Roadside Vegetation and Conservation Values in the Shire of Moora


Merewana Rd


Dalwallinu West Rd - Grevillea


Dalwallinu West Rd

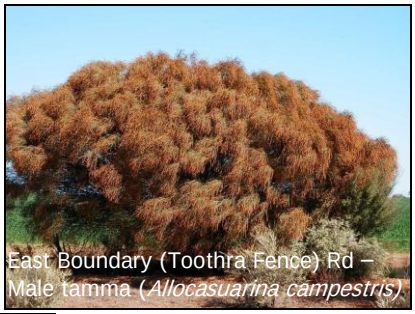
Dandaragan Rd


Nadji Mia Rd - Common cauliflower (Verticordia eriocephala)

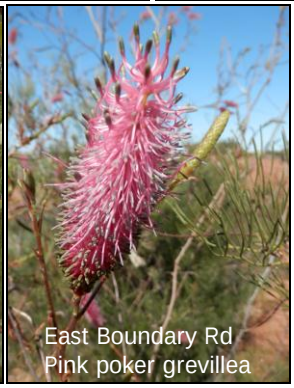

Masons Rd – Pear-fruited mallee

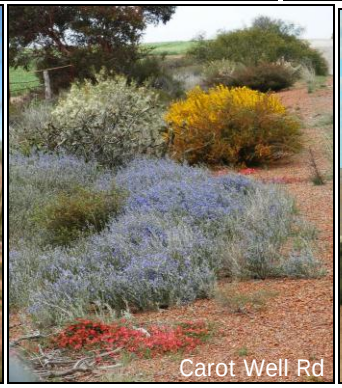

Miling East Rd

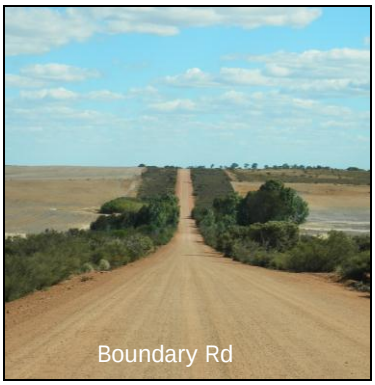

Cardo Rd- *Acacia ulicina*


East Boundary (Toothra Fence) Rd – Male tamma (*Allocasuarina campestris)*


Madingarra Rd
Enormous native willow


East Boundary Rd
Pink poker grevillea


Carot Well Rd


Boundary Rd

Photos: K.Payne & E. McLaughlin, RCC

April 2014

Roadside Conservation Committee

Roadsides - The vital link

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6. Metadata
7. Readme document
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12. Photos

Report compiled by Gillian Stack, Kylie Payne and Edna McLaughlin, Roadside Conservation Committee (RCC)
Map produced by Geographic Information Services (GIS) Section, Department of Parks & Wildlife (DPaW).
Data supplied by RCC from Shire of Moora roadside surveys conducted by local volunteers and RCC staff.

APPENDICES

Roadside Vegetation and Conservation Values in the Shire of Moora

Appendix

1

RCC VERGE NOTE

GUIDELINES FOR MANAGING THE HARVESTING OF NATIVE FLOWERS, SEED AND TIMBER FROM ROADSIDES

APPENDIX 1
GUIDELINES FOR MANAGING THE HARVESTING OF NATIVE FLOWERS, SEED AND TIMBER FROM ROADSIDES

Introduction

The diversity of values associated with roadside vegetation is well documented and acknowledged. In landscapes that have been extensively cleared, roadside vegetation provides essential wildlife corridors and habitat for local flora and fauna, including a number of threatened species. Hence it is highly desirable that this asset is managed in such a way as to ensure its conservation and sustainability.

The control and management of roadside vegetation is the responsibility of the road manager. Local government authorities, as road managers, are often approached for 'permission' to take various flora products from the roadside. These requests are mainly for wildflowers, native seed and firewood. Other products which may be sought include material for making didgeridoos, other types of craft wood, and stakes or poles for various purposes.

The implementation of these simple guidelines by road managers for the removal of flora and timber material from the roadsides will ensure that the vegetated roadside reserve is maintained for its biodiversity values, and the benefit of the community and road users.

In some instances the Roadside Conservation Committee (RCC) is supportive of the sustainable harvesting of flora, such as salvage (removal of dead material that is not significant wildlife habitat or is material to be destroyed by road works), or the selective collection of seed for revegetation. However, each case should be viewed on its merits and any decision to facilitate harvesting from roadsides should be referred to the Department of Environment and Conservation (DEC) and/or the RCC for advice. Licences allowing the taking of roadside flora may be issued by DEC when supported by the road managing authority.

Legislation

All Western Australian native flora is protected under the *Wildlife Conservation Act 1950*. Native flora includes all parts of a native plant, including its flowers, seed, and timber. Protection of native flora under the Act means that a person can only take (cut or remove) native flora from Crown land under a licence.

Road and rail reserves are Crown land, and hence a licence is required to cut or remove any native flora from a roadside or rail line. There is, however, a legal provision by which the road manager or their agent (contractor) does not require a licence whilst undertaking legitimate road management activities, such as those approved under the *Environmental Protection (Clearing of Native vegetation) Regulations 2004*. This provision does not extend to other persons who wish to take protected flora from roadsides.

There are two types of licences that apply to the taking of protected flora from Crown land: Commercial Purposes Licences, where the flora is being taken for any commercial purpose; and Scientific or Other Prescribed Purposes Licences, where the protected flora is being taken for specific non-commercial purposes.

In issuing a licence, DEC is required to be assured that the activity will not compromise the conservation of the flora. In determining this, DEC will seek advice from the road manager to determine the potential impact of the activity, and how the activity relates to the management objectives being applied to that land.

A licence application may be refused if the activity is either a conservation concern, or does not fit in with the management objectives of the road manager. Once issued with a licence, a licensee must comply with the conditions of the licence that are designed to ensure the activity does not adversely impact on the conservation of the flora or the natural environment in which it occurs.

Commercial Wildflower Harvesting.

Western Australia is referred to as the *'Wildflower State'*, and its wildflowers attract a significant number of tourists each year. Roadside vegetation provides the most accessible, and hence the most commonly viewed, array of wildflowers, and as such are an important feature of regional tourism, potentially providing a significant financial boost to local economies. Wildflower harvesting in many instances detracts from the biodiversity and tourism values of the roadside and should therefore be discouraged.

The RCC considers that the flora on roadsides is reserved and maintained for public benefit. It is therefore seen as a contradiction of purpose to allow wildflowers on roadsides to be harvested, particularly for private gain, and this activity should not be permitted. However, there are situations where some harvesting may be considered, such as in very wide road reserves where the activity can be screened from road users and has a smaller impact on biodiversity. It is often the case that flora is harvested from roadsides because of the convenience of access, and harvesters should be directed to find alternative locations. Road managers have been discouraged from supporting or allowing such harvesting to occur, but if harvesting is to be approved, then the points provided at the end of these guidelines should be considered.

Seed Collection.

Throughout much of the south west, revegetation of the native flora is being undertaken to redress the problems that historic clearing has created. Increasingly, this revegetation is aimed at using local native flora so as to recreate the native vegetation to support biodiversity objectives. The paradox is that in many areas the native vegetation has been cleared to such an extent that adequate sources of native seed cannot be found for undertaking this work. Roadside vegetation may be one of few sources of such seed.

Seed production is an important component of remnant vegetation. Some species, called re-seeder species, regrow only from seed when plants are either killed by an event, such as fire, storm damage, or die as part of their natural cycle. The maintenance of adequate seed of these species is necessary as a precaution to ensure the continuity of the flora biodiversity.

Native seed is also an important food source for native fauna living in roadside vegetation, from ants to birds and mammals. The maintenance of this fauna is important for the continuing survival of the vegetation, especially where the fauna is required to pollinate the flora.

When seed is needed for *bona fide* revegetation projects within the local community, and no other source of local seed is available, then the managing authority may consider giving permission for collection of seed from roadsides. Such collection must be under the appropriate licence issued by DEC and the harvesting should be done in a way that does not endanger the long-term survival of the roadside vegetation.

Where seed collection is to be authorised on roadsides, the road manager should consider the points listed at the end of these guidelines. Specific consideration should be given to the methods that are approved for harvesting the seed, the quantity of seed that may be taken, and the species from which the seed is to be sourced.

Timber Harvesting from Roadsides.

Timber is harvested for a range of reasons, including saw logs, firewood and craft wood. Due to the ease of access, timber harvesters may wish to source timber from roadside vegetation for these purposes.

Roadside managers are encouraged to retain timber on roadsides as an important component of the natural habitat, which fulfills ecological, aesthetic and land management functions. Fallen logs and branches within the roadside create important habitat for many species of insects, reptiles, mammals and birds, thus enhancing the roadside biodiversity. Insects and reptiles that live in fallen timber are also important elements of the food chain, and are very important to the functioning of natural systems, and the survival of many other native animals.

The RCC recommends that harvesting of timber from roadsides should not be permitted except in defined road safety, fence line or service clearance zones, or where a tree has fallen, or appears likely to fall into clearance zones.

Where timber removal is to be allowed, consideration should be given to the points raised at the end of these guidelines, especially in relation to safety issues related to timber cutting. Permission to remove timber should be specific to certain sections of roadsides where the removal is necessary for other planned road management purposes.

Guidelines for Harvesting on Roadsides.

- In all cases the permission of the managing authority, i.e. Main Roads WA, Local Government or CALM, must be sought before native flora is removed from a roadside.
- Flora removal should be from only designated roads, which have wider vegetated road verges i.e. vegetation width > 3metres.
- The number of operators authorised to remove flora from a roadside should be strictly limited to that which can be sustained and managed. The determination of this is at the judgment of the managing authority, but consideration should be taken of the type of flora being harvested and an evaluation of monitoring of the impact of the harvest activity. Advice may be sought from DEC or the RCC.
- Approval for flora harvesting should be for a set period, with a review of the impact and operation before renewal.
- Approval should also stipulate approved methods of harvesting, the species which may be harvested, and the quantity of material to be taken. Advice on harvest conditions may be obtained from DEC.
- Any flora removed should not affect the viability of the residual seed bank. It is recommended that no more than 20% of the flowers or seed on a plant should be taken, unless it is in an area that is scheduled to be cleared as part of road management.
- Methods of harvesting flora should not jeopardise the survival of the plant/tree, unless it is in an area that is scheduled to be cleared as part of road management.
- The removal of whole plants should be restricted to areas that are scheduled to be cleared as part of road management. Note: some species of flora such as zamia palms and grass trees cannot be removed for commercial purposes without a special endorsement on the Commercial Purposes Licence issued by DEC.
- No flora of special conservation concern (Declared Rare Flora or Priority Flora) should be removed without special authorisation through DEC.
- No commercial harvesting of any plant product should be allowed for any reason between the markers that delineate an Environmentally Sensitive Areas defined in the *Environmental Protection (Clearing of Native vegetation) Regulations 2004*.
- Flora harvesting should be prohibited from designated Flora Roads.
- Care should be taken that access to Dieback infected areas is limited to the drier months of the year, and vehicular access disallowed.
- Safety should always be of prime concern and every effort should be made to ensure that personal safety is a key consideration in any harvesting operation.
- Flora harvesters should not operate from the roadside in areas where the vegetation is close to the road, where vehicles cannot be safely parked off the road, or where there is poor driver visibility.

Appendix

2

WEEDS IN THE SHIRE OF MOORA ON FLORABASE

APPENDIX 2

WEEDS IN THE SHIRE OF MOORA WITH SPECIMENS IN THE WA HERBARIUM

There are 96 weeds occurring in Moora with specimens on FloraBase

Taxon Profile icon	Indicates that a profile of this taxon is available. Follow the link to see everything we know about the taxon.
Interactive Key icon	Indicates that an interactive key is available to help you identify taxa in this group. Follow the link to download the key and get started.
Photograph icon	Indicates that a photograph of the taxon is available. Follow the link to see the photograph. See the photograph primer for more information.
Distribution Map icon	Indicates that a summary of the known locations of this taxon is available as a distribution map. Follow the link to view the map. See the mapping primer for more information.
Specimen icon	Indicates that specimens of this taxon are available. Follow the link to see them. Please note that you need to be registered to access this area of FloraBase.
* *Alien icon*	Indicates that the associated taxon name is considered to be alien to Western Australia. This means it is a weed, or it is naturalised.

Aizoaceae					
Mesembryanthemum nodiflorum Slender Iceplant	*				
Alliaceae					
Nothoscordum gracile False onion weed	*				
Amaranthaceae					
Alternanthera pungens Khaki Weed	*				
Amaranthus albus Tumbleweed	*				
Anacardiaceae					
Schinus terebinthifolius Broad-leaved pepper tree	*				
Asparagaceae					
Ornithogalum arabicum Lesser Cape Lily	*				
Asteraceae					
Arctotheca calendula Cape Weed	*				
Carthamus lanatus Saffron Thistle	*				
Chondrilla juncea Skeleton Weed	*				
Cotula bipinnata Ferny Cotula	*				
Gorteria personata Gorteria	*				
Hedypnois rhagadioloides subsp. *cretica* Cretan weed	*				

Hedypnois rhagadioloides subsp. *rhagadioloides* *

Hypochaeris glabra Smooth Catsear *

Monoculus monstrosus Stinking Roger *

Oncosiphon piluliferum Globe Chamomile *

Sonchus oleraceus Common Sowthistle *

Tolpis barbata Yellow Hawkweed *

Ursinia anthemoides subsp. a*nthemoides* Ursinia *

Verbesina encelioides Golden Crownbeard *

Xanthium spinosum Bathurst Burr *

Buglossoides arvensis Corn Gromwell *

Echium plantagineum Paterson's Curse *

Brassicaceae

Brassica barrelieri subsp. *oxyrrhina* Smooth-stem Turnip *

Lepidium africanum Rubble Peppercress *

Lepidium bonariense Peppercress *

Rapistrum rugosum Turnip Weed *

Sinapis alba White Mustard *

Sinapis arvensis Charlock *

Sisymbrium orientale Indian Hedge Mustard *

Campanulaceae

Monopsis debilis var. *depressa* *

Caryophyllaceae

Corrigiola litoralis Strapwort *

Petrorhagia dubia Velvet pink *

Silene gallica L. var. *gallica* French catchfly *

Spergula pentandra Five Anther Spurry *

Spergularia marina Lesser Sea-spurrey *

Spergularia rubra Sand Spurry *

Chenopodiaceae

Chenopodium album Fat Hen *

Chenopodium murale Nettle-leaf Goosefoot *

Crassulaceae						
Crassula natans var. *minus* Swamp Stonecrop	*					
Cyperaceae						
Isolepis hystrix Awned Club-rush	*					
Isolepis marginata Coarse Club-rush	*					
Euphorbiaceae						
Croton setiger Doveweed	*					
Fabaceae						
Medicago laciniata Cutleaf Medic	*					
Medicago littoralis Strand Medic	*					
Medicago minima Small Burr Medic	*					
Ornithopus sativus French Serradella	*					
Trifolium arvense var. *arvense* Hare's-foot Clover	*					
Trifolium repens var. *repens* White Clover	*					
Vachellia farnesiana Mimosa Bush	*					
Frankeniaceae						
Frankenia pulverulenta	*					
Gentianaceae						
Centaurium tenuiflorum Branched Centaury	*					
Iridaceae						
Gladiolus caryophyllaceus Wild Gladiolus	*					
Moraea miniata Two-leaf Cape Tulip	*					
Moraea setifolia Thread Iris	*					
Romulea rosea Guildford Grass	*					
Lamiaceae)						
Lamium amplexicaule Deadnettle	*					
Orobanchaceae						
Bartsia trixago Bellardia	*					
Parentucellia latifolia Common Bartsia	*					
Oxalidaceae						
Oxalis pes-caprae Soursob	*					

- **Papaveraceae**
  - *Fumaria capreolata* Whiteflower Fumitory *
- **Plumbaginaceae**
  - *Limonium sinuatum* Perennial Sea Lavender *
- **Poaceae**
  - *Aira cupaniana* Silvery Hairgrass *
  - *Avellinia michelii* *
  - *Avena barbata* Bearded Oat *
  - *Avena fatua* Wild Oat *
  - *Brachypodium distachyon* False Brome *
  - *Bromus diandrus* Great Brome *
  - *Bromus rubens* Red Brome *
  - *Ehrharta longiflora* Annual Veldt Grass *
  - *Eragrostis curvula* African Lovegrass *
  - *Gastridium phleoides* Nitgrass *
  - *Hordeum glaucum* Northern Barley Grass *
  - *Hordeum leporinum* Barley Grass *
  - *Lamarckia aurea* Goldentop *
  - *Lolium rigidum* Wimmera Ryegrass *
  - *Molineriella minuta* Small Hairgrass *
  - *Panicum antidotale* Giant Panic Grass *
  - *Pentameris airoides* False Hairgrass *
  - *Pentameris airoides* subsp. *airoides* *
  - *Pentameris pallida* *
  - *Vulpia muralis* Wall Fescue *
  - *Vulpia myuros* forma *megalura* Fox Tail Fescue *
  - *Vulpia myuros* forma *myuros* Rat's Tail Fescue *
- **Polygonaceae**
  - *Emex australis* Doublegee *
  - *Rumex pulcher* subsp. *woodsii* Fiddle Dock *
- **Primulaceae**

Lysimachia arvensis Pimpernel	*				
Resedaceae					
Reseda luteola Wild Mingonette	*				
Rubiaceae					
Galium murale Small Goosegrass	*				
Scrophulariaceae					
Verbascum virgatum Twiggy Mullein	*				
Zaluzianskya divaricata Spreading Night Phlox	*				
Solanaceae					
Solanum linnaeanum Apple of Sodom	*				
Tamaricaceae					
Tamarix parviflora Small-flowered tamarisk	*				
Zygophyllaceae					
Tribulus terrestris Caltrop	*				

DPaW FloraBase http://florabase.dpaw.wa.gov.au/search/advanced?family=&genus=&species=&infrasp=&author=&common=&constat=&current=&alien=y&ms=&id=&reference=&photo=&colour=&fltime=&habitat=&habit=&soiltype=&layer1=LGA&obj1=MOORA&layer-op=&type=1&page=1. Accessed February 2014

Atlas of Living Australia http://bie.ala.org.au/. Accessed February 2014

Australia's Virtual Herbarium http://avh.ala.org.au/. Accessed February 2014

Appendix

3

RCC VERGE NOTE

GUIDELINES FOR THE NOMINATION AND MANAGEMENT OF FLORA ROADS

FLORA ROAD NOMINATION FORM

APPENDIX 3A

GUIDELINES FOR THE NOMINATION AND MANAGEMENT OF FLORA ROADS

Introduction

The Flora Roads program began as an initiative of the Roadside Conservation Committee (RCC), as a means of encouraging road managers to protect and conserve roadside vegetation of high conservation value. Flora Roads highlight areas of high conservation flora as a tourist asset to local communities. These are easily identified to passing travellers as areas worthy of an inspection to view the local flora.

The Roadside Conservation Committee has defined Flora Roads as “those roads which have conservation value owing to the vegetation growing within the reserve”.

Principle Conservation Values of Flora Roads:

- 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 – trees, shrubs and herbs are present in woodlands, for example. 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;
  - provides a source of local seed for revegetation projects;
  - acts as a wildlife habitat for the protection of fauna;
  - harbours rare or endangered plants in the roadside;
  - may provide nest sites and refuges for native animals; and
  - may act as a biological corridor.

Identification and Nomination of Flora Roads

The RCC has been coordinating a volunteer roadside survey program since 1989, which provides a list of high conservation value roads within many Shires in the agricultural areas of this state. These roadsides can be investigated further to see if they warrant declaration as a Flora Road. Nevertheless, roadsides that have not been surveyed may still be nominated.

Any person may suggest to the managing authority or to the RCC that a road or a section of road fits the criteria of a Flora Road. However, only the managing authority in whom care, control and management of the road is vested can officially declare it a Flora Road.
A road may be nominated as a Flora Road by submitting a written request to the RCC. The RCC requires the following information:

- endorsement from the managing authority;
- name of the road, Local Government Authority, and the road manager (MRWA, Local Government or CALM);
- distance of the proposed Flora Road; and
- width of the road reserve.

The following information would also be useful:

- photograph(s) of the road;
- a list of the dominant plant species; and
- threats such as weeds, disturbances, etc.

This information is stored in the RCC Flora Roads Register, a database that is maintained by the RCC Technical Officer.

Establishment of a Flora Road

Given that only the managing authority can officially declare a road, or section of road as a Flora Road, it is important to have the support of the road manager.

The RCC will provide two Flora Road signs to the managing authority. The signs are in the tourist sign colours of white letters and symbols on a leaf brown background. It is the responsibility of the managing authority to erect the signs, and to provide signposts, auxiliary signs and carry out maintenance. One sign may be placed at each approach to the area.

Management Implications

A standard sign was developed by Main Roads WA in the late 1980's; a policy for the erection of Flora Road signage was developed shortly afterwards.

Part 16 of the RCC *Roadside Manual* details the establishment and management of Flora Roads. The RCC's *Guidelines for Managing Special Environment Areas in Transport Corridors* and the *Roadside Handbook* also provides information on Flora Road establishment.

The aim of all management should be to minimise any disturbance to the roadside flora, consistent with the provision of a safe and efficient roadway.

The managing authority will be expected to take into consideration the high conservation values present, and take special care when working within the Flora Road road reserve and the surrounding area. More specifically though;

- council may choose to adopt a policy on Roadside Conservation;
- environmental assessments (pre-construction checklists) should be completed prior to any upgrade 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; and
- where rehabilitation is contemplated, local native species should always be used.

Tourism Implications

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;
- eventually showing all Flora Roads on a map of the region or State;
- using specially designed signs to delineate the Flora Road section; and
- constructing roadside flora rest areas where people can get out and enjoy the flora. Walk trails could be made from these, and information brochures produced. The RCC has established links with the W.A. Tourism Commission for inclusion on wildflower tourist publications.

Flora Road Register

To ensure that knowledge of Flora Roads sites does not get lost, due perhaps to staff changes, the RCC has established a Flora Roads Register. Information pertaining to each Flora Road (i.e. road name, location, length, etc) will be stored in the Flora Roads database, and updated as necessary.

In order to plan roadworks so that these important areas of roadside vegetation are not disturbed, road managers should also know of these areas. Therefore, it is suggested that the Managing Authority establishes a *Register of Roads Important for Conservation* also. This register should be consulted prior to any works being initiated in the area.

