorum
 *Isolepis cernua
 Isolepis setiformis
 Isopogon buxifolius var. linearis
 Isopogon buxifolius var. obovatus
 Isopogon buxifolius var. spathulatus
 Isopogon formosus subsp. formosus
 Isopogon latifolius P3
 Isopogon teretifolius subsp. teretifolius ms
 Isotoma scapigera
 *Ixia spp.
 Ixiolaena viscosa
 Jacksonia alata
 Jacksonia condensata
 Jacksonia furcellata
 Jacksonia grevilleoides
 Jacksonia horrida
 Jacksonia restioides
 Jacksonia spinosa
 Jacksonia sternbergiana
 *Juncus acutus
 Juncus kraussii subsp. australiensis
 Juncus pallidus
 Kennedia carinata
 Kennedia coccinea
 Kennedia microphylla
 Kennedia prostrata

Kunzea glabrescens
 Kunzea micromera
 Kunzea preissiana
 Kunzea recurva
 Lagenifera huegelii
 Lambertia ilicifolia
 Lasiopetalum glabratum P3
 *Lavatera cretica
 Lawrencella rosea
 Laxmannia minor
 Laxmannia ramosa subsp. ramosa
 Laxmannia sessiliflora
 Laxmannia sessiliflora subsp. australis
 Laxmannia squarrosa
 Lechenaultia biloba
 Lechenaultia formosa
 Lechenaultia tubiflora
 Lepidobolus chaetocephalus
 Lepidosperma gracile
 Lepidosperma leptostachyum
 Lepidosperma longitudinale
 Lepidosperma pubisquameum
 Lepidosperma sp.A2 Island Flat(G.J.Keighery 7000)
 Lepidosperma squamatum
 Leporella fimbriata
 Leptoceras menziesii
 Leptomeria lehmannii
 Leptomeria pauciflora
 Leptomeria scrobiculata
 Leptospermum erubescens
 *Leptospermum laevigatum
 Leptospermum spinescens
 Leucopogon alternifolius
 Leucopogon capitellatus
 Leucopogon conostephioides
 Leucopogon cymbiformis
 Leucopogon fimbriatus
 Leucopogon glabellus
 Leucopogon hirsutus
 Leucopogon obtusatus
 Leucopogon ovalifolius
 Leucopogon oxycedrus
 Leucopogon pendulus
 Leucopogon polymorphus
 Leucopogon propinquus
 *Linum marginale
 Lobelia alata
 Lobelia rarifolia
 Logania micrantha
 Lomandra caespitosa
 Lomandra hermaphrodita
 Lomandra integra
 Lomandra micrantha subsp. micrantha
 Lomandra purpurea
 Lomandra rigida
 Lomandra sericea
 Lomandra sonderi
 *Lotus angustissimus
 *Lotus suaveolens
 Loxocarya cinerea
 Lyperanthus serratus
 Lysinema ciliatum
 Marianthus candidus
 Melaleuca carrii ms
 Melaleuca densa
 Melaleuca lateriflora subsp. lateriflora ms
 Melaleuca micromera P3
 Melaleuca ordinifolia P2
 Melaleuca pritzelii P2
 Melaleuca spathulata
 Melaleuca thymoides
 Melaleuca trichophylla
 Melaleuca viminea
 Melaleuca viminea subsp. viminea
 Mesomelaena stygia subsp. stygia
 Microcorys glabra
 Microlaena stipoides
 Microtis atrata
 Microtis orbicularis
 Millotia tenuifolia var. tenuifolia
 Mirbelia ovata
 *Monadenia bracteata
 *Monopsis debilis
 *Muehlenbeckia adpressa
 Myriocephalus helichrysoides
 Nemcia emarginata