Roadside Conservation Committee

APPENDIX 3B - FLORA ROAD NOMINATION FORM

For enquiries phone 9334 0423

Name of person making nomination: _____

Date: _____

Contact details:

Phone: _____

Fax: _____

Email: _____

Postal address: _____

_____

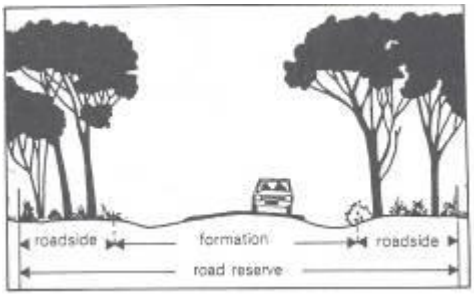
_____

General Information:

Road Name: _____

Locality: _____

Shire: _____



Road Reserve Details:

Length of road section (km): _____

Width of roadside vegetation (m): _____

Width of road reserve (m): _____

Condition of vegetation: _____

_____

Vegetation Type (E.g. types of trees, shrubs or annuals): (if known)

_____

_____

Is the road close to a Main road or Highway? (Please name) _____

_____

Have RCC roadside surveys been carried out previously? _____

Are there other values are present? (i.e. landscape, cultural, tourism, historic, etc) _____

_____

_____

Other information/comments: _____

_____

Please include photos if possible. Photos should show the road as part of a landscape rather than just close ups of particular plant species.

To nominate a Flora Road, please fill in this form and send to the Roadside Conservation Committee

Post- Locked Bag 104, Bentley Delivery Centre, Bentley, WA 6983.
Fax- (08) 9334 0199.
Email- rcc@dec.wa.gov.au

Appendix

4

MOORA FLORA DRIVES PAMPHLET

The salt lake system more or less overlies the Darling Fault. Samphires are especially adapted to grow in very saline soil. Their fleshy, jointed stems store fresh water collected during the rainy season.

The road now climbs up the Darling Escarpment, where the ancient rocks outcrop and the vegetation changes abruptly from kwongan to woodland of York Gum and mallee.

6. Eagle Hill Road to Jingemia Cave. 5 km.

An attractive winding road leads to a pleasant shady picnic site on Jingemia Hill (still in Watheroo National Park). A short walking trail leads to Jingemia Cave. It is formed in chert, an unusual rock which leads to a vegetation community on the hill that is very different from the surrounding areas.

In winter and spring you will find numerous orchids under the mallees, while later on in the year everlastings appear. Among the tumbled boulders around and above the cave are a number of attractive and unusual plants including the felty grey leaves and glorious scarlet flowers of Compact Poverty Bush.

7. Midlands Road.

For much of the way the road follows the Midlands Railway, which was an important influence in opening the land for settlement.

You will see several magnificent mature trees of Salmon Gum, York Gum and Wandoo.

Look out for the glorious Lilac Hibiscus, (especially just North of Coomberdale) from whose spindly stems enormous pale flowers appear in late spring.

Lilac Hibiscus

Cairn Hill is a chert outcrop south of Coomberdale which is covered with dense scrub dominated by wattles, sheoak and dryandras, with many interesting understorey plants. A small track crosses the railway and you will find many unusual plants on the edges of regenerating quarry areas.

Approaching Moora the road passes between a superb avenue of native trees, one of the most magnificent natural roadside avenues to be found anywhere in the world.

REMEMBER THE COUNTRY CODE!

Take nothing but photographs

Leave nothing but footprints.

TRAFFIC SAFETY

When stopping by the roadside, signal your intentions in plenty of time to alert the following traffic.

Do not park on crests or curves, or where traffic visibility is poor.

If crossing a road, keep control of children and pets.

BEST TIMES FOR TRAVEL

Most wildflowers are at their best from August to January, although there is something in flower all the year round.

FACILITIES AVAILABLE

MOORA: Food, fuel, motels, hotels, caravan park and medical services.

WATHEROO: Food, fuel, hotel.

FURTHER INFORMATION

For further information please contact:

Moora Tourist Information Centre
Shire Office Moora 6510
Telephone: (096) 51 1401

and

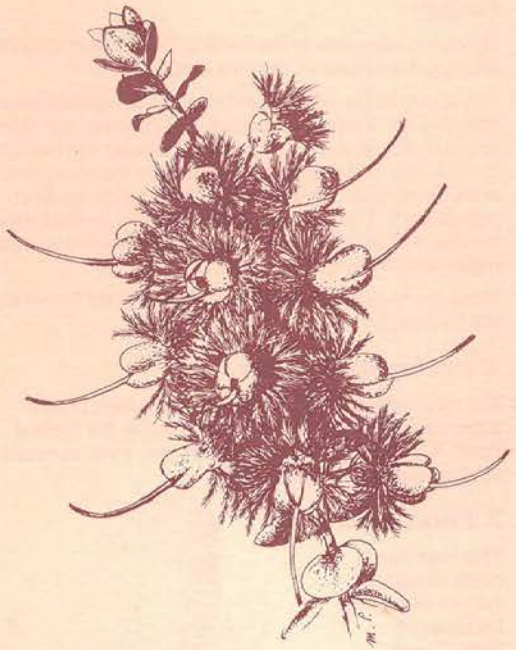
Vehicle Service Stations in Moora.

Produced by the Department of Conservation and Land Management in consultation with the Shire of Moora.

0719-0689-2m

Drawings by Margaret Pieroni.

Moora Wildflower Drive



Scarlet Featherflower

Roadside Conservation Committee

c/- P.O. Box 104 COMO W.A. 6152

Moora - Heart of the Midlands!

Like Australian plants?

Moora stands on the junction of two important - and very different - Botanical Districts, where the underlying geology has produced different soil types and so very different plant communities.

Pause awhile to study the differences.

Geology

Moora lies very close to the Darling Fault, a very important geological boundary in Western Australia.

To the east lie the very ancient rocks (2,000 million years or more!) of the Western Australian Shield, one of the oldest land surfaces on earth. It has fertile red soils and has largely been cleared for farming. To the west are the younger rocks of the Dandaragan Plateau, covered with poor sandy or gravelly soils. The fault line itself is marked by the course of the Moore River. This drive is designed to show you these regions and their plants.

There are many other attractive routes around Moora for you to discover!

1. Dandaragan Rd 9 km

The road crosses the Moore River, which here trends southward following the trough formed by the Darling Fault. A few York Gums and, to the west, some remnant Banksia woodland can be seen.

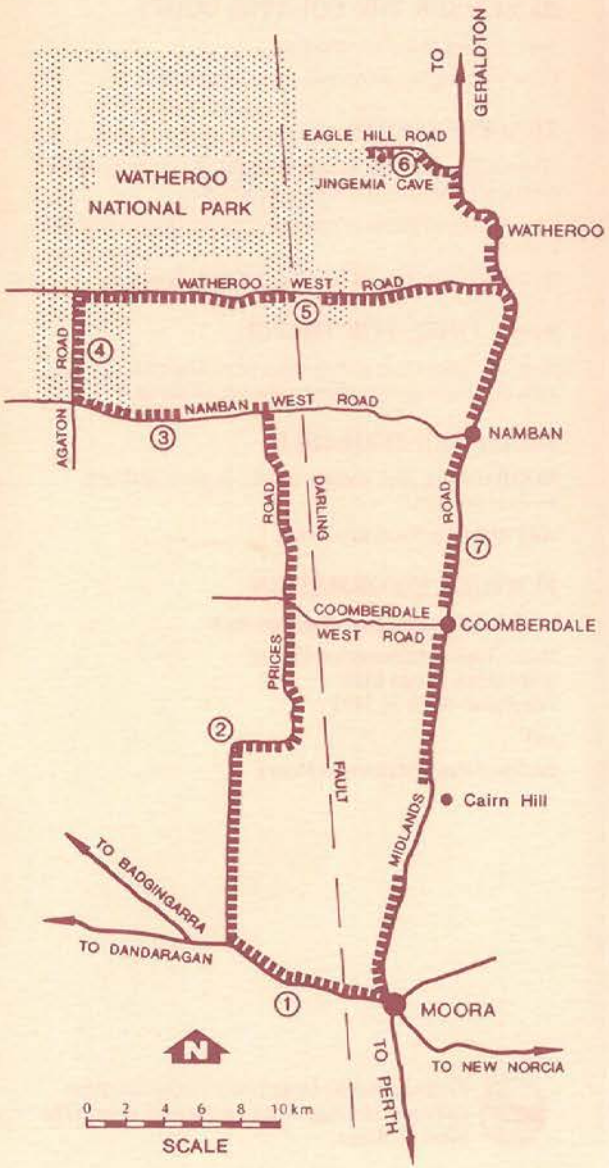
2. Prices Road. 31 km

Burdett's Banksia

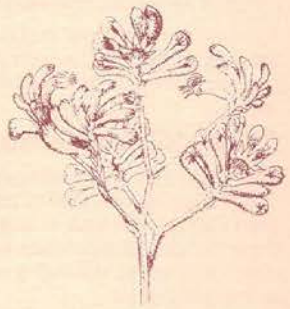
This road travels north along the eastern edge of the Dandaragan Plateau, with some good views east across the trough line of the Darling Fault.

Originally this sandy soil would have supported a dense prickly heath the Aboriginals called "kwongan". This can be seen in places where the wider road reserve has preserved it from clearing.

In winter and early spring look for bright masses of wattle and blue Dampiera, but as summer approaches, the colours change to orange Eremaeas, yellow Kangaroo Paws and pink and white Feather Flowers, all backed by the gentle waving grey of Smokebush.



The occasional WA Christmas Tree makes a brilliant show in December. Try photographing them with a polaroid filter against a clear blue sky - magnificent!



Yellow Kangaroo Paw

3. Namban West Road. 10 km

Soon after crossing a salt area note the magnificent stand of Saltmarsh Honey Myrtle which can grow in salty soils. It is an excellent windbreak and wildlife refuge and in early summer is smothered with small cream bottlebrush flowers.

4. Agaton Road. 6 km.

Watheroo National Park, which lies on either side of the road, contains superb examples of kwongan, one of the most diverse plant communities in the world. Feather flowers, including Scarlet Feather-Flower, and the extraordinary Bush Cauliflower - at its best in December - are a feature, and there are many myrtles, Dryandras and six different Banksias. In late summer look out for the spectacular white sprays on the Woody Pear trees. Their huge pear-shaped fruits open after fire to release two papery winged seeds.

Lambswool

5. Watheroo West Road. 28 km.

The road continues through the National Park, which here is low woodland dominated by plants of the Banksia and Myrtle families, among which the fluffy white balls of Lambswool can be seen in spring.

In some areas dense thickets of wattles form a glorious yellow hedge in spring.

Appendix

5

THREATENED FLORA DEFINITIONS

APPENDIX 5

THREATENED FLORA DEFINITIONS

What is Threatened Flora (Declared Rare Flora)?

- Flora that is likely to become extinct, is rare or in need of special protection
- Protected under the Wildlife Conservation Act 1950
- Ministerial permission required to 'take' Threatened Flora
- 415 species listed as Threatened Flora in Western Australia
- 21 Threatened Flora species known to occur within the Shire of Moora

  Threatened Flora is further divided into 3 categories *(International Union for Conservation of Nature (IUCN) Criteria):*
  - Critically Endangered – Extremely high risk of extinction in the wild
  - Endangered – Very high risk of extinction in the wild
  - Vulnerable – High risk of extinction in the wild

What is Priority Listed Flora?

- Flora that could potentially meet the criteria for Threatened Flora however is poorly known and in need of further survey
- 2974 species of priority flora in WA, 72 in the Shire of Moora
- Priority 1 Species
  - Known from one or few collections or locations (generally less than 5 populations), all on lands not managed for conservation. e.g. agricultural land, urban areas, Shire and Main Roads land, road and rail reserves or active mineral leases which are under immediate threat from known threatening processes and are in urgent need of further survey.
- Priority 2 Species
  - Known from one or few collections or locations some of which are on lands not under immediate threat of habitat destruction or degradation, eg. e.g. national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but need further survey and appear to be under threat from known threatening processes.
- Priority 3 Species
  - Known from several populations (generally more than 5) The known populations are protected, widespread or large. In need of further survey.
- Priority 4 Species

  (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.
  (b) Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
  (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
- Priority 5 Species

  Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened in five years.

Department of Parks and Wildlife (2014) http://florabase.dpaw.wa.gov.au/search/advanced

Department of Parks and Wildlife, (2014) Conservation Codes for Western Australian Flora and Fauna http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation_code_definitions_18092013.pdf

Appendix

6

LANDSCOPE ARTICLE ON THE COOMBERDALE CHERT HILLS THREATENED ECOLOGICAL COMMUNITY

APPENDIX 6

LANDSCOPE ARTICLE ON THE COOMBERDALE CHERT HILLS THREATENED ECOLOGICAL COMMUNITY

endangered

by Jill Pryde

Unique bushland on chert

A very distinctive vegetation occurs on a narrow band of low rocky hills between Moora and Watheroo. It is only found associated with exposed ridges and gravelly slopes of a type of rock known as 'Coomberdale (Noondine) chert'. This threatened ecological community's composition varies with soil depth and subsurface rock. On the upper slopes vegetation sub-types include tammar *(Allocasuarina campestris), Allocasuarina microstachya, Regelia megacephala* and *Xanthorrhoea drummondii* shrublands, *Kunzea praestans* scrublands and *Melaleuca calyptroides* and *Hibbertia subvaginata* heath.

Downslope the vegetation changes to desert gum mallee *(Eucalyptus eudesmoides)*, rock sheoak woodlands *(Allocasuarina huegeliana)* and jam *(Acacia acuminata)* low woodlands. These sub-types are considered to represent the 'core' areas of this threatened ecological community.

The community contains 12 'declared rare' or 'priority flora', including *R. megacephala*, that are either totally or largely confined to the chert hills. The distinctive *R. megacephala* with its dark green foliage and deep red flowers is found only on the tops of the ridges where chert is exposed and the soil is generally very shallow. The more common tammar shrubland occurs downslope or in deeper soils.

Chert is a flint-like form of quartz, and is a variety of silica. This rock type is valued for its high quality quartz which is mined mainly for silicon. The largest and most extensive outcrop of the Coomberdale chert occurs between Coomberdale and Dalaroo (a range of about 12 kilometres), mostly on private land. Only two areas of the Coomberdale chert threatened ecological community are in conservation reserves—Cairn Hill Nature Reserve and Watheroo National Park—at the northern-most end of its range.

The chert vegetation has a total range of about 42 kilometres, and is known from 10 main patches that cover about 750 hectares. Almost all occurrences are surrounded by agricultural land, many with little or no bushland buffer. Major threats include clearing for mining and other uses, grazing, weed invasion, altered fire regimes, and potentially hydrological change. It was ranked 'endangered' in 2001 due to restricted distribution and threats.

The recovery plan for the community is currently being updated, including a more comprehensive description based on recent detailed vegetation and condition mapping. The updated plan will help to determine future conservation priorities for the Coomberdale chert community. Recovery will require close collaboration with land managers, and some occurrences of this community have already been fenced by landowners to help protect the unique vegetation.

Photos by Jill Pryde

(Department of Parks and Wildlife, Landscope magazine, Spring 2011 issue Vol 27 No.1 pg. 39)

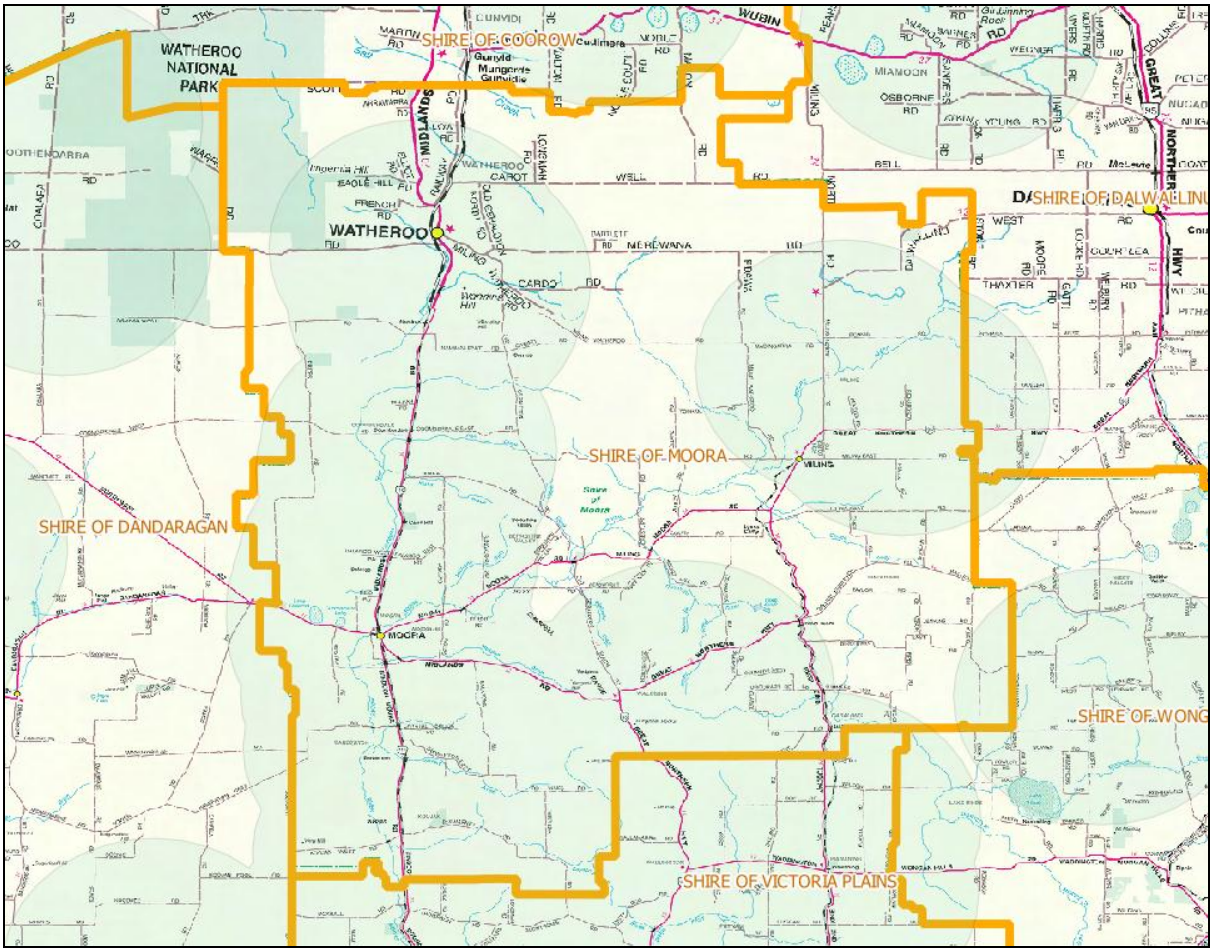
Appendix

7

MAP OF CARNABY'S COCKATOO BREEDING AREAS

APPENDIX 7

CARNABY'S COCKATOO BREEDING AREAS



Carnaby's Cockatoo breeding areas with 12m buffer

Department of Environment and Conservation (2011). *Carnaby's cockatoo breeding areas confirmed within the Swan Coastal Plain and Jarrah Forest IBRA Regions*.

Appendix

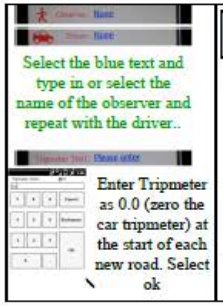
8

OVERVIEW OF SURVEY PROGRAM

(HANDHELD DEVICES - SCREEN SHOTS)

ROADSIDE CONSERVATION VALUE (RCV) SURVEY PROGRAM
Handheld Devices

START TAB



Select the blue text and type in or select the name of the observer and repeat with the driver..

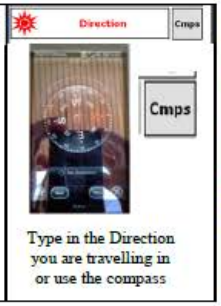
Enter Tripmeter as 0.0 (zero the car tripmeter) at the start of each new road. Select ok

Enter the road name and start location/ intersection using the qwerty keyboard

QWERTY keyboard

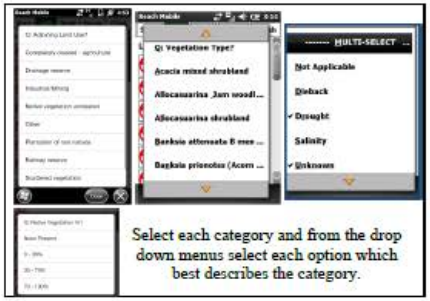
Select the name of the shire from the drop

Select the road reserve width from the drop down menu



Type in the Direction you are travelling in or use the compass

LEFT AND RIGHT TAB



Select each category and from the drop down menus select each option which best describes the category.

Select either yes or no.

Fill out the right tab the same as for the left OR select copy from left if it's the same and change individual categories.

WEED TAB

Select the amount of weed observed

Finished Tab

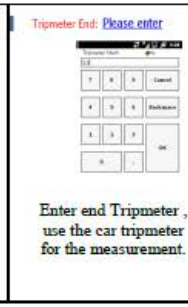
Select Additional Weeds

Select the additional weed from the drop down menu and then the amount present

FINISH TAB

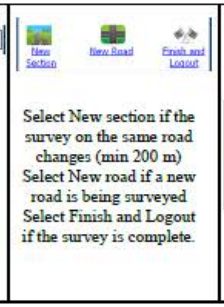
A photo of the road or specific plants can be taken using the camera button

Comments can be entered using the QWERTY keyboard



Enter end Tripmeter , use the car tripmeter for the measurement.

Enter the end location/ intersection using the qwerty keyboard



Select New section if the survey on the same road changes (min 200 m) Select New road if a new road is being surveyed Select Finish and Logout if the survey is complete.

Selected options for the survey can be copied into a new section.

Select the option from the menu that appears after Finish and logout has been chosen.

Switch off the device once data has been sent

Appendix

9

SUMMARISED SURVEY SHEET

SHOWING SAMPLE ROADS AND EXPLANATION OF FIELDS USED TO CALCULATE ROADSIDE CONSERVATION VALUES

APPENDIX 9 - SUMMARISED SURVEY SHEET FOR A SMALL SELECTION OF ROADS IN THE SHIRE

(NB: The full survey sheet showing all fields and attributes that were surveyed for each section of each road is included in the attached CD)

Road Name	Road Number	Section #	OD Start	OD End	Distance	Direction	Intersection		Width of Vegetation		Extent of Vegetation		# of Native Plant Species		General Weeds		Native Vegetation		Habitat Features		Conservation Value Score (0-12)		Dominant Weeds Combined	Additional Weeds Combined	Comments
			(km)	(km)	(km)		Start	End	L	R	L	R	L	R	L	R	L	R	L	R	L	R			
Airstrip	5100038	1	0	0.2	0.2	S	Dandaragan Rd		1-5	1-5	1	1	1	1	2	2	2	2	3	3	8	4	AfricanLovegrass Wild Radish	Lupin Capeweed E_Sts_Eucs	quandong
Airstrip	5100038	2	0.2	0.6	0.4	S			1-5	1-5	0	2	0	2	1	2	1	2	2	3	11	6	AfricanLovegrass Wild Radish	Capeweed Gazania Soursob E_Sts_Eucs	
Airstrip	5100038	3	0.6	0.9	0.3	S			1-5	1-5	0	1	0	1	1	2	1	2	2	3	9	4	AfricanLovegrass Wild Radish	Capeweed E_Sts_Eucs Gazania	Sandplain cypress 0.8km
Airstrip	5100038	4	0.9	1.1	0.2	S		Rubbish Tip Rd	1-5	1-5	1	1	1	1	1	2	1	2	2	2	7	4	AfricanLovegrass	E_Sts_Eucs Gazania	Sandplain cypress
Airstrip	5100038	5	1.1	1.3	0.2	S	Rubbish Tip Rd		1-5	1-5	1	1	1	1	1	2	2	2	2	2	10	10	AfricanLovegrass		
Airstrip	5100038	6	1.3	1.9	0.6	S			1-5	1-5	1	1	1	1	2	2	2	2	2	2	10	10	AfricanLovegrass Wild Radish	Capeweed Ann Grass	
Airstrip	5100038	7	1.9	2.2	0.3	S			1-5	1-5	1	1	0	0	0	0	2	2	2	2	6	8	AfricanLovegrass Wild Radish	Capeweed Nightshade Ann Grass Wild Oats Sowthistle	
Airstrip	5100038	8	2.2	2.5	0.3	S			1-5	1-5	1	1	0	0	2	2	2	2	2	2	8	8	Wild Radish	Capeweed Ann Grass Soursob Stinking Roger	
Airstrip	5100038	9	2.5	2.9	0.4	S			1-5	1-5	1	1	1	0	2	2	2	2	2	2	7	7	Wild Radish	Capeweed Ann Grass	gravel pit rhs 2.7km
Airstrip	5100038	10	2.9	3.1	0.2	S			1-5	Unknown	0	1	0	0	2	2	2	2	2	2	8	7	Wild Radish	Capeweed Ann Grass Soursob	banksia ground cover
Airstrip	5100038	11	3.1	3.3	0.2	S			1-5	Unknown	0	1	0	0	0	0	2	2	2	3	3	2	Wild Radish	Ann Grass Soursob Couch	
Airstrip	5100038	12	3.3	3.7	0.4	S		Webb Moora Rd	1-5	Unknown	1	1	0	1	2	2	2	2	2	3	8	9		Ann Grass	
Airstrip	5100038	13	3.7	4.1	0.4	S	Webb Moora Rd		1-5	1-5	0	0	0	0	0	0	1	1	2	2	8	5		Ann Grass Capeweed	Verticordia at 4.1
Airstrip	5100038	14	4.1	4.2	0.1	S			1-5	1-5	1	1	1	1	2	2	2	2	2	2	8	6		Ann Grass Capeweed	Sandplain cypress 4.2
Airstrip	5100038	15	4.2	4.4	0.2	S			Unknown	1-5	2	2	1	1	2	2	2	2	3	3	7	5		Ann Grass Capeweed	Sandplain cypress 4.2
Airstrip	5100038	16	4.4	4.5	0.1	S			1-5	1-5	1	0	1	0	2	1	2	2	1	2	1	3		Ann Grass Capeweed	

Road Name	Road Number	Section #	OD Start	OD End	Distance	Direction	Intersection		Width of Vegetation		Extent of Vegetation		# of Native Plant Species		General Weeds		Native Vegetation		Habitat Features		Conservation Value Score (0-12)		Dominant Weeds Combined	Additional Weeds Combined	Comments
			(km)	(km)	(km)		Start	End	L	R	L	R	L	R	L	R	L	R	L	R	L	R			
Boundary Rd	5100051	1	0.00	2.40	2.40	N	Koojan Pool Rd	Koojan West Rd	>20	>20	2	2	2	2	2	2	2	2	1	1	10	11	Veldt Grass	Capeweed	birds, grevillea, banksia, Christmas tree woolly bush, grass trees, stirlingia, ntv tea tree, dwarf sheoak
Boundary Rd	5100051	2	2.40	2.90	0.50	N	Koojan West Rd		>20	>20	2	2	2	2	2	2	2	2	1	1	10	10	Veldt Grass	Capeweed	Euc todtiana, WA ntv teatree
Boundary Rd	5100051	3	2.90	4.40	1.50	N			>20	>20	2	2	2	2	2	2	2	2	1	1	10	10	Veldt Grass	Capeweed VicTeatree	teatree, peas, dryandra, dwarf sheoak, 3.7 Euc falcata?, sheoak 3.9,verticordia, adenanthos, banksia
Boundary Rd	5100051	4	4.40	4.60	0.20	N			Unknown	>20	2	2	2	2	2	2	2	2	3	3	12	12		Capeweed Wild Pines	banksia hookeriana, B. attenuata, B. menzesii, B. prionotes
Boundary Rd	5100051	5	4.60	5.20	0.60	N			>20	>20	2	2	2	2	2	2	2	2	2	3	11	12		Capeweed Wild Pines	banksia spherocarpha, hakea trifurcata, flame grevillea, Euc todtiana, gravel pit both sides 5.2, pine plantation ended 5.0
Boundary Rd	5100051	6	5.20	5.80	0.60	N			>20	>20	2	2	2	2	2	2	2	2	1	1	10	10			dwarf sheoak, hakea, myrtaceae sps, peas, synaphea
Boundary Rd	5100051	7	5.80	6.10	0.30	N			>20	>20	2	0	1	0	1	0	2	2	1	1	8	4	FountainGrs Spiny Rush Veldt Grass		ntv teateee & vic tea tree, sheoak, large infestation of bamboo on right, planted eucalypts
Boundary Rd	5100051	8	6.10	6.40	0.30	N			>20	>20	2	2	2	2	2	2	2	2	1	1	10	10	Veldt Grass		ntv teatree, banksia prionotes, acacia, flame grevillea, sheoak, myrtaceae
Boundary Rd	5100051	9	6.40	7.60	1.20	N			>20	>20	2	2	2	2	2	2	2	2	1	1	10	10	Veldt Grass		ntv teatree, banksia prionotes, sheoak, myrtaceae, lechenaultia linarioides, grass trees, native grasses, hakea, echidna noted in August survey

Boundary Rd	5100051	10	7.60	8.20	0.60	N			>20	>20	2	2	2	2	2	2	2	2	1	1	10	10	Veldt Grass		ntv teatree, banksia, dwarf sheoak, myrtaceae, native grasses, calothamnus, dryandra carlionoides, blue leaved pea, flame grevillea
Boundary Rd	5100051	11	8.20	8.60	0.40	N			>20	>20	0	2	0	1	1	2	2	2	1	1	5	9	Veldt Grass		banksia prionotes, B. hookeriana, B. attenuata, ntv tea tree
Boundary Rd	5100051	12	8.60	8.90	0.30	N			>20	>20	2	2	1	1	2	2	2	2	1	1	9	9	Veldt Grass		banksia prionotes, hookeriana, attenuata, ntv tea tree, pine @8.9

Key to table interpretation:
Road Name: Official 'Road Name' on Main Roads WA database are (NB Sometimes local names or the signposted name is different).
Road Number: Official 'Road Number' assigned by Main Roads WA.
Section#: Roads are surveyed chronologically in sections. When there is a change in roadside attributes, a new section is started.
OD Start/Finish: Odometer reading for t
he section start and finish points.
Distance: Distance between the OD start and OD finish for each section. It is the length of the section.
Direction: Main Roads WA direction of the road and generally the direction travelled by the surveyors when assessing the roadside.
Intersection: Cross road at start or end of section.

The following attributes are ranked from 0 (lowest level) to 1, 2 or 3 (highest level) as per the descriptions below on the left and right sides of the road.
Width of Vegetation: Vegetation alongside the road to the fenceline line. 0-5m (scores 0), greater than 5m (scores 1)
Extent of Vegetation: Proportion of native vegetation in the roadside. Scores 0 for 0-30%, 1 for 30-70%, 2 for greater than 70%
#Native Plant Species: Diversity of native plants species in the roadside. Scores 0 for 0-5 species, 1 for 6-19 species, 2 for 20 or more species
General Weeds: Level of weed infestation (lower scores indicate higher levels of weed infestation) Score 0 for greater than 70%, 1 for 30-70%, 2 for 0-30% weed cover.
Native Vegetation: Number of native vegetation layers present (ie) tree, shrub and/or ground cover layers. Scores 0 for no layer, 1 for 1 layer, 2 for 2 or more layers.
Habitat Features: Number of roadside vegetation attributes present that are important for fauna habitat or biodiversity. Eg. Connects uncleared areas, hollow logs, tree hollows, flowering shrubs and environmentally sensitive areas. Score 1 for each feature up to maximum of 3.

Conservation Value Score: Tally of the scores for the 6 attributes described above. This is the score which is shown on the map. 0-4 Low conservation, 5-6 Medium Low Conservation, 7-8 Medium High Conservation, 9-12 High Conservation.

Dominant Weeds: Weeds chosen by shire staff and/or natural resource management group members to target. Weed overlays are provided for these species.
Other Weeds: Additional Weeds noted during the survey.
Comments: Any additional comments or information noted during the survey.

Appendix 10

ADDITIONAL WEED DATA AND GRAPHS

APPENDIX 10A

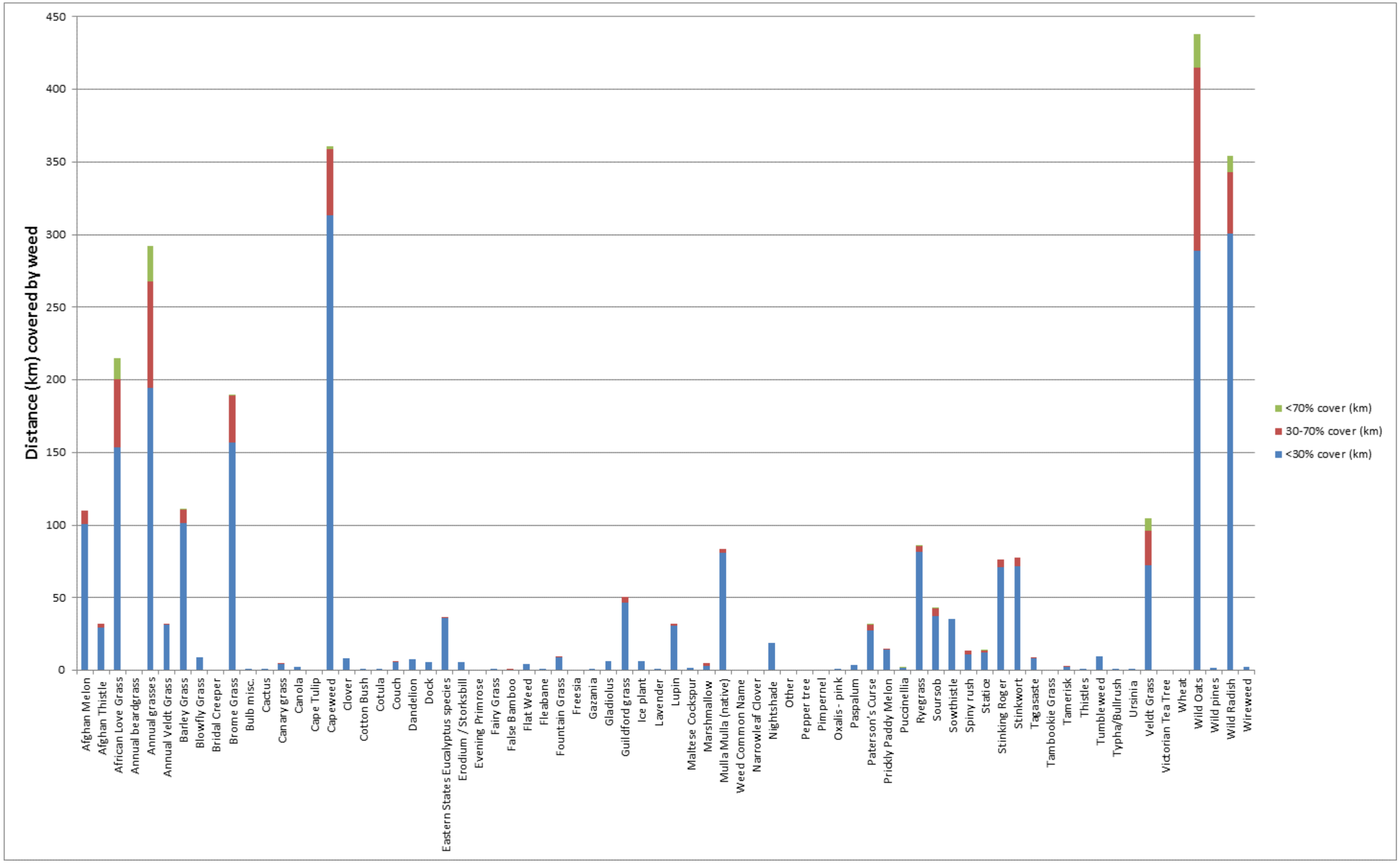
LIST OF ADDITIONAL WEEDS RECORDED ON SHIRE OF MOORA ROADSIDES DURING THE 2011-2013 ROADSIDE SURVEYS

Weed Common Name	<30% cover (km)	30-70% cover (km)	<70% cover (km)	Total (km)
Afghan Melon	100.8	8.9		109.7
Afghan Thistle	29.7	2.1		31.8
African Love Grass	153.6	46.5	14.6	214.7
Annual beardgrass	0.4			0.4
Annual grasses	194.5	73.4	24.2	292.1
Annual Veldt Grass	31.1	0.5		31.6
Barley Grass	101.7	8.9	0.2	110.8
Blowfly Grass	9.3			9.3
Bridal Creeper	0.3			0.3
Brome Grass	157	32.3	0.1	189.4
Bulb misc.	1.1			1.1
Cactus	1			1
Canary grass	4.2	0.6		4.8
Canola	2.5			2.5
Cape Tulip	0.2			0.2
Capeweed	313.5	45.5	1.8	360.8
Clover	8.4			8.4
Cotton Bush	0.8			0.8
Cotula	1.1			1.1
Couch	5.9	0.2		6.1
Dandelion	7.7			7.7
Dock	5.5			5.5
Eastern States Eucalyptus species	36.3	0.3		36.6
Erodium / Storksbill	5.9			5.9
Evening Primrose	0.3			0.3
Fairy Grass	1			1
False Bamboo	0.3	0.3		0.6
Flat Weed	4.4			4.4
Fleabane	1.1			1.1
Fountain Grass	8.9	1		9.9
Freesia	0.2			0.2
Gazania	1.2			1.2
Gladiolus	6.2			6.2
Guildford grass	46.9	3.6		50.5
Ice plant	6.2			6.2
Lavender	1.1			1.1
Lupin	31	1		32
Maltese Cockspur	1.6			1.6
Marshmallow	3.3	1.6		4.9
Mulla Mulla (native)	80.8	2.8		83.6

Weed Common Name	<30% cover (km)	30-70% cover (km)	<70% cover (km)	Total (km)
Narrowleaf Clover	0.1			0.1
Nightshade	19.1			19.1
Other	0.3			0.3
Pepper tree	0.4			0.4
Pimpernel	0.3			0.3
Oxalis - pink	0.9			0.9
Paspalum	3.9			3.9
Paterson's Curse	27.5	4.2	0.7	32.4
Prickly Paddy Melon	14	0.4		14.4
Puccinellia	1.5		0.4	1.9
Ryegrass	81.3	4	1	86.3
Soursob	37.6	5.1	0.4	43.1
Sowthistle	35.1			35.1
Spiny rush	11	2.7		13.7
Statice	12.3	1.4	0.4	14.1
Stinking Roger	71.3	4.9		76.2
Stinkwort	72	5.7		77.7
Tagasaste	8.1	0.7		8.8
Tambookie Grass	0.2			0.2
Tamerisk	2.7	0.6		3.3
Thistles	0.8			0.8
Tumbleweed	9.5			9.5
Typha/Bullrush	1.3			1.3
Ursinia	1.3			1.3
Veldt Grass	72.4	23.8	8.5	104.7
Victorian Tea Tree		0.3		0.3
Wheat	0.6			0.6
Wild Oats	288.5	126.1	23.6	438.2
Wild pines	1.5			1.5
Wild Radish	300.6	42.3	11.3	354.2
Wireweed	2.1			2.1

GRAPH SHOWING ALL WEEDS RECORDED ON SHIRE OF MOORA ROADSIDES DURING THE 2011-2013 ROADSIDE SURVEY

**Graph shows distance of roadside each weed was recorded along and the degree of infestation:
less than 30%, 30-70% or greater than 70%**



APPENDIX 10B

WEEDS RECORDED ON SHIRE OF MOORA ROADSIDES IN PRIORITY ORDER FROM WIDEST SPREAD WEEDS TO MINOR OCCURANCE WEEDS

(Does not indicate priority to control - some of the weeds with small infestations may be problem weeds which could be removed relatively easily)

Weeds covering greater than 20km of roadside

Weed Common Name	<30% cover (km)	30-70% cover (km)	<70% cover (km)
* Wild Oats	288.5	126.1	23.6
* Capeweed	313.5	45.5	1.8
* Wild Radish	300.6	42.3	11.3
Annual grasses	194.5	73.4	24.2
* African Love Grass	153.6	46.5	14.6
Brome Grass	157	32.3	0.1
Barley Grass	101.7	8.9	0.2
Afghan Melon	100.8	8.9	
* Veldt Grass	72.4	23.8	8.5
Ryegrass	81.3	4	1
Mulla Mulla (native)	80.8	2.8	
* Stinkwort	72	5.7	
Stinking Roger	71.3	4.9	
Guildford grass	46.9	3.6	
Soursob	37.6	5.1	0.4
Eastern States Eucalyptus species	36.3	0.3	
Sowthistle	35.1		
* Paterson's Curse	27.5	4.2	0.7
* Lupin	31	1	
Afghan Thistle	29.7	2.1	

Weeds covering 5-20km of roadside

Weed Common Name	<30% cover (km)	30-70% cover (km)	<70% cover (km)
Nightshade	19.1		
Prickly Paddy Melon	14	0.4	
Statice	12.3	1.4	0.4
Spiny rush	11	2.7	
* Fountain Grass	8.9	1	
Tumbleweed	9.5		
Blowfly Grass	9.3		
* Tagasaste	8.1	0.7	
Clover	8.4		
Dandelion	7.7		
* Gladiolus	6.2		
Ice plant	6.2		
Couch	5.9	0.2	
Erodium / Storksbill	5.9		

Dock	5.5		

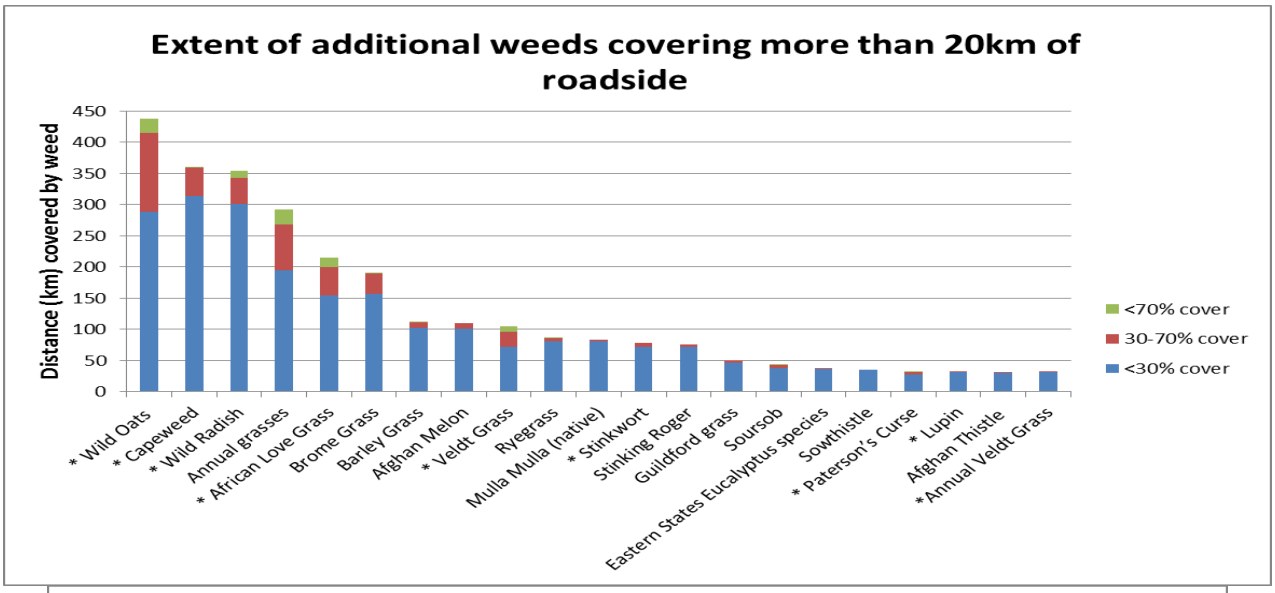
Weeds covering less than 5km of roadside