Nemcia retusa	Prasophyllum cyphochilum
Nemcia tricuspidata	Prasophyllum gracile
Neurachne alopecuroidea	Prasophyllum hians
*Oenothera stricta subsp. stricta	Prasophyllum plumiforme
Olax benthamiana	Pseudanthus virgatus
Oligarrhena micrantha	Pterochaeta paniculata
Opercularia spermacoea	Pterostylis recurva
Opercularia vaginata	Ptilotus declinatus
*Ornithopus compressus	Ptilotus drummondii var. drummondii
*Oxalis corniculata	Ptilotus manglesii
*Oxalis perennans	Pultenaea calycina
Oxylobium lineare	Pultenaea radiata P3
*Papaver hybridum	Pultenaea verruculosa
Patersonia pygmaea	Pultenaea verruculosa var. brachyphylla
Patersonia umbrosa	*Raphanus raphanistrum
Pelargonium littorale subsp. littorale	Regelia cymbifolia P4
Pericalymma ellipticum	Regelia inops
Persicaria prostrata	Rhodanthe citrina
Persoonia quinquenervis	Rhodanthe manglesii
Persoonia striata	Ricinocarpos glaucus
Petrophile diversifolia	Ricinocarpos tuberculatus
Petrophile longifolia	*Rubus spp.
Petrophile rigida	*Rumex spp
Petrophile serruriae	Samolus junceus
Petrophile squamata subsp. squamata	Samolus repens var. paucifolius
Petrophile teretifolia	Scaevola calliptera
*Phalaris aquatica	Scaevola pulvinaris
Phebalium tuberculatum	Scaevola repens var. repens
Phyllanthus calycinus	Scaevola striata var. arenaria
Phyllota gracilis P3	Schoenus caespititius
Pimelea angustifolia	Schoenus efoliatus
Pimelea ciliata subsp. ciliata	Senecio hispidulus var. hispidulus
Pimelea lehmanniana subsp. nervosa	*Senecio lautus subsp. dissectifolius
Pimelea suaveolens subsp. suaveolens	Senecio quadridentatus
*Pinus spp.	*Setaria sphacelata
Plantago debilis	Siloxerus humifusus
Platysace juncea	Siloxerus multiflorus
Platysace tenuissima	*Solanum hoplopetalum
Podolepis gracilis	*Solanum nigrum
Podolepis lessonii	Sollya heterophylla
Podolepis microcephala	*Sorghum halepense
Podotheca gnaphalioides	Sowerbaea laxiflora
*Polypogon monspeliensis	*Sparaxis bulbifera

Sphaerolobium daviesioides
Sphaerolobium medium
Stackhousia monogyna
Stipa hemipogon
Stipa mollis
Stirlingia latifolia
Stirlingia seselifolia
Stylidium affine
Stylidium breviscapum
Stylidium breviscapum var. *breviscapum*
Stylidium brunonianum
Stylidium brunonianum subsp. *minor*
Stylidium bulbiferum
Stylidium calcaratum
Stylidium caricifolium
Stylidium carnosum
Stylidium choreanthum P2
Stylidium crassifolium
Stylidium dichotomum
Stylidium hirsutum
Stylidium leptophyllum
Stylidium obtusatum
Stylidium piliferum
Stylidium piliferum subsp. *minor*
Stylidium piliferum subsp. *piliferum*
Stylidium repens
Stylidium scandens
Stylidium schoenoides
Stylidium spathulatum
Stylidium squamellosum
Stylidium uniflorum
Stypandra glauca
Synaphea favosa
Synaphea floribunda
Synaphea gracillima
Synaphea obtusata
Synaphea petiolaris subsp. *triloba*
Tetragia capillaris
Tetragia octandra
Tetragia laevis
Tetragia affinis
Tetragia hirsuta
Tetragia pubescens
Tetragia virgata
Thelymitra villosa
Thelymitra x *macmillanii*
Thomasia angustifolia
Thomasia foliosa
Thomasia macrocalyx
Thomasia purpurea
Thomasia sp. Big Brook (M. Koch 2373)
Thysanotus aff. *patersonii*
Thysanotus dichotomus
Thysanotus manglesianus
Thysanotus tenellus
Thysanotus thyrsoideus
Trachymene pilosa
Tribonanthes australis
Tribonanthes longipetala
Tribonanthes violacea
 **Tribulus terrestris*
Trichocline spathulata
Tricoryne elatior
Tricostularia compressa
Tricostularia neesii var. *neesii*
Trifolium campestre var. *campestre*
 **Trifolium dubium*
 **Trifolium hirtum*
 **Trifolium pratense*
 **Trifolium striatum*
 **Trifolium subterraneum*
Triglochin aff. *calcitrapum*
Triglochin muelleri
Triodia longipalea
Tripterococcus brunonis
Triticum aestivum
Trymalium ledifolium var. *lineare*
Trymalium ledifolium var. *rosmarinifolium*
 **Ursinia anthemoides*
Utricularia violacea
Velleia trinervis
Veronica plebeia
Verticordia chrysanthella
Verticordia densiflora var. *cespitosa*
Verticordia densiflora var. *densiflora*
Verticordia endlicheriana var. *endlicheriana*

Verticordia fimbrialepis subsp. *fimbrialepis* R

Verticordia grandiflora

Verticordia habrantha

Verticordia huegelii var. *stylosa*

Verticordia insignis subsp. *compta*

Verticordia lindleyi subsp. *purpurea* P4

Verticordia multiflora subsp. *multiflora* P4

Verticordia pennigera

Verticordia plumosa var. *brachyphylla*

Vicia villosa subsp. *eriocarpa*

Viminaria juncea

Vittadinia australasica var. *australasica*

Vittadinia gracilis

Waitzia acuminata

Waitzia nitida

Waitzia suaveolens

**Watsonia* spp.

Wurmbea dioica subsp. *alba*

Wurmbea monantha

Wurmbea sinora

Xanthorrhoea gracilis

Xanthorrhoea preisii

Xanthosia candida

Xanthosia huegelii

**Zantedeschia aethiopica*