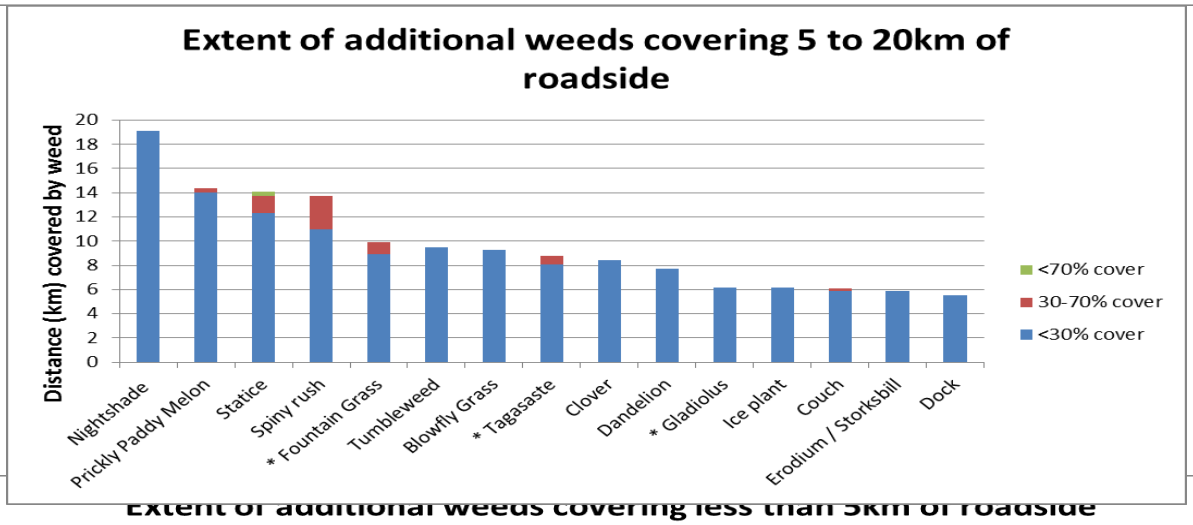
Weed Common Name	<30% cover (km)	30-70% cover (km)	<70% cover (km)
Marshmallow	3.3	1.6	
Canary grass	4.2	0.6	
Flat Weed	4.4		
Paspalum	3.9		
Tamerisk	2.7	0.6	
*Canola	2.5		
Wireweed	2.1		
Puccinellia	1.5		0.4
Maltese Cockspur	1.6		
* Wild pines	1.5		
Typha/Bullrush	1.3		
Ursinia	1.3		
* Gazania	1.2		
* Bulb misc.	1.1		
* Lavender	1.1		
Cotula	1.1		
Fleabane	1.1		
Cactus	1		
Fairy Grass	1		
Oxalis - pink	0.9		
* Cotton Bush	0.8		
Thistles	0.8		
*False Bamboo	0.3	0.3	
Wheat	0.6		
Annual beardgrass	0.4		
Pepper tree	0.4		
* Bridal Creeper	0.3		
* Evening Primrose	0.3		
Other	0.3		
Pimpernel	0.3		
* Victorian Tea Tree		0.3	
* Cape Tulip	0.2		
* Freesia	0.2		
*Tambookie Grass	0.2		
Rough Dogs Tail Grass	0.1		
Narrowleaf Clover	0.1		

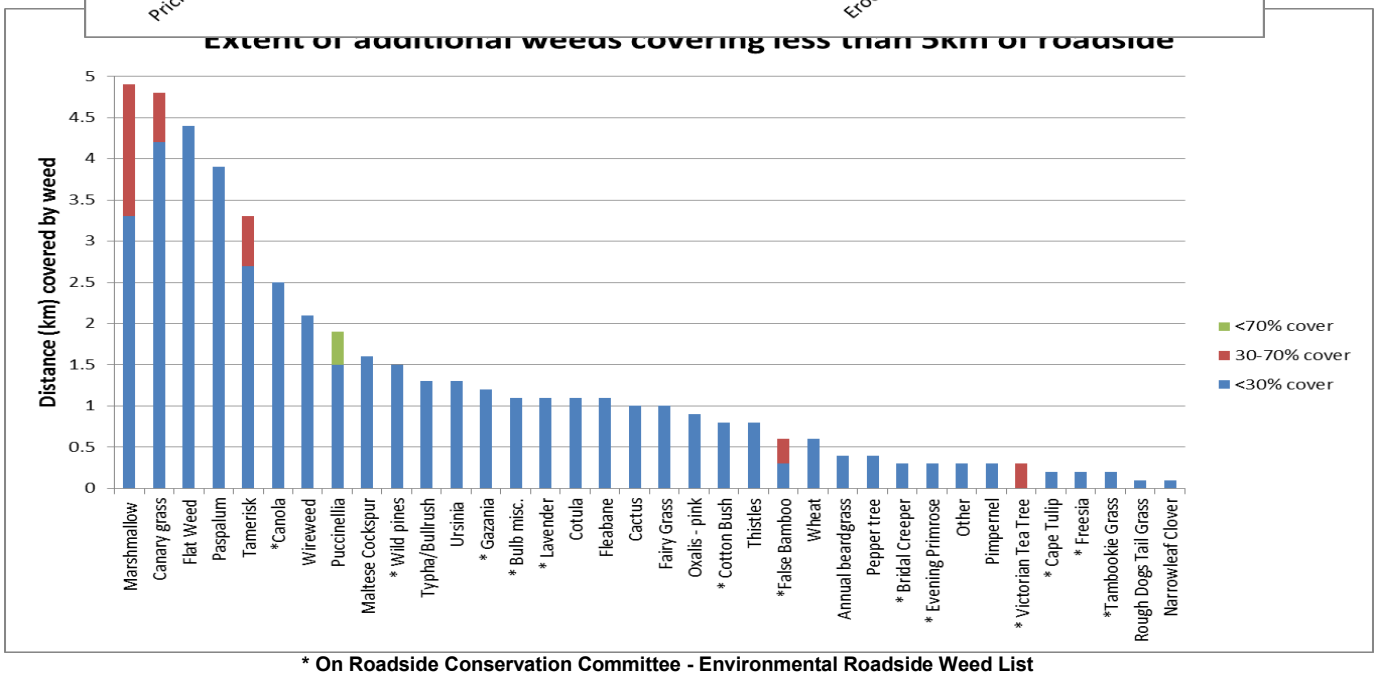
* On Roadside Conservation Committee - Environmental Roadside Weed List

GRAPHS SHOWING ADDITIONAL WEEDS RECORDED ON SHIRE OF MOORA ROADSIDES

Graph shows distance of roadside each weed was recorded along and the degree of infestation: less than 30%, 30-70% or greater than 70%







*** On Roadside Conservation Committee - Environmental Roadside Weed List**

Executive Summary

This report provides an overview of the conservation status of roadside remnant vegetation in the Shire of Moora. The report primarily gives detailed results of the roadside vegetation survey and is accompanied by management recommendations. It also briefly describes the natural environment in Moora, legislative considerations and threats to conservation values.

Aware of the need to conserve roadside remnants, the Moore Catchment Council, Shire of Moora and local community members liaised with the Roadside Conservation Committee (RCC) to survey roadsides in the Shire of Moora. Surveys to assess the conservation values of roadside remnants were conducted between September 2011 and June 2013. Approximately 82% of the Shire's 899 km of rural roadsides were assessed by the RCC for their conservation status, and maps were produced via a Geographic Information System (GIS). This represents the majority of non-urban roads. Roadside locations of six nominated weeds were also recorded and mapped onto separate clear overlays.

The results of the survey indicated that high conservation value roadsides covered of 7% of the roadsides surveyed in the Shire, with medium-high conservation value roadsides accounting for 25%. Medium-low and low conservation value roadsides occupied 29% and 39%, respectively. A more detailed analysis of results is presented in Part C of this report.

It is envisaged that the primary purpose of the roadside survey data and Roadside Conservation Value (RCV) map will be for use by Shire and community groups as a management and planning tool. Applications may range from prioritising work programs to formulating management strategies. Past experience has shown that this document and the accompanying maps are valuable in assisting with:

- formulating a roadside vegetation management plan for road maintenance work;
- identifying degraded areas for strategic rehabilitation or specific management techniques and weed control programs;
- re-establishing habitat linkages throughout the Shire's overall conservation network;
- developing regional or district fire management plans;
- identifying potential tourist routes, i.e. roads with high conservation value provide visitors with an insight into the natural landscape of the district; and
- planning for natural resource management or similar 'whole of landscape' projects.

Successive surveys of some Shires have revealed an alarming decline in the conservation status of many roadside reserves. In some cases the conservation value has declined at a rate of approximately 10% in nine years. This trend indicates that without appropriate protection and management, roadside reserves will become biological wastelands in the near future. However, proactive and innovative management of roadside vegetation has the potential to abate and reverse this general decline. Opportunities exist for the Shire of Moora to utilise the RCV map in many facets of its landcare, tourism, road maintenance operations and natural resource management (NRM) strategy documents. In addition, the RCC is available to continue to provide assistance with the development of roadside vegetation management plans and associated documents.

PART A

OVERVIEW OF ROADSIDE CONSERVATION

1.0 Why is roadside vegetation important?

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, settlements and other development. The fragmentation of the more or less continuous expanse of native vegetation communities by clearing has resulted in a mosaic of man-made biogeographical islands of small native vegetation remnants.

Tree hollows are of vital importance to breeding birds.
Photo: L. McMahon, Birds Australia

The flora and fauna in these areas are in jeopardy due to limited resources, increased disease risk and reduced genetic diversity caused by a diminishing gene pool. Some habitat fragments may be too small to provide the requirements for even a small population; therefore it is essential to their survival that they have a means of dispersing throughout the landscape. The presence of native vegetation along roadsides often fulfils an important role in alleviating this isolation effect by providing connectivity between bush remnants. While many roadside reserves are inadequate in size to support many plant and animal communities, they are integral in providing connections between larger areas of remnant vegetation. It is therefore important that all native vegetation is protected regardless of its apparent conservation value in isolation. It is important to acknowledge that even degraded roadsides have the ability to act as corridors for the dispersal of a variety of fauna.

Native vegetation along Nadji Mia Rd
Photo: K.Payne, RCC

Other important values of transport corridor remnants are that they:

- are often the only remaining example of original vegetation within extensively cleared areas;
- often contain rare and endangered plants and animals, such that roadside plants represent more than 20% of the known populations of threatened flora and three species are known only to exist in roadside populations (DPaW, 2014c)
- provide the basis for our important wildflower tourism industry, as roadside native vegetation in good condition is aesthetically pleasing and colourful in season;
- provide a sense of place for tourists and residents alike;
- often contain sites of Aboriginal /European historic or cultural significance;
- provide windbreaks and stock shelter areas for adjoining farmland, helping to stabilise temperature and reduce evaporation;
- assist with erosion and salinity control, in both the land adjoining the road reserve and further afield; and
- provide a valuable source of seed for regeneration projects, especially shrub species, as clearing and grazing beneath farm trees often removes this layer. Approval of the Shire and a Department of Parks and Wildlife (DPaW) permit are required prior to collection. Guidelines for seed and timber harvesting can be found in Appendix 1.

Heritage value on Moora Miling Rd
Photo: K. Payne.

Flora Roads are high conservation value roadside remnants
Photo: C. Wilson.

2.0 What are the threats?

2.1 Lack of awareness

The general decline of the roadside environment can, in many instances, be attributed to the lack of awareness of the functional and conservation value of the roadside remnants, both by the general community and those who work in the road reserve environment. The lack of awareness of the roadside vegetation's values means that those connected with the roadside are unable to modify their actions to minimise their impact. As a result, activities such as road maintenance and the use of fire can act as a catalyst for decline in environmental quality.

Care must be taken when clearing to ensure large trees are not damaged, that the clearing is actually necessary and that the required permits are obtained.
Photos: RCC

2.2 Roadside clearing

Western Australia's agricultural region, also known as the Intensive Land-use Zone (ILZ), covers an area of approximately 24,834,575 ha, of which only 7,531,044 ha (30.3%) is covered by the original native vegetation. Of the 86 rural Local Government Authorities (LGAs) in this zone, 10 have less than 10% of the original remnant vegetation and a further 38 LGAs have more than 10% but less than 30% of native vegetation extent (DAFWA, 2011).

Road and roadside vegetation management practices have a significant impact on the conservation of roadside vegetation. The decision to minimise clearing for construction and maintenance, and avoid systematic and indiscriminate clearing which creates irreversible damage, will enable roadside vegetation to continue to act as a biological corridor and habitat. Intact native vegetation also often suppresses weeds on roadsides.

Creative solutions include creating passing areas rather than widening a whole road.
Photo: C. Macneall, RCC

Due to the movement and disturbance of soil, all road construction and maintenance activities have the potential to introduce and spread weeds and dieback, which have a devastating impact on native vegetation. It is thus important to work from "clean" areas to "dirty" – that is, from areas that are weed and/or dieback free to those areas in which weeds and/or dieback exist. It is also important to clean down machinery before moving between work sites.

In 2004, amendments to the *Environmental Protection Act* 1986 (EP Act) put in place a permit application process designed to assess proposed native vegetation clearing based upon a number of clearing principles which ensure ecological, conservation and land degradation issues are considered. Under the EP Act clearing native vegetation requires a permit unless it is for exempt purposes (see pgs. 11-12). The EP Act native vegetation clearing provisions are designed to provide improved protection for native vegetation, maintain biodiversity and allow for some incidental clearing activities to continue without the need for a permit.

2.3 Fire

Although Western Australia's flora and fauna have evolved with a tolerance to pre-European fire regimes, these are generally not present today. Fire in transport corridors will inevitably alter the native vegetation; however the extent of changes is dependent on a number of factors such as:

- species present;
- intensity of fire;
- frequency of fire; and
- seasonality of the fire.

Before a decision is made to burn a road verge, the impact on natural, cultural and landscape values should be carefully considered and permission from the landowner should be obtained. Eg. Shire, Main Roads
Photos: Miling East Road (above), Boundary East Road (below).
Photos: K.Payne, RCC

The RCC's policy on fire management is:

- roadside burning should not take place without the consent of the managing authority;
- local government authorities should adopt by-laws to control roadside burning;
- roadside burning should be planned as part of a total Shire/area Fire Management Plan;
- only one side of a road should be burnt in any one year; *this will ensure habitat retention for associated fauna and also retention of some of the scenic values associated with the road.*
- when designing a Fire Management Plan, the two principles which must be kept in mind are the ecological management of vegetation and the abatement of fire hazard;
- no firebreaks should be permitted within the road reserve unless the width of the roadside vegetation strip is greater than 20m;
- a firebreak on any road reserve should be permitted only when, in the opinion of the road manager, one is necessary for the protection of the roadside vegetation. The road manager shall specify the maximum width to which the break may be constructed; and
- in the case of any dispute concerning roadside fire management, the Department of Fire and Emergency Services (DFES) should be called in to arbitrate.

Controlled burning of roadside vegetation should result in a mosaic of burnt & unburnt patches.
Photo: DFES

Burnt roadside from recent bushfire showing signs of regeneration (above). Weeds also come up after fire, so follow up weed control needs to occur to ensure flammable weeds don't establish/expand in the bare ground.
Photo: K.Payne, RCC

Before any decision is made to burn a road verge, particularly if threatened flora is present, the proponent should be aware of all values present and the impact the fire will have. It is illegal to burn roadsides where threatened flora is present without written permission from the Minister for the Environment. Fire can also be particularly destructive to heritage sites of either Aboriginal or European origin.

More information about fire management in roadsides can be found in the RCC's publication, *Biodiversity Conservation and Fire in Road and Rail Reserves: Management Guidelines* (2011).

It is illegal to burn roadsides where threatened flora is present
Photo: DPaW, Moora District

2.4 Weeds

Weeds are generally disturbance opportunists and the soil disturbance common on road verges provides an easily colonised niche. Their establishment can impinge on the survival of existing native plants, increase flammability of the vegetation and interfere with the engineering structure of the road. 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 considerable resources to control or eradicate. The roadside survey recorded populations of six significant weeds, and their locations were mapped by the RCC onto clear overlays. The six nominated weeds were:

- African lovegrass *(Eragrostis curvula)*
- Fountain grass (*Cenchrus setaceus)*
- Paterson's curse (*Echium plantagineum*)
- Spiny rush *(Juncus acutus)*
- Veldt grass *(Ehrharta* spp.*)*
- Wild radish (*Raphanus raphanistrum)*

Roadside populations of these weeds can be observed on the weed overlays provided with the Moora Roadside Conservation Value (RCV) map 2014. The RCV map and weed overlays will assist the Shire and community in planning, budgeting and coordinating strategic weed control projects. Further information on the presence of these nominated weeds is presented in Part C of this report. A list of all weeds in the Shire of Moora which are on FloraBase and have a specimen in the WA Herbarium can be found in Appendix 2.

African lovegrass – Perennial grass growing in dense tufts, 0.3-1.2m high

Flowers: purple/green from August to November

Grows in: a variety of soils in disturbed sites

Dispersal: birds, foxes, rabbits, water, soil, machinery, garden refuse.

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/376
Accessed: December 2013.

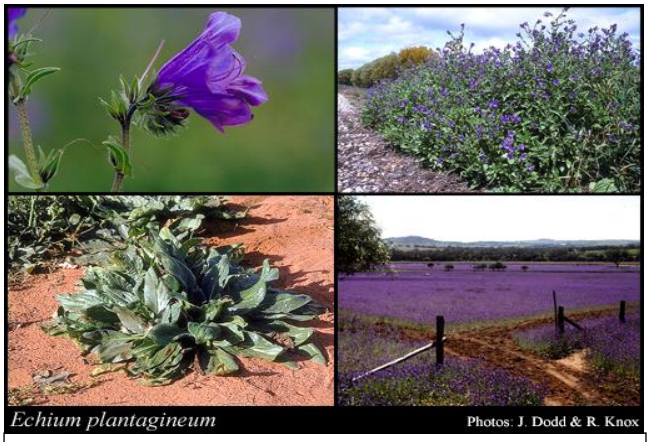
Fountain grass – Perennial grass growing in dense tufts to 1m

Flowers: March to August

Dispersal: wind, water, mammals, livestock, slashing, and humans

Weed of woodlands, grasslands, coastal vegetation, rail embankments, roadsides and mines

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/41568
Accessed December 2013.



Paterson's curse – **Large coarse, erect annual,**

0.1-0.6 m high

Flowers: purple/blue or occasionally pink/white from September to December

Weed of roadsides, vacant lands & disturbed grounds.

FloraBase. florabase.dpaw.wa.gov.au/browse/profile/6681
Accessed December 2013

Spiny rush (*Juncus acutus*) - Robust, sharp, perennial sedge to 1.5m high

Flowers: brown/green from August to November

Grows in: grey sand, loam, often in saline areas in creeks and soaks

Dispersal: water, mud, soil movement, machinery, and inappropriate or inadvertent plantings.

FloraBase florabase.dpaw.wa.gov.au/browse/profile/1175
Accessed December 2013

Veldt grass - Perennial grass grows in dense tufts, 0.3-0.7m high

Flowers: green/purple/red from March to April or August to September.

Grows in: white, grey or yellow sand or loam, widespread weed of roadsides and is a significant fire hazard.

Dispersal: water, wind, birds, mammals, slashing

FloraBase http://florabase.dpaw.wa.gov.au/browse/profile/347
Accessed December 2013

Wild radish- Erect annual, herb, 0.15-1 m high

Flowers: yellow to white/pink from April to May or July to November.

Grows in: disturbed areas, very common agricultural, horticultural and roadside weed

FloraBase http://florabase.dpaw.wa.gov.au/browse/profile/3061

Accessed December 2013

2.5 Salinity

Salinity is one of the greatest environmental threats facing Western Australia's agricultural areas, with over three million hectares in the south west agricultural region already affected to some degree (George & Short, 2006). Dryland salinity has occurred as a consequence of the heavy clearing undertaken in the past, namely the removal of deep-rooted perennial native vegetation and replacement by shallow-rooted annual crops and the subsequent rising of the water table. The large amount of salt stored within the soil column in these areas of Western Australia is dissolved by the rising water and carried into the root-zone to the soil surface. Once at the surface, the water evaporates leaving a white film of salt over the landscape, making it unproductive for current agricultural practices and severely impacting upon the remaining native vegetation.

Salt affected area in Moora Shire
Photo: K. Payne, DPaW

In 2006, monitoring of groundwater levels by Department of Agriculture and Food hydrologists indicated that groundwater levels (and hence the risk of salinity) are continuing to climb in most agricultural areas. (DAFWA, 2009)

The effect of salinity has not been restricted to agriculture, but is also having a serious effect on rural townsites and the road and rail network. The National Land and Resources Audit (2000) warned that across Australia nearly 20,000km of roads and 1,600km of railways are at a high risk from dryland salinity (Land & Water Australia, 2001). More than 4,000km (5%) of roads in the South West Land Division of Western Australia are currently affected by salinity (George et al, 2005).

Salt damaged road surface
Photo: D. Mickle

Based on figures supplied by the Department of Agriculture WA for the Salinity Investment Framework Interim Report (2003), approximately 27%, or 274km of roads in the Shire of Moora are potentially under threat from salinity (Table 1).

Table 1. Distance of road potentially affected by salinity in the Shire of Moora and surrounding shires

Shire	Total road length assessed (km)	Roads potentially affected by salinity - length in km					
		Highways	Local roads	Main roads	Other roads	Total affected	% of total potentially affected
Moora	**1,000.21**	**4.38**	**123.78**	**18.63**	**127.28**	**274.05**	**27.40**
Coorow	851.04		93.18	7.13	143.85	244.15	28.69
Dandaragan	1,374.19		13.05		12.18	25.23	1.84
Victoria Plains	917.73	1.38	46.73	3.05	26.03	77.18	8.41
Wongan-Ballidu	1,396.91		127.10	5.78	42.85	175.73	12.58
Dalwallinu	1,895.68	7.15	114.35	2.65	46.78	170.93	9.02

Adapted from material produced by the Department of Agriculture WA for Department of Environment 2003, Salinity Investment Framework Interim Report - Phase 1, 2003, Department of Environment, Salinity and Land Use Impacts Series No. SLUI 32

2.6 *Phytophthora* dieback

One of the major threats to the biodiversity of Western Australia's ecosystems is Phytophthora dieback. Phytophthora dieback is caused by the microscopic soil-borne pathogens in the *Phytophthora* genus. These cause the roots to rot in susceptible species. Plant death occurs because plants cannot take up the water and nutrients they need for survival. Infected plants often appear to be dying from drought conditions.

Over 40% of native WA plant species are susceptible to this pathogen (Dieback Working Group, 2014). While there have been no known *Phytophthora* outbreaks in the Shire of Moora, infestations have been confirmed in surrounding shires. *Phytophthora cinnamomi*, the most widespread and well known species usually affects plants in rainfall zones of greater than 400mm, however other *Phytophthora* species are increasingly being identified that may be affecting other species, such as wandoo. Roadsides provide an avenue for the spread of the disease.

Recent infestation: Banksia and Xanthorrhoea (grass trees) species are very susceptible which suggests that the infestation has just reached this area. Close by is a firebreak and it is very likely that the spread of the infestation was accelerated by moving dirt along the firebreak
Photo: J. Brooker, Project Dieback

Dieback can cause:

- Significant loss of biodiversity including loss of key canopy and understorey species and disruption to woodland vegetation structure;
- loss of habitat and food sources for birds, small mammals and insects;
- extinctions of threatened plant and animal species;
- disruption of ecological function/ change in ecosystem cycles;
- increased fire risk;
- altered hydrology and increased erosion; and
- the increased dominance of resistant plants such as grasses, rushes and sedges.

The pathogen is spread through the movement of infested soil and mud, especially by vehicles and footwear. It also moves in free water and via root to root contact between plants.

Phytophthora dieback does not have a cure. However, it has been shown plants can improve their resistance to the pathogen by being sprayed or injected with the fungicide phosphite (a derivative of phosphorus acid).

The most cost effective way of managing Phytophthora dieback is by limiting the spread of the disease rather than managing the impacts of the pathogen once it is introduced into bushland.

Management practices include:

- information signs and education;
- seasonal or permanent road and trail closures;

Universal Dieback signage system

- vehicle washdown using established cleaning stations where available to avoid transport of contaminated soil and vegetative material. *Please note: Dry cleaning (cleaning vehicles/machinery when dry) is preferable to wash-down;*
- cleaning of all equipment that comes into contact with soil or plant material (vehicles, tools and footwear) before a job, and before moving to next job (eg. with stiff brush, rag, methylated spirits);
- using only dieback-free construction and revegetation material. Ensure gravel is sourced from a dieback-free supplier/location; and
- applying phosphite to infected plants.

Roadside dieback front
Photo: E. Edmonds, South Coast NRM

Where an infestation has been identified, it is important that works crews take great care to:

- schedule activities for low rainfall months and plan activity for dry soil conditions;
- grade toward the infestation area (rather than away from it);
- lift the blade frequently to minimise the distance that dirt is carried;
- clean (dry clean or wash down) the blade (and the whole machine) before leaving the infested area;

A little time and care taken can ensure the disease is not spread to another area.

It is also important to note that where dieback-free areas are mapped, emphasis should be given to the protection of these areas.

- Plan activity for dry soil conditions only.
- Start clean, stay clean – clean machinery before arriving/working in these areas. *This also includes footwear or any equipment which comes into contact with any soil or plant material.*

Possible Phytophthora dieback on a shire road in the south west
Photo: K.Payne, RCC

Phytophthora dieback tends to occur in low-lying areas following drainage lines, flats, swamps etc. Upland areas are more often dieback-free and it is important to be aware of this when moving vehicles/equipment from lowland areas to upland (e.g. hills) potentially spreading infection. When moving through the landscape you can stay low or stay high in the profile or clean when moving from low to high areas.

Cleaning/disinfecting also reduces other biosecurity threats such as weeds so it has multiple benefits.

More information about managing Phytophthora dieback can be obtained from the Dieback Working Group website www.dwg.org.au where you can also download the '*Managing Phytophthora Dieback: Guidelines for Local Government'* http://www.dwg.org.au/files/dieback_lga_guidelines.pdf.

3.0 Legislative requirements

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 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
- *Environmental Protection (Clearing of Native Vegetation) Regulations* 2004
- *Heritage of WA Act* 1990
- *Land Administration Act* 1997
- *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* 1984
- *Wildlife Conservation Act* 1950, 1979

Commonwealth legislation:

- *Environment Protection and Biodiversity Conservation Act* 1999

The Department of Parks and Wildlife (DPaW; previously DEC) has the legislative responsibility to manage and protect all native flora and fauna in Western Australia. It is important to note that all native flora and fauna is protected under provisions of the *Wildlife Conservation Act* 1950 (Wildlife Conservation Act) and the *Environmental Protection Act* 1986 (EP Act), and cannot be impacted on unless relevant permits are held. 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 that Act.

Legalisation introduced under the EP Act specifies that all clearing of native vegetation requires a permit, unless it is for an exempt purpose. Schedule 6 of the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations* 2004 detail these requirements. Clearing applications are assessed against ten clearing principles, which incorporate the:

- biological value of the remnant vegetation;
- potential impact on wetlands, water sources and drainage;
- existence of rare flora and threatened ecological communities; and
- land degradation impacts.

There are two types of native vegetation clearing permits available: area and purpose. For example, where clearing is for a once-off clearing event such as clearing for pasture or development, an area permit is required. Where clearing is necessary for a specific purpose, such as a road widening program, a purpose permit is needed. Clearing of regrowth to maintain an existing shire road formation is exempt, to the width and height legally cleared for that purpose (refer to Schedule 2 of the Regulations).

A clearing permit is required for road upgrades. More information can be found on the Department of Environment Regulation's (DER) website www.der.wa.gov.au/your-environment/native-vegetation or contact DER's Native Vegetation Conservation Branch on 6467 5020.

It is recommended that a precautionary 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.

4.0 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are protected under the *Environmental Protection (Clearing of Native Vegetation) Regulations* 2004. They require special protection due to their environmental values at state or national levels. Some of the reasons include protection of

- threatened species or threatened ecological communities;
- wetlands and water courses;
- sites that have other high conservation, scientific or aesthetic values; and/or
- Aboriginal or European cultural sites.

Environmentally Sensitive Areas can be delineated by the use of site markers. The RCC publication *Guidelines for Managing Special Environmental Areas in Transport Corridors (2000)* has advice on the design and placement of ESA markers. Workers who come across an ESA marker in the field should not disturb the area between the markers unless specifically instructed. If in doubt, the Works Supervisor, Shire Engineer or CEO should be contacted. Western Power and Brookfield Rail also have systems for marking sites near power or rail lines.

Roadside ESA markers are highly visible to ensure roadside workers see them and are aware of the significance of the area.
Photo: K Payne, RCC

To ensure that knowledge of threatened flora and other sites does not get lost due, perhaps, to staff changes, is it recommended that the Shire establish an *Environmentally Sensitive Area Register.* This should outline any special treatment that the site should receive and be consulted prior to any work being initiated in the area. This will ensure that inadvertent damage does not occur.

Local governments are also encouraged to permanently mark ESAs to prevent inadvertent damage to threatened flora or other values being protected. Markers of a uniform shape and colour will make recognition easier for other authorities using road reserves.

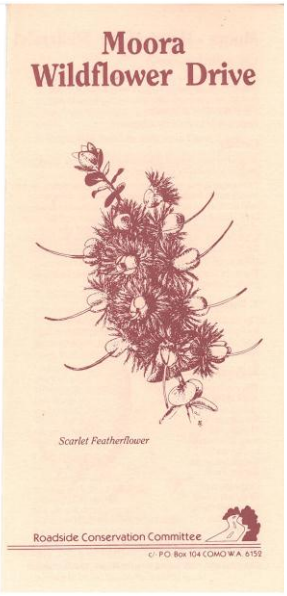
5.0 Flora Roads

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 and upon recommendation of the RCC. The RCC has prepared *Guidelines for the Nomination and Management of Flora Roads* (Appendix 3). The Flora Road signs (provided by the RCC) draw the attention of both the tourist and those working in the road reserve to the roadside flora, indicating that it is special and worthy of protection. The program seeks to raise the profile of roadsides within both the community and road management authorities.

Roadsides are one of the most accessible places for tourists to view wildflowers.
Photo: K Payne, RCC

There are currently no Flora Roads in the Shire of Moora, although there was a *Moora Flora Drives* pamphlet (Appendix 4) produced several years ago with descriptions of groups of roads with noteworthy flora:

- Dandaragan Rd
- Prices Road
- Namban West Rd
- Watheroo West Road
- Eagle Hill Rd to Jingamia Cave
- Midlands Road



Flora Roads also provide habitat for fauna
Photo: K. Payne, RCC.

This pamphlet was developed by the RCC and the Shire of Moora in the early 1990s. A few copies of the pamphlet are still available but it may be worth revising and reprinting this pamphlet.

The roadside survey and the RCV map highlighted some roadsides that have the potential to be declared as Flora Roads. These roads may be investigated further to see if they warrant declaration as a Flora Road (see Part C of this report).

In order to plan roadworks so that important areas of roadside vegetation are not disturbed, road managers should be aware of these areas. To ensure this is not overlooked, it is suggested that areas declared as Flora Roads be included in the Shire's *Special Environmental Areas Register*.

Wildflowers along Miling East Road.
Photo: K. Payne, RCC

Attractive roadsides are an important focus in Western Australia, the "Wildflower State". 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 these roads by means of a small brochure or booklet, similar to that developed in the early 1990s with the *Flora Drives* pamphlet;
- showing all Flora Roads on a map of the region or State; and
- using specially designed signs to delineate the Flora Road section (provided free of charge by the RCC).

PART B

THE NATURAL ENVIRONMENT IN MOORA

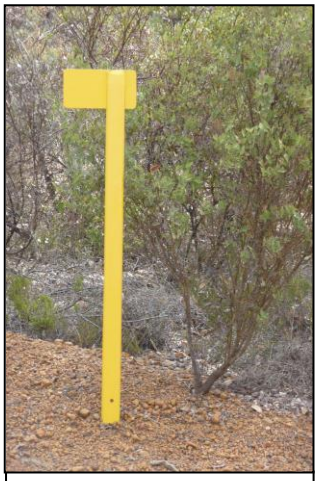
1.0 Flora

On a global scale Western Australia has almost ten times more vascular plant varieties than countries such as Great Britain (JNCC, 2014). In fact, Western Australia has about four percent of the 281,000 known vascular flora present on Earth (Australian National Herbarium, 2012). The native flora of the south-west of Western Australia (which includes the Shire of Moora) is internationally renowned for its diversity and uniqueness, with over 8000 species of native flora. Of these, over 75% are endemic to WA and found nowhere else in the world. (DPaW, 2014a).

The WA Herbarium has recorded over 1225 species of native plants from the Shire of Moora. The most prolific families are Myrtaceae (eg eucalypts and melaleucas - 205 species), Fabaceae (peas - 155 species), Proteaceae (eg banksias and grevilleas - 119 species), and Asteraceae (daisies - 76 species) (NatureMap, DPaW, 2007-2014). The complete list of recorded flora can be viewed on the CD attached to this report.

2.0 Threatened and Priority flora

Threatened flora species are of great conservation significance and should therefore be treated with special care when road and utility service, construction or maintenance is undertaken. Populations of threatened flora along roadsides are designated ESAs and should be delineated by yellow markers. It is the responsibility of the road manager to ensure these markers are installed in consultation with DPaW. The RCC suggests using the publication *Guidelines for Managing Special Environmental Areas in Transport Corridors (2000)* as a guideline for managing these sites.



Threatened flora sites should be clearly marked with these yellow posts.
Photo: RCC

Priority flora are species which may be threatened, but insufficient information is available to make an assessment. 'Priority' refers to the priority of searching other appropriate habitat as circumstances and resources allow.

As of February 2014, there are twenty one species of threatened flora and seventy two species of priority flora throughout the Shire of Moora (DPaW, 2014a). Fourteen species of threatened flora are found along forty six shire roadside locations, and eight species of priority flora are found on thirteen databased roadside locations (DPaW, 2014c).

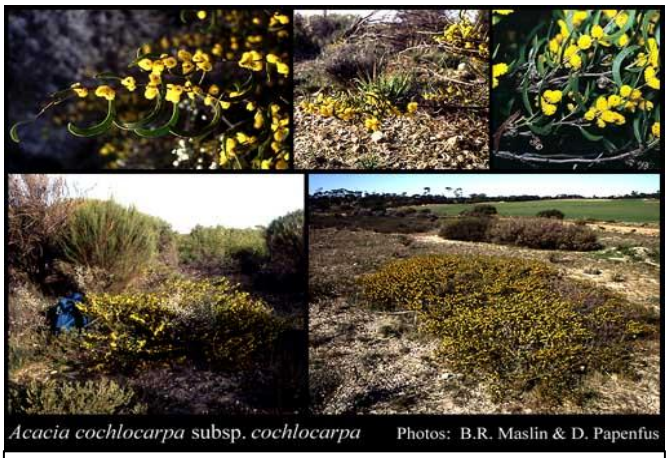
Threatened flora on Moora roadsides

- *Acacia aristulata* (Watheroo wattle)
- *Acacia cochlocarpa* subsp. *cochlocarpa* (Spiral-fruited wattle)
- *Acacia vassalii* (Vassal's wattle)
- *Chorizema humile* (Prostrate flame pea)
- *Darwinia acerosa* (Fine-leaved darwinia)
- *Daviesia dielsii* (Diels' daviesia)
- *Eremophila scaberula* (Rough emu bush)
- *Eucalyptus pruiniramis* (Midlands gum, Jingymia gum)
- *Eucalyptus rhodantha* var. *rhodantha* (Rose mallee, Rose gum)
- *Gastrolobium appressum* (Scale-leaf poison)
- *Grevillea bracteosa* subsp. *bracteosa*
- *Grevillea christineae* (Christine's grevillea)
- *Hemiandra gardneri* (Red snakebush)
- *Jacksonia pungens* (Pungent jacksonia)

***Acacia aristulata*, Watheroo wattle**

- **Erect or scrambling shrub**
- **Grows to 0.25-1m high**
- **White-cream flowers in September to December**
- **Found in loamy or clay sand over chert on low rocky ridges, hills and outcrops.**

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/14051
Accessed: December 2013



***Acacia cochlocarpa* subsp. *cochlocarpa*, Spiral-fruited wattle**

- Glabrous, sprawling shrub
- Grows to 0.3-1.5m high
- Yellow flowers
- Found in clayey, sandy and often gravelly soils.

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/14062
Accessed: December 2013

***Acacia vassalii*, Vassal's wattle**

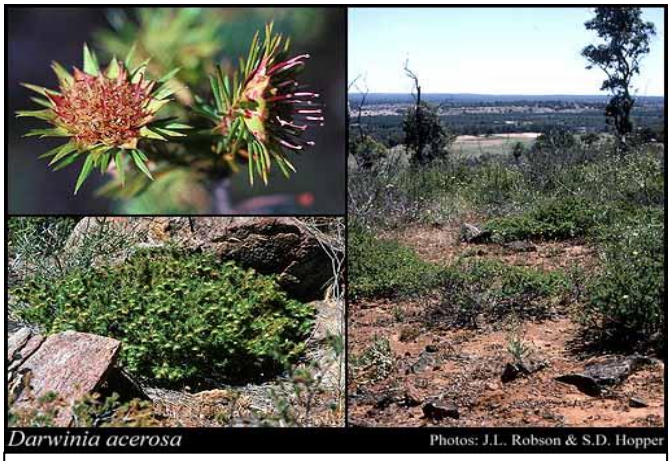
- Semi-prostrate, spreading
- Grows to 0.15-0.3m high
- Yellow flowers in June- July.
- Found in grey/brown or yellow sand, sandy loam

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/3594)
Accessed: December 2013

***Chorizema humile*, Prostrate flame pea**

- Sprawling, prostrate or decumbent shrub
- Yellow and red/brown flowers from July to September
- Found in sandy clay or loam soils on plains

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/13115
Accessed: December 2013



***Darwinia acerosa*, Fine-leaved darwinia**

- Spreading, compact shrub
- Grows to 0.2-0.6m high
- Green, red and purple flowers in September to November
- Found in sand, loam, often moist soils on granite outcrops and road verges

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/5504
Accessed: December 2013

***Daviesia dielsii*, Diels' daviesia**

- Branching shrub
- Grows to 0.5-0.9m high
- Orange and red flowers in July
- Found in sandy, often gravelly soils.

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/3806
Accessed: December 2013

***Eremophila scaberula*, Rough emu bush**

- Low compact or sprawling to upright shrub
- Grows to 0.15-0.7m high
- Purple- blue flowers in August to October
- Found in clay, sandy clay or loam on winter-wet plains and inundated areas.

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/7266

Eucalyptus pruiniramis Photo: S.F. Patrick

Eucalyptus pruiniramis, Midlands gum, Jingymia gum

- Mallee or tree
- Grows to 2.5-7m high
- Often with straggly, tumbledown crown; bark rough and ribbony at base, smooth above
- Cream flowers in December
- Found in skeletal soils over sandstone or laterite on rocky hillslopes.

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/13040

Eucalyptus rhodantha var. *rhodantha* Photo: B. & B. Wells

Eucalyptus rhodantha var. *rhodantha,* Rose mallee, Rose gum

- Spreading mallee
- Grows to 1.5-4m high with smooth bark
- Red/cream to white flowers in July or September to December or January
- Found in grey/yellow/red sand over laterite on undulating country and hillslopes.

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/14280

Gastrolobium appressum Photos: S.J. Patrick

Gastrolobium appressum, Scale-leaf poison

- Erect shrub
- Grows to 0.3m high
- Yellow, orange, red and purple flowers in August to December.
- Found in white/yellow sand with quartz gravel on sandplains and low rises.

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/3888

Grevillea christineae Photos: S.F. Patrick

Grevillea christineae, Christine's grevillea

- Erect, wiry shrub
- Grows to 0.5-0.6m high
- White-cream flowers in August to September
- Found in clay loam, sandy clay, often moist area.

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/1976)

Hemiandra gardneri Photos: A.P. Brown, C. Chapman & M. Hancock

Hemiandra gardneri, Red snakebush

- Prostrate, pungent shrub
- Grows to 0.1-0.2m high to 1m wide
- Red/pink flowers in August to October
- Found in grey or yellow sand, clayey sand and sandplains

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/6835

Jacksonia pungens Photos: J.A. Cochrane

Jacksonia pungens, Pungent jacksonia

- Rounded shrub
- Grows to 0.45-0.8m high
- Orange flowers in November to December
- Found in yellow sand, gravelly lateritic spills and undulating areas.

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/14744

Priority flora on Moora roadsides

- *Grevillea pinifolia (*Pine-leaved grevillea) Priority 1
- *Acacia arcuatilis* Priority 2
- *Pertusaria trachyspora* (a lichenised fungi) Priority 2
- *Acacia flabellifolia* Priority 3
- *Eucalyptus subangusta* subsp. *virescens* Priority 3
- *Gastrolobium rotundifolium* (Gilbernine poison) Priority 3
- *Calothamnus accedens (*Piawaning clawflower) Priority 4
- *Diuris recurva* (Mini donkey orchid) Priority 4

***Acacia arcuatilis* -** Priority 2

- **Rounded spreading shrub**
- **Grows to 0.4-1.5m high and to 2m wide**
- **Yellow flowers in June to August**
- **Found in sand or sandy loam sometimes with lateritic gravel on undulating plains and rises.**

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/14050
Accessed: December 2013

***Diuris recurva,* Mini donkey orchid –** Priority 4

- **Tuberous perennial herb**
- **Grows to 0.2-0.3m high**
- **Yellow and brown flowers in July to August**
- **Found in loam in winter wet areas**

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/12936
Accessed: December 2013

***Gastrolobium rotundifolium,* Gilbernine poison**
Priority 3

- **Erect, bushy shrub**
- **Grows to 0.8m high**
- **Orange, yellow and red flowers in August to September**
- **Found in heavy clay or loam soils, granite, sandstone, and quartzite on low rises and breakaways**

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/3922

***Grevillea pinifolia,* Pine-leaved grevillea**
Priority 1

- **Much-branched shrub**
- **Grows to 0.3-0.9m high**
- **Red flowers in July to October**
- **Found in yellow sand and/or gravel**

FloraBase: florabase.dpaw.wa.gov.au/browse/profile/2067
Accessed: December 2013

For definitions of threatened and priority flora refer to Appendix 5. For more detailed information regarding threatened and priority flora in the Shire of Moora, contact the DPaW Threatened Flora Administrative Officer in Species and Communities Branch at Kensington flora.data@dpaw.wa.gov.au, or the Conservation Officer (Flora) in DPaW's Moora District on 9652 1911. Knowledge of roadside populations may change over time, so it is important that the Shire update information through DPaW periodically to avoid inadvertent damage to newly discovered populations of threatened flora. If roadworks need to be carried out near known threatened flora sites, contact DPaW at least six weeks in advance to obtain necessary permits and have an inspection to confirm exactly where plants occur near the road.

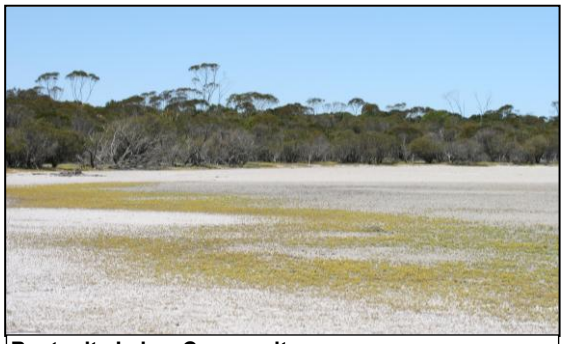
2.1 Threatened Ecological Communities (TECs)

An ecological community is a naturally occurring group of plants, animals and other organisms that occur in a particular habitat (DPaW, 2014d). The Minister for Environment may list an ecological community as being threatened if the community is presumed to be totally destroyed or to be at risk of becoming totally destroyed.

Coomberdale Chert Hills Community
Photo: J. Pryde, DPaW

There are 2 TECs in the Shire of Moora - one of these is the Coomberdale Chert Hills community which is 'Vegetation associations on ridges and slopes of the chert hills of the Coomberdale Floristic Region'. A Landscope article on the Coomberdale Chert Hills Community is in Appendix 6.
There is also the Bentonite Lakes community, which is 'Herbaceous plant assemblages on bentonite lakes'.

***Regelia megacephala*, Cairn Hill**
Photo: B. Todd, DPaW



Bentonite Lakes Community
Photo: W. Chow, DPaW

3.0 Fauna

The Western Australian Museum records approximately 401 species of fauna from the Moora area. This list can be viewed on the CD attached. WA Museum fauna records comprise specimen records, museum collections and observations from 1850 to present and therefore it is intended to act only as a general representation of the fauna in the area. Of the fauna species recorded in the Moora area, there were 180 bird, 10 amphibia, 13 mammal, 142 invertebrate and 54 reptile species.

Many fauna species, particularly small birds, need continuous corridors of dense vegetation to move throughout the landscape. Roadsides therefore are of particular importance to birds because they can contain the only continuous vegetation connection in some areas.

The *Wildlife Conservation Act* 1950 provides for native fauna (and flora) to be specially protected where they are under an identifiable threat of extinction, and as such, are considered to be "Threatened". According to distributional data from NatureMap (DPaW, 2007-2014), 25 species of threatened and priority fauna have been recorded or sighted within the Shire of Moora, and these are listed below.

Birds

- *Ardea modesta* (Eastern great egret) International agreement
- *Ardeotis australis* (Australian bustard) Priority 4
- *Burhinus grallarius* (Bush stone-curlew) Priority 4
- *Cacatua leadbeateri* (Major Mitchell's cockatoo) Specially protected
- *Calidris acuminate* (Sharp- tailed sandpiper) International Agreement
- *Calidris melanotos* (Pectoral sandpiper) International Agreement
- *Calyptorhynchus latirostris* (Carnaby's cockatoo) Threatened
- *Charadrius rubricollis* (Hooded plover) Priority 4
- *Falco peregrinus* (Peregrine falcon) Specially protected
- *Falco peregrinus* subsp. *macropus* (Australian peregrine falcon) Specially protected
- *Hylacola cauta* (Shy groundwren) Priority 4
- *Ixobrychus minutus* subsp. *dubius* (Australian little bittern) Priority 4
- *Leipoa ocellata* (Malleefowl) Threatened
- *Merops ornatus* (Rainbow bee-eater) International Agreement
- *Platycercus icterotis* subsp. x*anthogenys* (Western rosella (inland)) Priority 4
- *Rostratula benghalensis* subsp. a*ustralis* (Australian painted snipe) Threatened

Malleefowl
Photo: © B. & B. Wells, DPaW

Mammal

- *Dasyurus geoffroii* (Chuditch, Western quoll) Threatened
- *Hydromys chrysogaster* (Water-rat) Priority 4
- *Macropus irma* (Western brush wallaby) Priority 4
- *Macrotis lagotis* (Bilby) Threatened

Invertebrate

- *Daphnia jollyi* (freshwater crustacean) Priority 1
- *Idiosoma nigrum* (Shield- backed Trapdoor Spider) Threatened

Reptile

- *Aspidites ramsayi* (Woma) Specially protected
- *Egernia stokesii* subsp. *badia* (Western spiny-tailed skink) Threatened
- *Morelia spilota* subsp. *imbricata* (Carpet python) Specially Protected

Bilby (top)
Chuditch with juveniles (middle)
Water rat (bottom)
Photos: © B. & B. Wells, DPaW

Carpet python
Photo: © B. & B. Wells, DPaW

3.1 Carnaby's cockatoo breeding areas

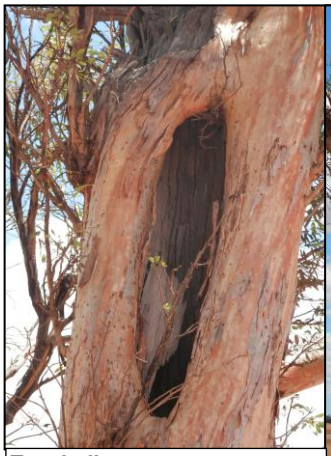
Carnaby's cockatoo chicks, near Marchagee Track
Photo: R. Dawson, DPaW

Carnaby's cockatoos are one of two species of white-tailed black cockatoo which are endemic (restricted) to the south west of Western Australia. Since the late 1940s the species has experienced a thirty percent reduction in range and a fifty percent decline in population (DPaW, 2013). The Shire of Moora is a very significant Carnaby's cockatoo breeding area with 39 known breeding sites and most known to occur on or near road reserves, particularly in the western and southern part of the shire (DPaW, 2007-2014) (See Appendix 7)

Carnaby's cockatoo in roadside hollow Moora area
Photo: R. Dawson, DPaW

During the nesting season Carnaby's cockatoos occur in uncleared or remnant eucalypt woodlands, predominately wandoo or salmon gum. They feed in shrubland known as Kwongan heath predominantly on banksia, grevillea and hakea species. They also feed on seeds of eucalyptus species, such as marri.

Many of the Carnaby's feeding, roosting & breeding sites have been removed due to clearing in the Wheatbelt and urbanisation on the Swan Coastal Plain. Old wandoo and salmon gum trees provide ideal breeding sites for these threatened birds. However, remaining nesting and feeding areas are becoming degraded due to grazing, water logging, salinity, weed invasion, storm damage, firewood collection and changes in fire management. There is a lack of new eucalypt trees growing to replace dead trees in remaining nesting sites and existing nesting hollows are deteriorating.



Tree hollow
Barberton West Road
Photos: K.Payne, RCC

Carnaby's cockatoos face competition for hollows from other species (eg. galahs and corellas) that use hollows to nest in. Feral bees also cause problems when they use suitable nest hollows for their hives.

While roadsides aren't the ideal place for nesting birds, with so much of their habitat destroyed, roadsides are now a significant habitat for Carnaby's cockatoos. It is important that the vegetation around these hollows and buffer areas is retained or replaced to ensure close-by feeding areas remain. A recent report confirms the importance of native vegetation close to breeding areas to ensure chicks fledge successfully (Saunders et al, 2014). Roadsides also provide corridors to allow movement between nesting and feeding areas in larger patches of remnant vegetation.

Carnaby's cockatoo food source Banksia woodland on nearby Boundary Road
Photo: K.Payne, RCC

4.0 Remnant vegetation cover

Only fifteen per cent of the original native vegetation remains in the Shire of Moora (Table 2A) and this is located in a variety of tenures from nature reserves to privately owned land to road reserves. Fifteen percent remnant vegetation is low, and the second lowest of the surrounding shires. The remaining native vegetation can easily be further depleted if proactive measures are not taken to manage this priceless resource.

Table 2A. Remnant vegetation remaining in the Shire of Moora and surrounding shires (Govt. WA, 2013)

Shire	Total Area (ha)	Area Cleared (ha)	Vegetation Cover Remaining	
			(ha)	(%)
Moora	376,192.20	316,768.55	59,423.65	15.80%
Coorow	418,942.25	252,907.59	166,034.66	37.76%
Dandaragan	670,531.13	373,094.83	297,436.30	39.55%
Victoria Plains	255,060.88	214,464.70	40,596.19	15.92%
Wongan Ballidu	336,569.44	314,522.88	22,046.56	6.55%
Dalwallinu	722,663.09	554,752.75	167,910.34	23.23%

The continued presence of the flora and fauna living in these fragmented remnants is dependant on connectivity throughout the landscape. This enables access to habitat and food resources essential for the survival of species and the overall biodiversity of the region. In many situations remnant native vegetation in transport corridors is of vital importance as it provides the only continuous link throughout the landscape.

Remnant roadside vegetation, Boundary Rd

Photo: K.Payne, RCC

4.1 Moora Vegetation Associations

The vegetation associations known from the Shire of Moora, noted in Table 2B, 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 overall and not specifically representative of roadside remnants.

Table 2B. Vegetation types and percentages remaining in the Shire of Moora (Govt. WA, 2013)

Moora Vegetation Association Types*	% Remaining
Medium woodland; York gum (*Eucalyptus loxophleba*) & wandoo (7)	14.20
Shrublands; *Melaleuca thyoides* thicket with scattered York gum (31)	28.74
Bare areas; salt lakes (125)	30.76
Bare areas; rock outcrops (128)	47.70
Medium woodland; York gum & salmon gum (142)	8.67
Medium woodland; York gum (352)	35.09
Shrublands; *Melaleuca thyoides* thicket (392)	6.99
Shrublands; Allocasuarina campestris thicket (551)	12.26
Succulent steppe with woodland and thicket; York gum over *Melaleuca thyoides* & samphire (631)	17.97
Shrublands; scrub-heath on yellow sandplain *Banksia-Xylomelum* alliance in the Geraldton Sandplain & Avon-Wheatbelt Regions (694)	21.19
Medium woodland; salmon gum (936)	25.47
Shrublands; dryandra heath (952)	12.04
Succulent steppe with thicket; *Melaleuca thyoides* over samphire (988)	40.36
Medium woodland; York gum, wandoo & salmon gum (*Eucalyptus salmonophloia*) (1023)	12.67
Shrublands; mallee & casuarina thicket (1024)	2.86
Low woodland; *Banksia attenuata* & *B. menziesii* (1030)	31.13
Low woodland; *Banksia prionotes* (1036)	40.15
Shrublands; mallee with scattered York gum (1039)	66.20
Medium woodland; York gum & *Casuarina obesa* (1040)	27.09
Low woodland; *Allocasuarina huegeliana* & Jam (1041)	32.46
Succulent steppe with low woodland; sheoak over samphire (1042	20.23
Mosaic: Medium woodland; York gum & salmon gum / Shrublands; *Melaleuca thyoides* thicket (1044)	15.73
Shrublands; scrub-heath *Acacia-Ecdeiocolia* association in the south-east Geraldton Sandplain Region (1149)	11.25

** Numbers in brackets refer to the identification numbers of vegetation associations listed in the Statewide Vegetation Statistics Report (Govt. WA, 2013).*

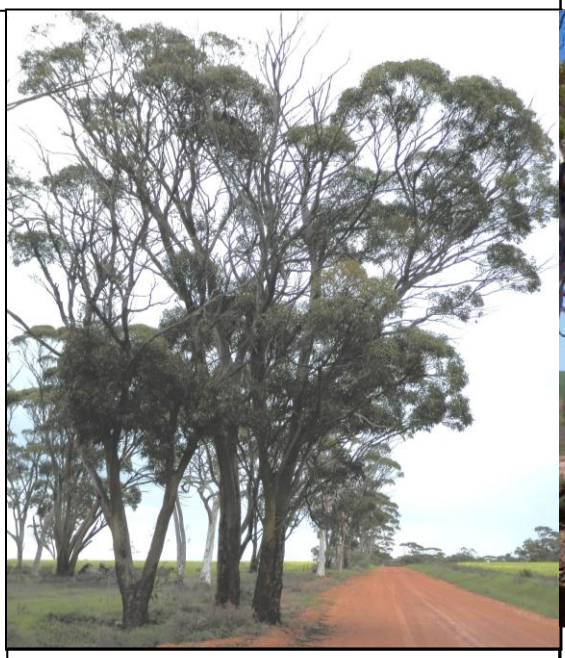
Figure 8 in Part C of this report shows the vegetation types and amounts recorded along the Shire of Moora roadsides during the survey.

Medium woodland; Wandoo - Edibegebege Road.

Shrublands - Merewana Road.

Bare areas; salt lakes - Dennis Road

Shrublands; *Acacia, Hakea* - Cardo Road.



Medium woodland; York gum, wandoo Merewana Road.

Medium woodland; Salmon gum - Lyons East Road.

PART C

ROADSIDE SURVEYS IN THE SHIRE OF MOORA

1.0 Introduction

The roadside survey and mapping program was developed to provide a method of determining the conservation status of roadsides. Using this method, community volunteers are able to participate in a 'snap-shot' survey of roadside vegetation to identify a range of attributes that, when combined, give an overall indication of the conservation status of the vegetation.

Usually 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.

The majority (735 km or 82%) of the Shire of Moora's 899 km of rural roads were surveyed by the RCC and Moore Catchment Council staff with assistance from 12 volunteers. The survey assessed the conservation status of the road reserves. The surveys were carried out from September 2011 to June 2013. The enthusiastic effort of the roadside surveyors ensured that this project was successfully completed. The roadside surveyors were:

- Angela Keamy
- Ann Lewis
- Bev Stirling
- Clive Tonkin
- Edna McLaughlin
- Guy Hicks
- Ingrid Krockenberger
- Joy Fraser
- Julia White
- Kylie Payne
- Lyn Hamilton
- Marie Carter
- Maureen Tonkin
- Pauline Dilley
- Rachel Walmsley
- Renee Ettridge

Survey Training Day – September 2011
Photos K. Payne, RCC

1.1 Methods

The roadside surveys were undertaken in a vehicle, generally with two people per vehicle. The passenger recorded the roadside survey data using handheld PDAs as shown in Appendix 8. The Moora surveys were conducted using new devices and software which was developed specifically for the roadside surveys. The PDAs have inbuilt GPS and camera and collect more data than was previously collected including vegetation type, tree decline, environmentally sensitive areas and additional weeds. The data is uploaded to a purpose-built RCC survey website via the mobile phone network. This data is then downloaded and analysed by the RCC, and the RCC works with DPaW's Geographic Information Systems (GIS) section to generate the Roadside Conservation Value map and weed overlays.

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). However, this has been expanded with the new computerised system. All volunteers participate in a one day pre-survey volunteer training session. During this session, volunteers are given an overview of the survey process, information to assist with identifying vegetation types and weeds, step by step instructions on how to use the PDAs and survey safety information.

The survey process involves choosing an option from a set of attributes, which when combined represent a roadside's conservation status.

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

- the structure of native vegetation (e.g. layers - trees, shrubs, groundcovers) (Scores: 0-2)
- the extent of native vegetation (% of native vegetation cover) (Scores: 0-2)
- the approximate number of *different* native plant species (diversity) (Scores: 0-2)
- the degree of weed infestation (% weed cover) (Scores: 0-2)
- habitat value/value as a biological corridor (Scores: 0-3)
  (i) connects to other bushland areas;
  provides habitat or food for reptiles, birds and other animals e.g. (ii) hollow logs, (iii) tree hollows and (iv) flowering shrubs;
  (v) environmentally sensitive areas (yellow hockey stick markers)
- width of vegetated roadside (Scores: 0-1).

Each of these attributes is given a score ranging from 0 to 3 points (see above). Their combined scores provide a Roadside Conservation Value score ranging from 0 to 12. The conservation values are represented on the roadside conservation value map by the following colour coded conservation status categories.

Conservation Value	Conservation Status	Colour Code
9 – 12	High	Bright Green
7 – 8	Medium High	Pale Green
5 – 6	Medium Low	Orange
0 – 4	Low	Yellow

The following attributes are also noted but do not contribute to the conservation value score:

- adjoining landuse
- width of road reserve
- vegetation type
- tree decline
- revegetation
- clearing
- rabbits
- presence of utilities/disturbances
- general comments
- presence and percentage of six nominated weeds and
- presence and extent of additional weeds

It is intended that the recording of these attributes will provide a dataset capable of being used by a broad range of shire staff plus community and land management interests.

1.2 Mapping Roadside Conservation Values

The RCC in conjunction with DPaW's GIS section produced a computer-generated map at a scale of 1:100,000 for the Shire of Moora. Known as the Roadside Conservation Value map (RCV map), it shows the conservation status of the roadside vegetation and the width of the road reserves within the Shire of Moora. The data used to produce both the map and the following figures and tables are on the CD attached. A simplified data sheet with a small sample of roads can be found in Appendix 9.

Digital information of roads, remnant vegetation and watercourses on both Crown estate and privately owned land used in the map was obtained from Main Roads WA, Landgate, DPaW, Department of Agriculture and Food WA and Geoscience Australia.

1.3 Roadside Conservation Value categories

Boundary Rd - this high conservation value road contains relatively intact, undisturbed and diverse remnant vegetation.
Photo: K.Payne, RCC

High conservation value roadsides are those with a score between 9 and 12, and generally display the following characteristics:

- intact natural structure consisting of a number of layers, often ground, shrub and tree layers;
- extent of native vegetation greater than 70%, i.e. little or no disturbance;
- high diversity of native flora, i.e. greater than 20 different species;
- few weeds, i.e. less than 30% of the total plants; and
- high value as a biological corridor; i.e. may connect uncleared areas, contain flowering shrubs, tree hollows and/or hollow logs for habitat, and/or environmentally sensitive areas.

Medium-high conservation value roadsides contain a moderate number of native species, some weed invasion, but have relatively intact natural structure. For example, the last section of Barberton East Road.
Photo: K.Payne, RCC

Medium-high conservation value roadsides are those with a score between 7 and 8, and generally have the following characteristics:

- generally intact natural structure, with one layer disturbed or absent;
- extent of native vegetation between 30 and 70%;
- medium to high diversity of native flora, i.e. between 6 and 19 species;
- few to half weeds, i.e. between 30 and 70% of the total plants; and
- medium to high value as a biological corridor and with some habitat features.

Medium-low conservation value roadsides are those with a score between 5 and 6, and generally have the following characteristics:

- natural structure disturbed, i.e. one or more vegetation layers absent;
- extent of native vegetation between 30 and 70%;
- medium to low diversity of native flora, i.e. between 0 and 5 species;
- half to mostly weeds, i.e. between 30-70% of total plants; and
- medium to low value as a biological corridor and with few habitat features. *May still contain ESAs with yellow hockey stick markers (see below).*

Medium-low conservation value roadsides have some native vegetation but may not have understorey plants and often have many weeds. For example, Merewana Road.
Photo: K.Payne, RCC

Weedy roadsides may contain ESA's with threatened flora
Photo: K. Payne, RCC

Low conservation value roadsides are those with a score between 0 and 4, and generally have the following characteristics:

- narrow roadsides with no natural structure i.e. two or more vegetation layers absent;
- low extent of native vegetation, i.e. less than 30%;
- low diversity of native flora, i.e. between 0 and 5 different species;
- mostly weeds, i.e. more than 70% of total plants, or ground layer totally weeds; and
- low value as a biological corridor and minimal habitat value.

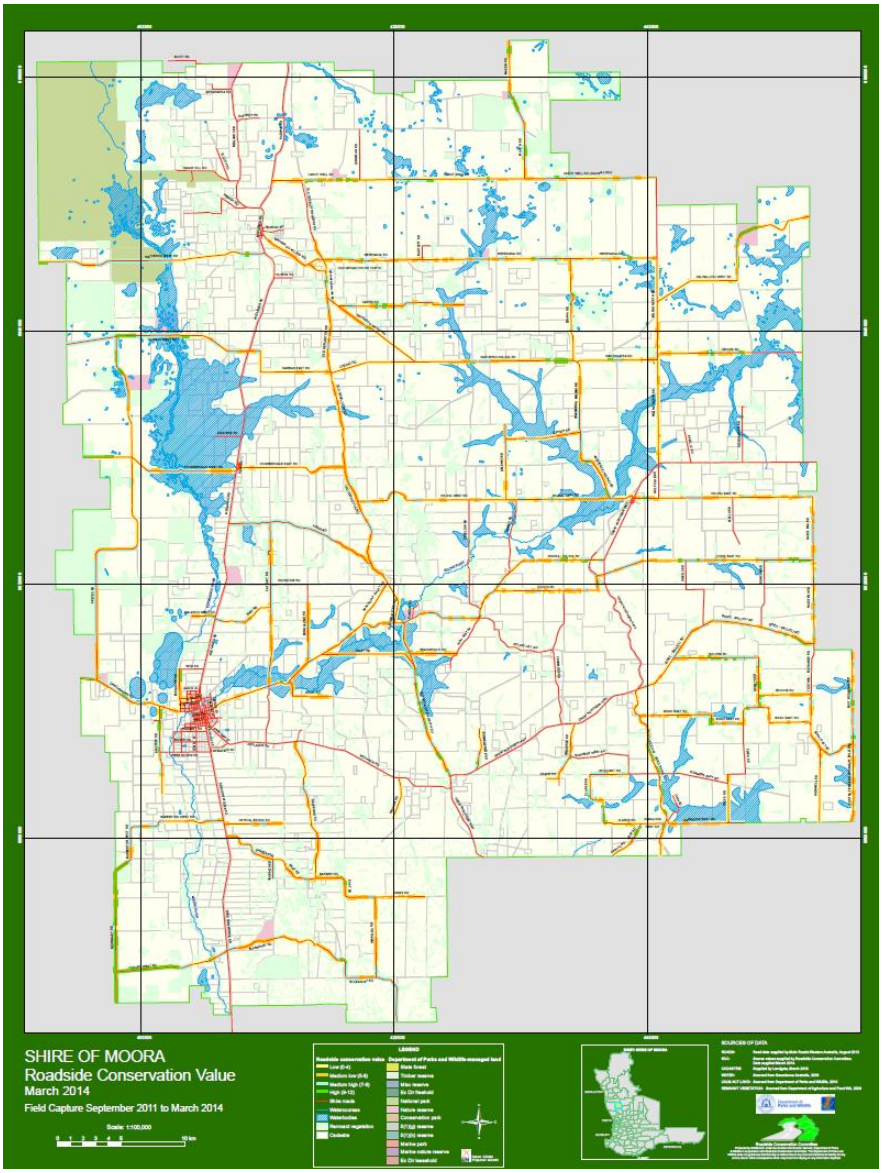
Low conservation value roadsides are typically dominated by weeds and have little or no native vegetation. For example, a section of Balarong Road dominated by capeweed and Paterson's curse.
Photo: K. Payne, RCC

2.0 Using the Roadside Conservation Value (RCV) map

The Roadside Conservation Value (RCV) map (Figure 1) initially provides an inventory of the condition of the roadside vegetation. This is important as the 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, as it enables the condition of roadside vegetation to be easily viewed. 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 or 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.

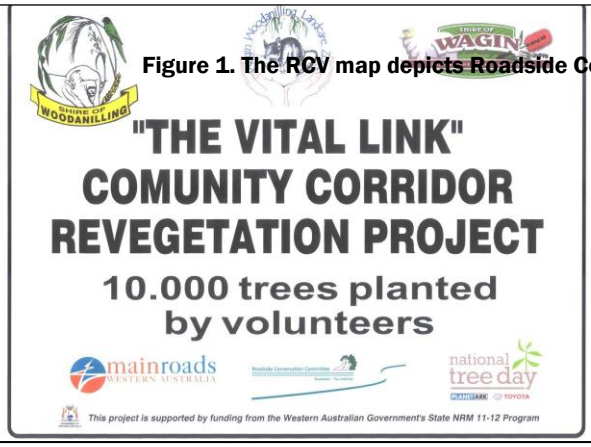


As well as providing a road reserve planning and management tool, the RCV map can also be used for developing:

- roadside vegetation management plans;
- regional or district fire management plans;
- natural resource management projects that would be able to incorporate the information from this survey into 'whole of landscape' projects; and
- tourist routes, i.e. roads depicted as high conservation value would provide visitors to the district with a view of the native flora of the district.

The road manager can declare high conservation value roads as Flora Roads - potential Flora Road section in the Shire of Moora
Photo: K. Payne, RCC

Weed control along a rural roadside
Photo: D.Morgan, Morgan Rural Services



Landcare projects, such as revegetation programs can utilise the information conveyed on roadside conservation value maps.
Photo: D. Perrie, Wagin Woodanilling Landcare Zone

The survey data and map can be used in developing regional or district fire management plans. Above, a fire was started by lightning in the Shire of Moora.
Photo: K. Payne, RCC

Figure 1. The RCV map depicts Roadside Con

3.0 Results

Data collected during the Shire of Moora roadside survey has been compiled and a summary is presented in Table 3. Total distances and percentages of roadside occupied by each of the conservation status categories and the attributes used to calculate the conservation values are provided. As roadsides occur on both sides of the road, roadside distances (km) are equal to *twice* the actual distance of road travelled.

Table 3. Summary of results from the roadside survey in the Shire of Moora

Summary Information: Shire of Moora 2014

Length of roadsides surveyed (left & right): 1471.8km (Length of road 735.9km)

Roadside Conservation Status

	Total (km)	(%)
High (9-12)	104.76	7.12
Medium-high (7-8)	361.76	24.58
Medium-low (5-6)	429.94	29.21
Low (0-4)	575.40	39.09
Total	1471.86	100.00

Native Vegetation in Roadsides

	Total (km)	(%)
2-3 vegetation layers	938.09	63.74
1 vegetation layer	391.24	26.58
0 vegetation layers	142.53	9.68
Total	1471.85	100.00

Number of Native Plant Species

	Total (km)	(%)
Over 20 species	1064.50	72.32
6 to 19 species	339.96	23.10
0 to 5 species	67.39	4.58
Total	1471.85	100.00

Adjoining Land Use

	Total (km)	(%)
Cleared	1063.08	72.23
Scattered	110.76	7.53
Native Veg	190.50	12.94
Plantation	14.06	0.96
Planted Natives	21.03	1.43
Other	72.43	4.92
Total	1471.86	100.00

Weed Infestation

	Total (km)	(%)
Light <30% weeds	634.36	43.10
Medium 30-70% weeds	523.27	35.55
Heavy >70% weeds	314.23	21.35
Total	1471.85	100.00

Roadside Conservation Values

Score	Total (km)	(%)
0	88.64	6.02
1	79.58	5.41
2	107.04	7.27
3	156.83	10.65
4	143.31	9.74
5	190.30	12.93
6	239.65	16.28
7	232.71	15.81
8	129.05	8.77
9	52.95	3.60
10	39.93	2.71
11	10.29	0.70
12	1.59	0.11
Total	1471.86	100.00

Width of Vegetated Roadside

	Total (km)	(%)
1 to 5 m	1317.66	89.52
5 to 20 m	115.77	7.87
Over 20 m	6.91	0.47
Unfenced	31.52	2.14
Total	1471.85	100.00

Extent of Native Vegetation

	Total (km)	(%)
Over 70%	154.29	10.48
30% to 70%	717.35	48.74
Less than 30%	600.21	40.78
Total	1471.85	100

Habitat Features

	Total (km)	(%)
Low (0)	355.72	24.17
Medium low (1)	687.54	46.71
Medium high (2)	304.88	20.71
High (3-5)	123.73	8.41
Total	1471.85	100.00

Roadside surveys were carried out in the Moora Shire from September 2011 to June 2013

Width of road reserve

The RCV map indicates the width of assessed road reserves as well as their conservation value. The width of road reserves was recorded in increments of 20 metres, generally from fence to fence. The majority (89%) of road reserves were 20 metres wide (Table 3, Figure 2). Three percent of road reserves were unfenced. These are usually found along roads adjacent to uncleared vegetation, for example nature reserves and national parks.

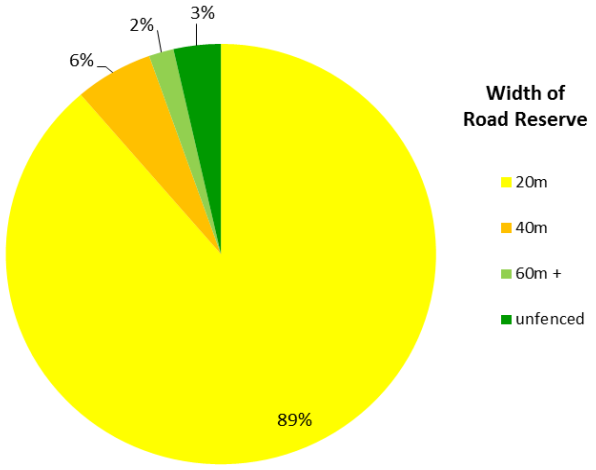
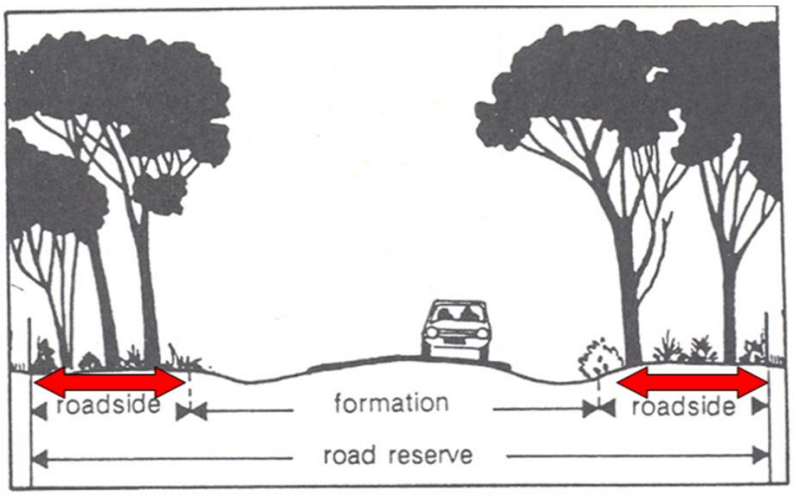


Figure 2. Width of road reserve in the Shire of Moora

Width of vegetated roadside

The width of roadside vegetation is closely linked with its resilience and is often related to conservation value. The wider the reserve, the more resilient to disturbance it is, and often the higher conservation value it has (i.e. more bush equals more habitat, generally in better condition).



The width of vegetated roadside was recorded by selecting one of four categories: 1-5 metres, 5-20 metres or over 20 metres or unknown in width. The left and right hand sides were recorded independently, and then summed to give the figures presented here (Table 3 and Figure 3). Most roadsides (90%) had vegetation between 1 and 5 metres wide. 2% of roadsides were 'unfenced' where no fence line defined the edge of the road reserve.

These results indicate that the great majority of roadsides in the shire are vulnerable to disturbance, and that care will be needed to prevent a marked decline in condition.

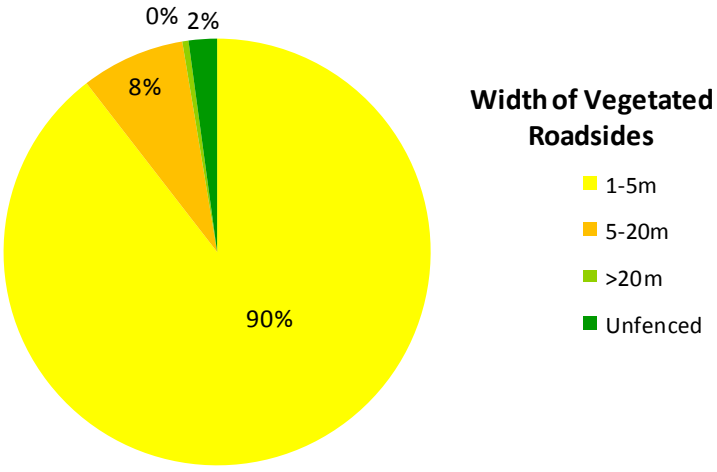


Figure 3. Width of vegetation on roadsides in the Shire of Moora

Structure of native vegetation on roadsides

The number of native vegetation layers present (i.e. tree, shrub and/or ground layers) determined the 'native vegetation on roadside' score. Most roadsides (64%) still had two to three layers of native vegetation present (Table 3 and Figure 4). This vegetation will maintain more natural ecosystem function than that with one or no layers of native vegetation. It will also have value to a greater range of plants and animals. The tree layer is often retained in road management - this is very positive, as they are long-lived and provide both home and food for many vertebrates and invertebrates. Retaining the shrub and ground layers is also extremely important for conservation, as they provide home and food for a different set of species. These layers also do a great deal to suppress weeds, and in wildflower season will provide a colourful display for residents and tourists. If care is taken during maintenance such as pruning, slashing and clearing, these layers should persist with minimal input.

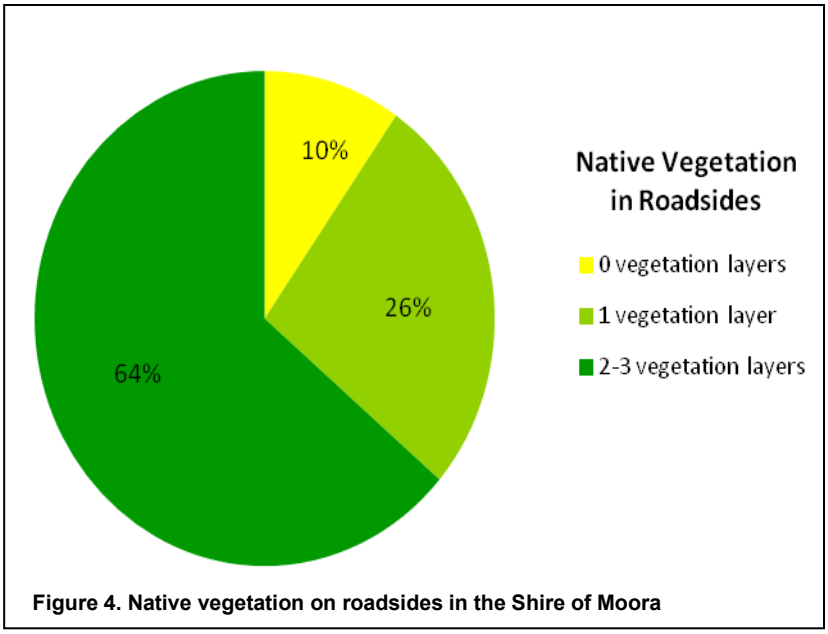


Figure 4. Native vegetation on roadsides in the Shire of Moora

Number of native plant species

As mentioned in Section B, Western Australia has a very high number of native plant species in world terms, with many restricted to small areas of the state. In Moora, a diverse range of native plant species would be expected in intact vegetation. The 'number of native plant species' score provides a measure of the diversity of the roadside vegetation. Survey sections with over 20 plant species spanned 5% of the roadsides surveyed, while 72% of surveyed roadsides contained less than 5 plant species (Table 3 and Figure 5). These figures suggest that natural plant diversity is dropping in roadside vegetation and with it the range of animals that can be supported there. Hopefully these species persist in larger remnants of vegetation, but the ease with which residents and tourists can see and appreciate local flora and fauna is falling. Likewise, the animals' ability to traverse the landscape to meet their various needs is also dropping. Measures need to be taken to ensure this diversity is not lost altogether.

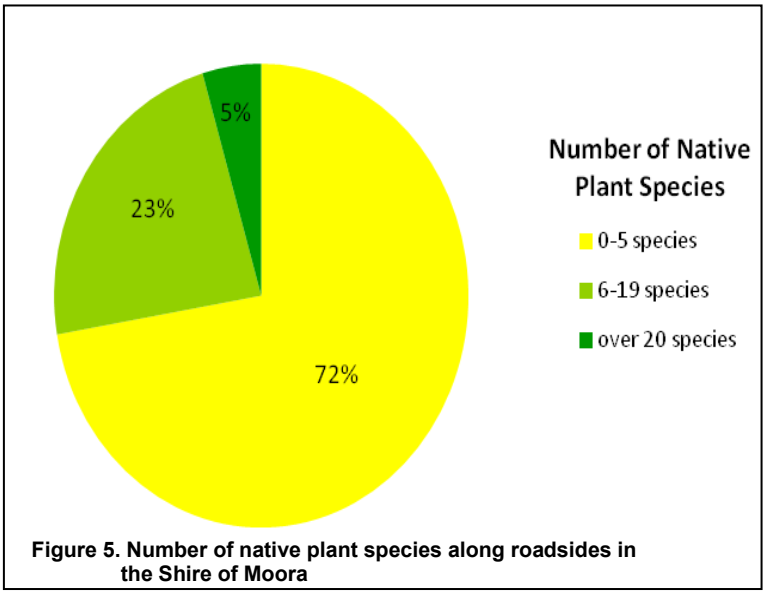


Figure 5. Number of native plant species along roadsides in the Shire of Moora

Extent of native vegetation

The 'extent of native vegetation' cover refers to the continuity of the roadside vegetation and takes into account the presence of disturbances such as weeds. Gaps in vegetation cover provide more opportunity for weeds to establish and spread. Roadsides with extensive vegetation cover, i.e. greater than 70% occurred along 154 km (10%) of the roadsides surveyed. Survey sections with medium vegetation cover, i.e. 30% to 70%, accounted for 717 km (49%) of the roadsides. The remaining 600 km (41%) had less than 30% native vegetation cover, and would therefore be very vulnerable to weed incursion (Table 3 and Figure 6).

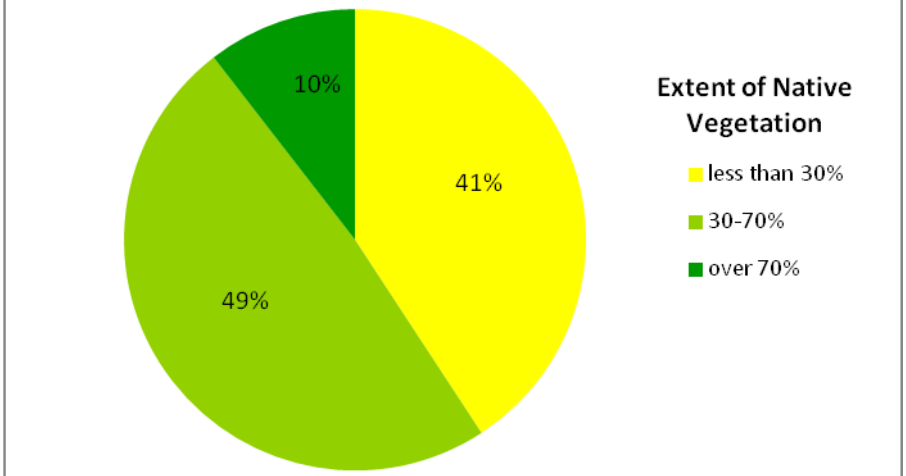


Figure 6. Extent of native vegetation on roadsides in the Shire of Moora

Habitat value

This factor considered the presence of five attributes: connection of remnant vegetation patches; presence of flowering shrubs; presence of large trees with hollows; presence of hollow logs; and environmentally sensitive areas. Roadsides with a high number (more than 3 out of 5) of habitat features were present along 8% (124km) of the roadsides surveyed. Roadsides having no habitat features at all were recorded along 24%, (356km) of the roadsides (Table 3 and Figure 7). This indicates that over three quarters of the roads in the shire are serving at least some habitat function.

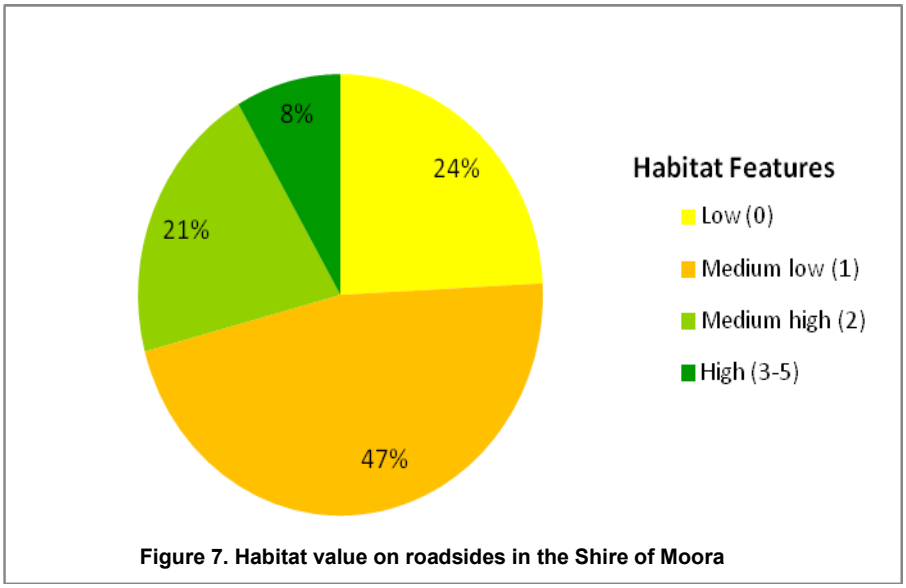


Figure 7. Habitat value on roadsides in the Shire of Moora

Roadside vegetation types

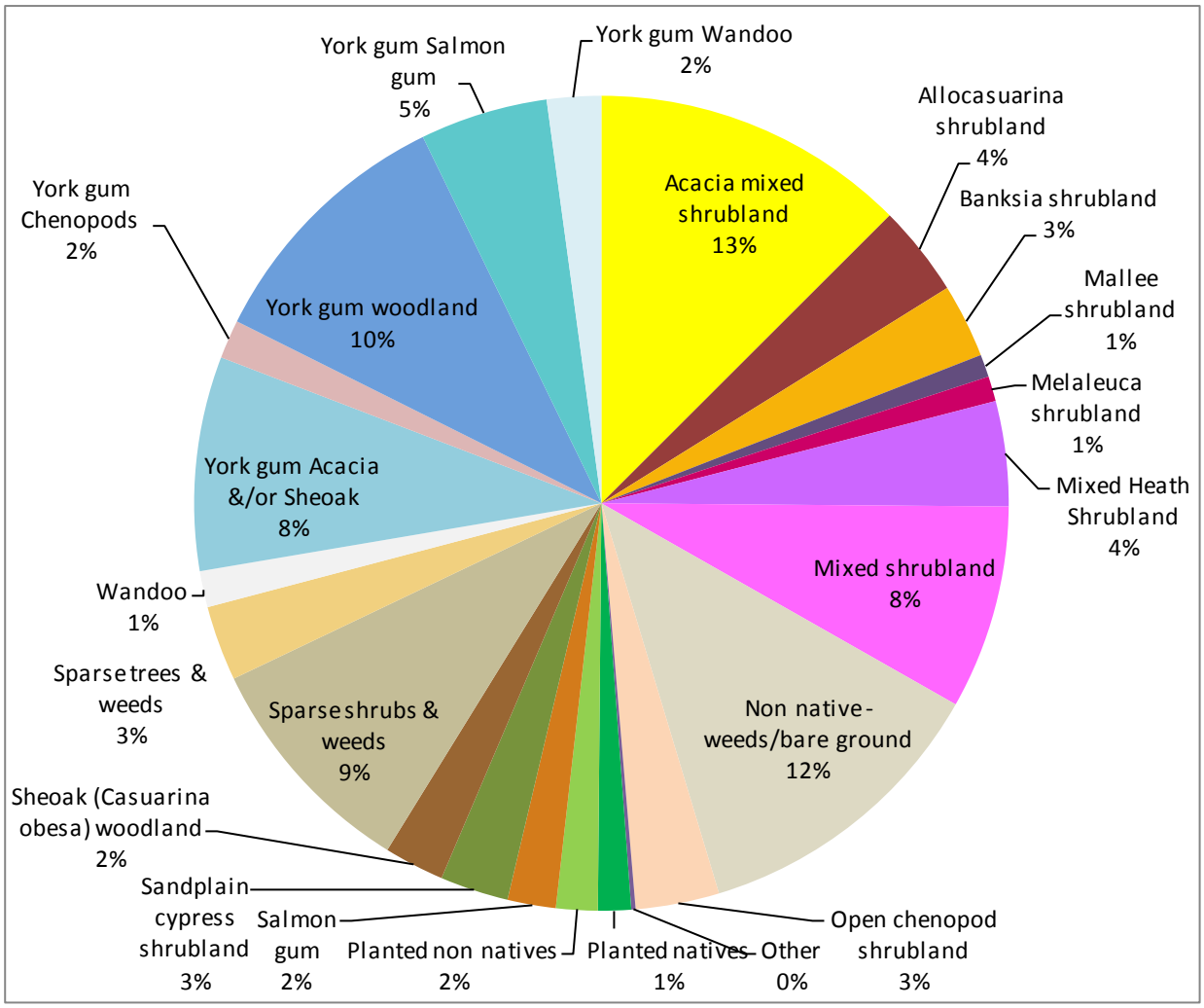


Figure 8. Vegetation types along roadsides in the Shire of Moora

Surveyors were asked to record the main vegetation type along each section of roadside to identify the variety of types present, and those which are particularly characteristic of the shire. The most common vegetation type was Acacia mixed shrubland, which was recorded along 13% of roadsides in the Shire of Moora. Non native weeds/bare ground (12%) was the second most common vegetation type or lack thereof. York gum was found on 27% of shire roadsides, salmon gum on 7% and wandoo on 3%. Planted vegetation covered 3% of roadsides. Mixed shrubland and mixed heath shrubland combined covered 12% in total of roadsides. Sparse vegetation with weeds also covered 12% of roadsides. Sheoak, banksia, sandplain cypress, melaleucas, mallees and chenopods made up most of the minor vegetation types (Figure 8).

Environmentally Sensitive Areas

ESA markers were found along Bindi East Road, Carot Well Road, Dalwallinu West Road, Gabalong East Road, Gabalong West Road, Honeys Road, Mason Road, Merewana Road, Prices Road, Taylors Road, and Toodyay Bindi Bindi Road. There were multiple ESA markers on a number of these roads, marking a number of populations. Two new populations of *Daviesia dielsii* were found during the surveys.

There are other roadsides in the shire which contain threatened flora which has not been marked. Priority species may not be marked either. It is important to maintain contact with the Moora District DPAW office on 9652 1911 when road upgrades and maintenance work are to be undertaken to find out about any threatened or priority flora populations which may be impacted. Often these populations are found in weedy and otherwise unattractive roadsides so it is important to check even if it appears there is nothing there but weeds.

***Daviesia dielsii*, a disturbance opportunist. Two new populations of this threatened flora species were found during the roadside surveys.** Photos: K. Payne, RCC

***Eucalyptus rhodantha* var. *rhodantha* is restricted to a few populations in the northern agricultural region.** Photos: K. Payne, RCC

ESA markers marking threatened flora on roadsides in the shire.
Left burnt bushland on neighbouring property dangerously close to threatened flora on roadside. Photo: DPAW, Moora District.
Middle and right, threatened flora has been invaded by weeds. Photos: K. Payne, RCC

3.1 Threats

Weed infestation

Light levels of weed infestation (weeds comprising less than 30% of total plants), were recorded on most of the roadsides surveyed (634 km, 43%), while heavy infestations (more than 70% of the plants present were weeds) were recorded on 314 km (21%) of roadsides surveyed (Table 3 and Figure 9). Roadsides with light or no weed presence are a priority for protection and minimising soil disturbance. This is because it is more efficient and cost effective to prevent weed invasion by retaining native vegetation than it is to control weeds once established.

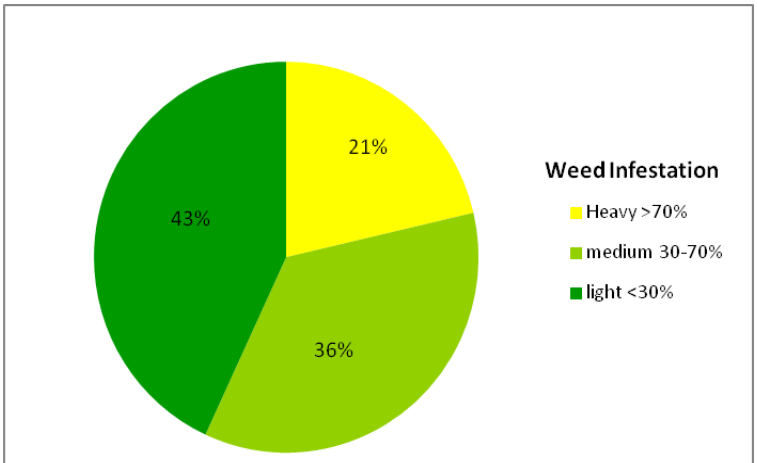


Figure 9. Weed infestations along roadsides in the Shire of Moora.

Nominated weeds

The following weeds were chosen for the Shire of Moora survey:

- African lovegrass (*Eragrostis curvula)*
- Fountain grass (*Cenchrus setaceus*)
- Paterson's curse (*Echium plantagineum*)
- Spiny rush (*Juncus acutus*)
- Veldt grass (*Ehrharta* sp.)
- Wild radish (*Raphanus raphanistrum*)

Roadside populations of nominated weeds were recorded as being present in the road reserve, and were not recorded specifically for the left and/or right hand sides. Therefore, the occurrence of each weed (in kilometres) indicates the presence of the weed within the road reserve generally.

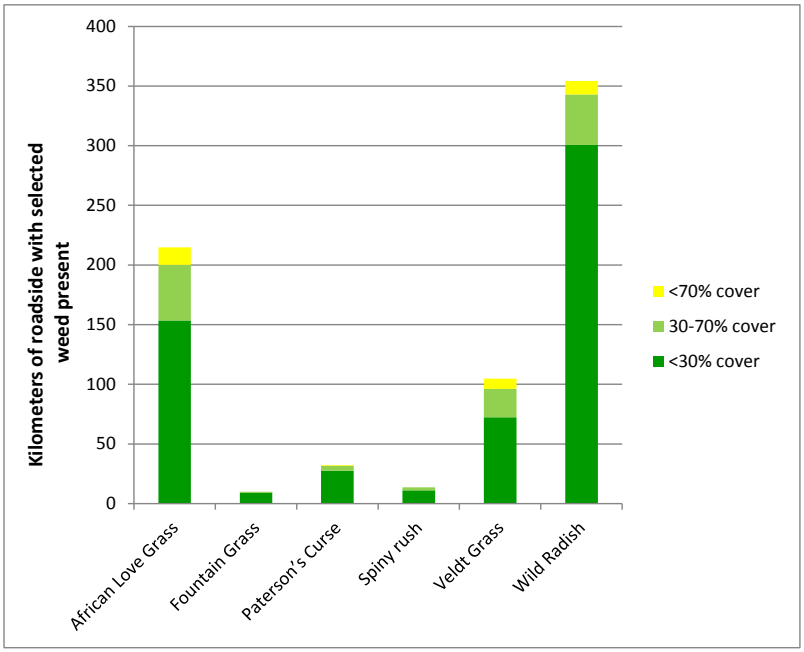


Figure 10. Presence and abundance of chosen weeds along roadsides in the Shire of Moora

Of the selected weed species, wild radish was the most prevalent and was recorded on 354 kilometres of the roads surveyed. For most of this distribution (301 km) it was at a density of less than 30%. The next most commonly recorded weeds were African lovegrass (215 km) and veldt grass (105 km) respectively. Like wild radish, most records of African lovegrass and veldt grass were at a density of less than 30%. However, control of these weeds will need to be done with care to minimise harm done to the native vegetation. If the native vegetation maintains or improves in health, it will help to suppress future weed levels. Paterson's curse (32 km), spiny rush (14 km) and fountain grass (10km) occurred along smaller sections of roadside (Figure 10). Control of Paterson's curse and eradication of spiny rush and fountain grass from the shire thus looks achievable within the short to medium term, if a targeted program to control them is instigated. Contact RCC if advice on control methods is required.

Figure 11 shows the spatial extent of these weeds on a simplified version of the Moora map. These are shown in more detail on the weed overlays provided with the Roadside Conservation Value map.

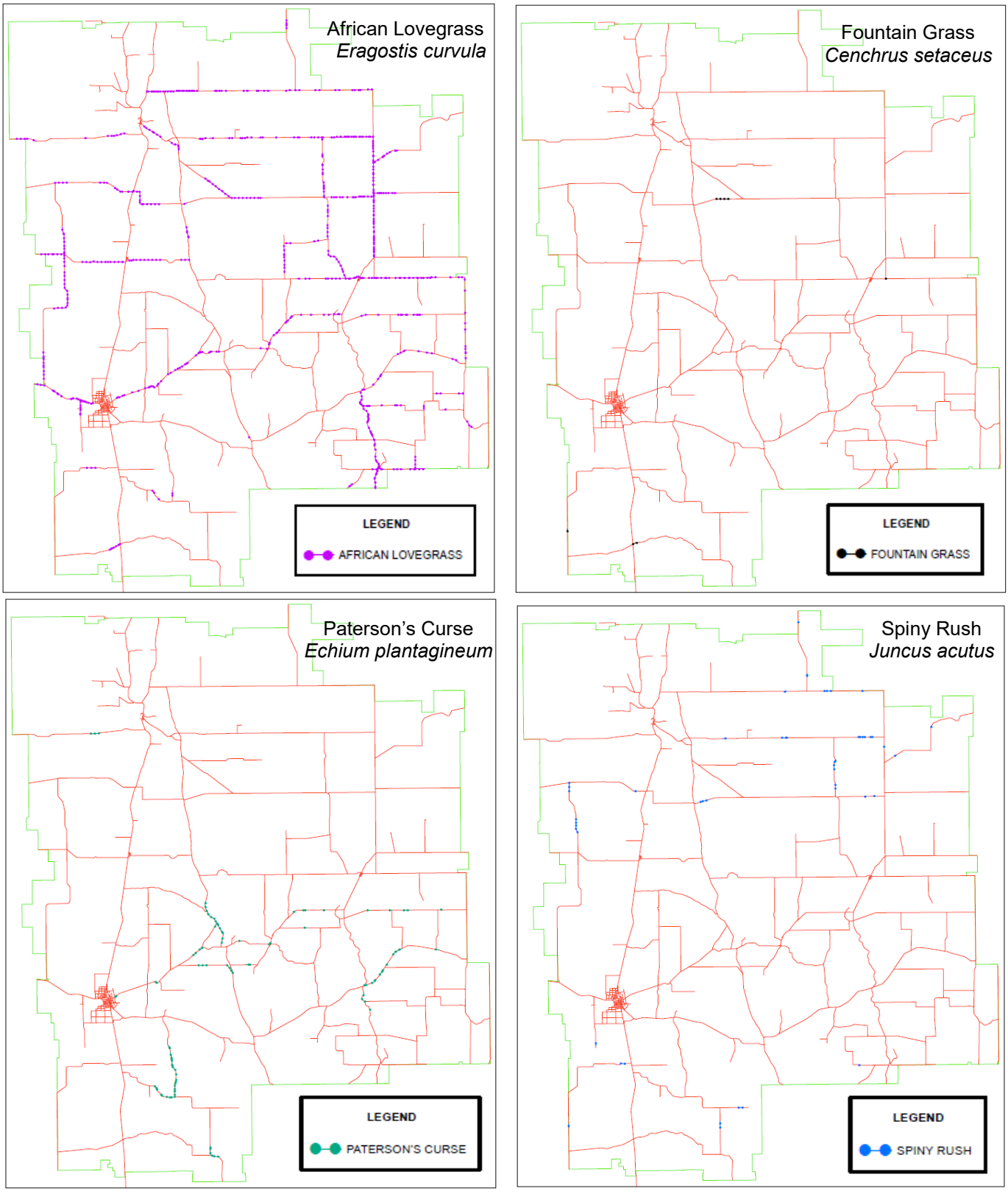
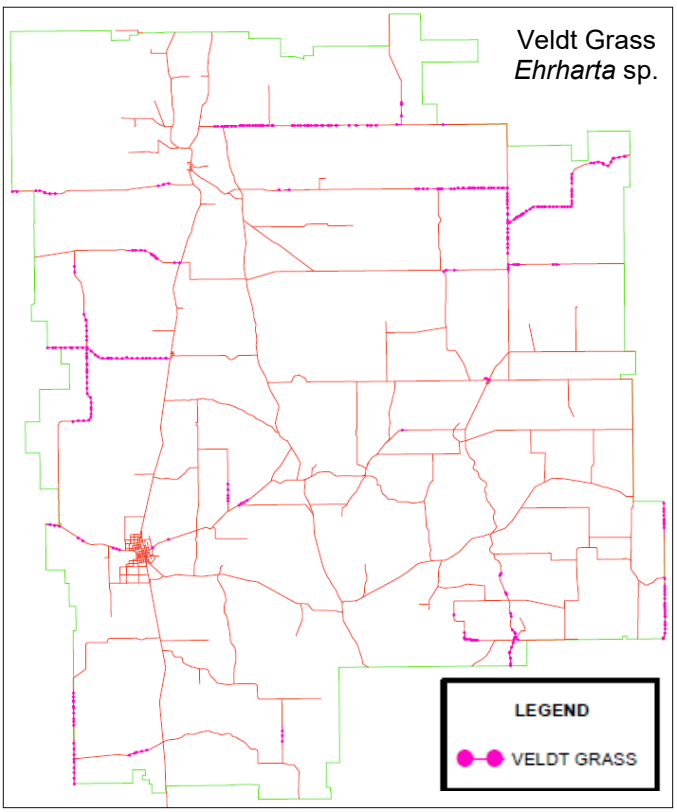


Figure 11. Spatial extent of nominated weeds on roadsides in the Shire of Moora.



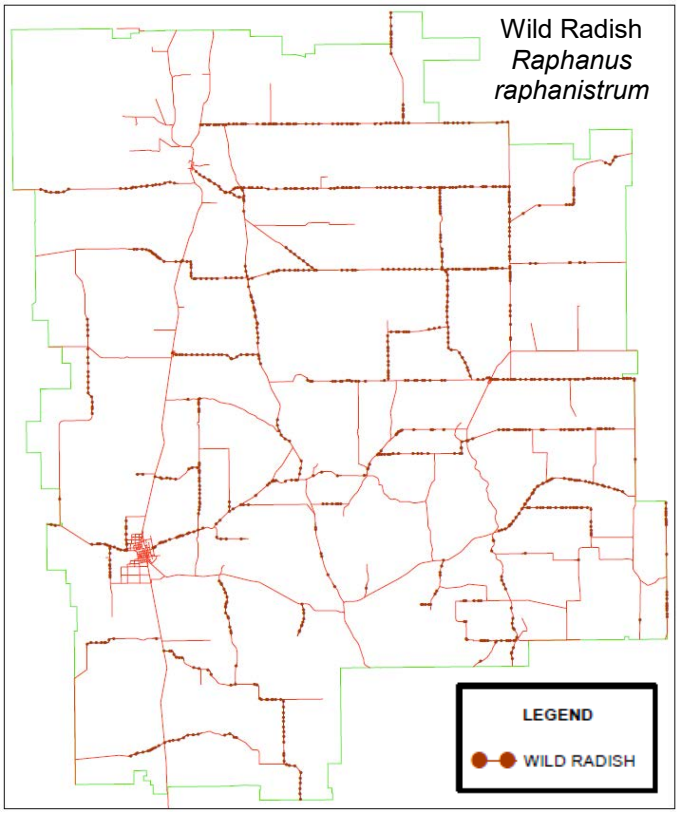


Figure 11. Spatial extent of nominated weeds on roadsides in the Shire of Moora (*continued*).

Appendix 10 provides tables and graphs of abundance all additional weeds recorded along roadsides throughout the August 2012 to June 2013 surveys. The final data sheet (on CD attached) is a comprehensive spreadsheet which shows all weeds recorded along sections of roadsides during the surveys.

Feral animals – rabbits

There was no evidence or sightings of rabbits on 94% (1387 km) of the roadsides surveyed. On 6% (85 km) of road reserves there was evidence (e.g. warrens) of the presence of rabbits (Figure 12). This is positive for the condition of vegetation, as rabbits foster weeds through their disturbance of soil and spread of weed seed. Rabbit presence was noted along sections of Airstrip Road, Bindi East Road, Boundary Road, Coomberdale East Road, Coomberdale West Road, Delanes Road, East Boundary Road, Edawa Road, Ferguson Road, Lyons East Road, Madingarra Road, Mason Road, Merewana Road, Moora-Miling Road, Old Geraldton Road, Prices Road, Taylors Road, Tootra Fence Road, and Watheroo Miling Road.

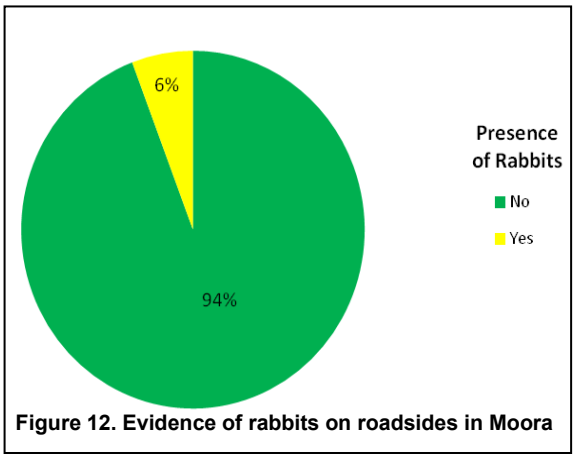


Figure 12. Evidence of rabbits on roadsides in Moora

Tree decline

Roadside surveyors were asked to record areas of tree decline and to suggest a possible reason for that decline. Of the roadsides surveyed, 92% (1358 km) did not have noticeable signs of tree decline. The majority of tree decline recorded (3%) was from an unknown cause. Salinity, drought, recent fire and clearing were given as possible causes for a combined total of 5% (64 km) of tree decline (Figure 13).

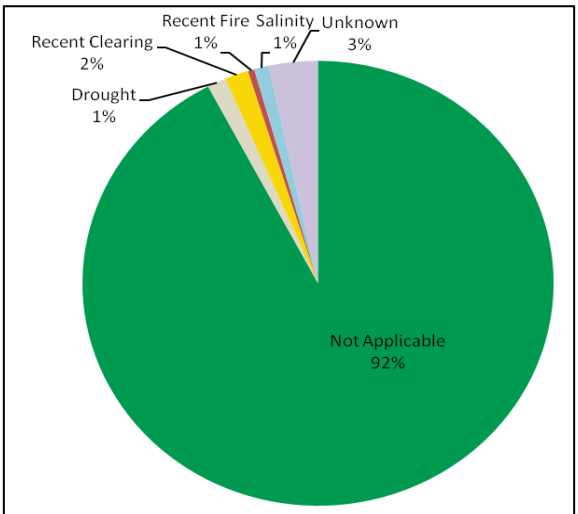


Figure 13. Possible reasons for tree decline

Adjoining land use

Most (72%, or 1063km) of roadsides adjoined land that had been completely cleared. Land cleared for agriculture but retaining scattered native vegetation (e.g. paddock trees, creekline vegetation) adjoined another 8% (110 km) of the roadsides. Remnant native vegetation adjoined 13% (190 km) of surveyed roadsides. It is important to protect these areas from weed invasion to prevent the roadside acting as a launch pad for weeds into these larger areas of vegetation. Plantations (native & non-native) adjoined 2% of roadsides. There were also 5% of other land uses adjoining; predominantly this was saline land or salt lakes (Table 3 and Figure 14).

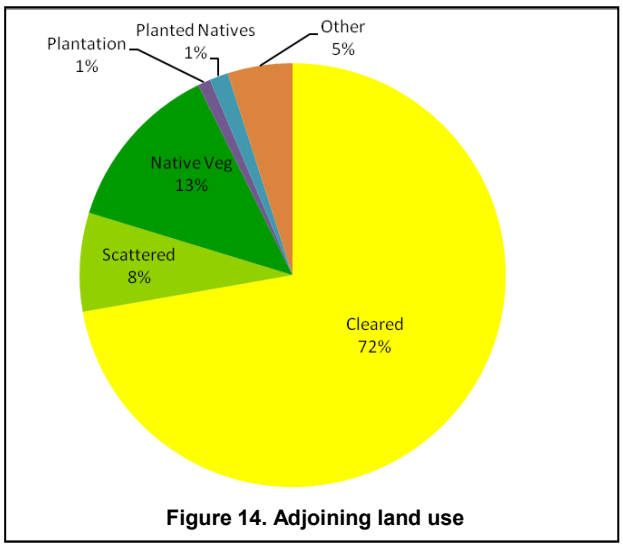


Figure 14. Adjoining land use

3.2 Roadside Conservation Value scores

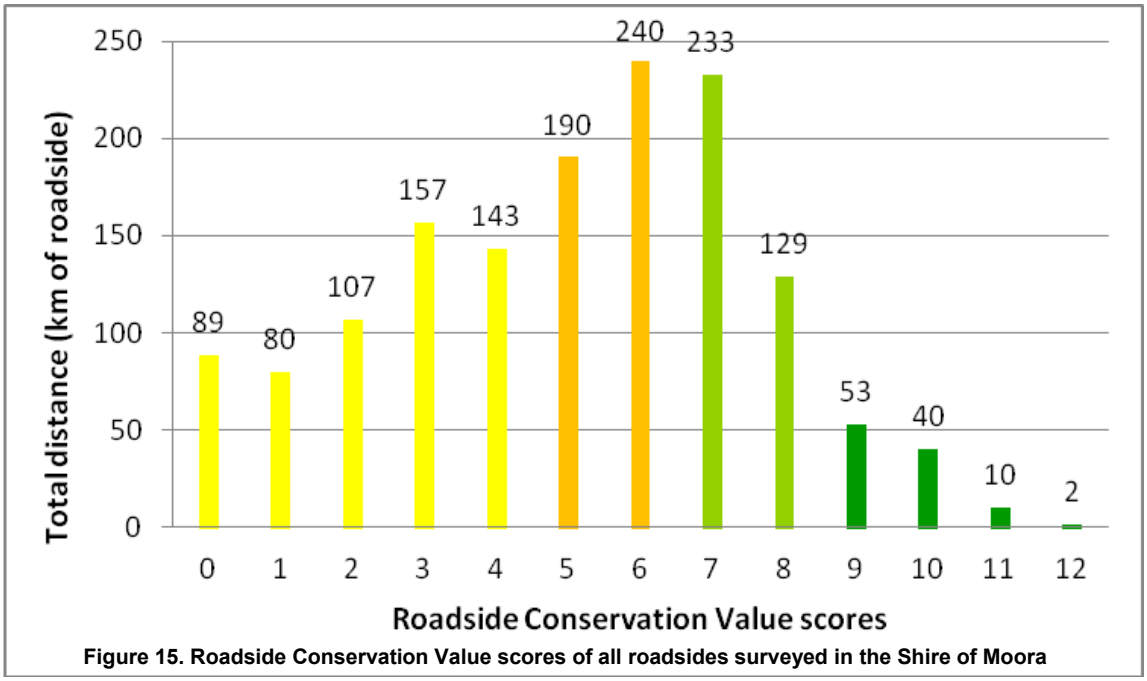


Figure 15. Roadside Conservation Value scores of all roadsides surveyed in the Shire of Moora

Roadside Conservation Value (RCV) scores were calculated for each section of roadside surveyed. Scores ranged from 0 to 12, from lowest to highest conservation value respectively (Figure 15). The figures follow a bell curve but it is weighted more to the low and medium low conservation value scores. The single most commonly occurring RCV score was 6, followed by 7, 5 and 3.

The conservation status category indicates the combined conservation value of roadsides surveyed in the Shire of Moora. With a total of 575 kilometres, 39% of roadsides rated as Low (coloured yellow in Figure 15), and 430 kilometres (29%) rated as Medium-low (orange). Compare this to 362 kilometres (25%) rated as Medium-high (pale green) and 105 kilometres (7%) rated as High (dark green) (Table 3 and Figure 16). Over two thirds of the roadsides are of low to medium low conservation value. This shows the decline in native vegetation along roadside reserves. It is therefore very important that the 32% of high and medium high conservation value reserves are managed and preserved for the habitat of native animals and birds including the threatened Carnaby's cockatoos and for the numerous threatened and priority flora and threatened ecological communities that occur on or near road reserves in the shire. The Northern Agricultural Region, of which the Moora Shire is part, is a drawcard for tourists wanting to view wildflowers, many along roadsides, so for economic and tourism reasons these roadsides also need to be preserved.

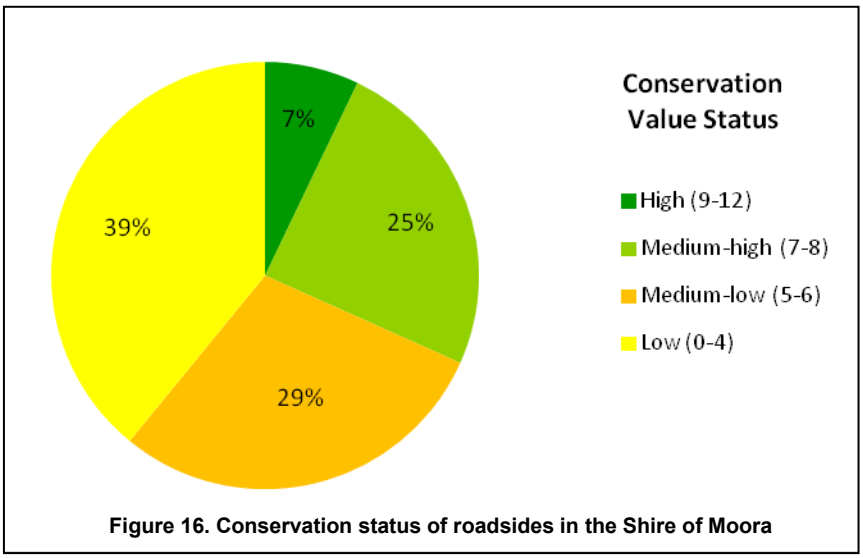


Figure 16. Conservation status of roadsides in the Shire of Moora

3.3 Comparison of conservation status with nearby shires

Roadside conservation mapping has been undertaken in five adjoining shires with comparable vegetation and landscapes to Moora: Victoria Plains and Coorow in 1994, Dalwallinu in 2004, Wongan-Ballidu in 2005 and Dandaragan in 2009. Coorow had the largest percentage of high conservation value roadsides (68%) closely followed by Dalwallinu with 65% and Moora had the lowest percentage of high conservation value with only 7%. In contrast Moora had the highest percentage of low conservation value (39%) roadside vegetation. Wongan-Ballidu and Victoria Plains had 26% and 24% respectively. Coorow and Dandaragan both had 13%, and Dalwallinu had the lowest occurrence of low conservation value roads with just under 6% (Figure 17). However, it is likely that the roadside conservation status values recorded for the other shires have decreased since being surveyed 5 to 20 years ago, due to the general trend of declining vegetation condition along roadsides.

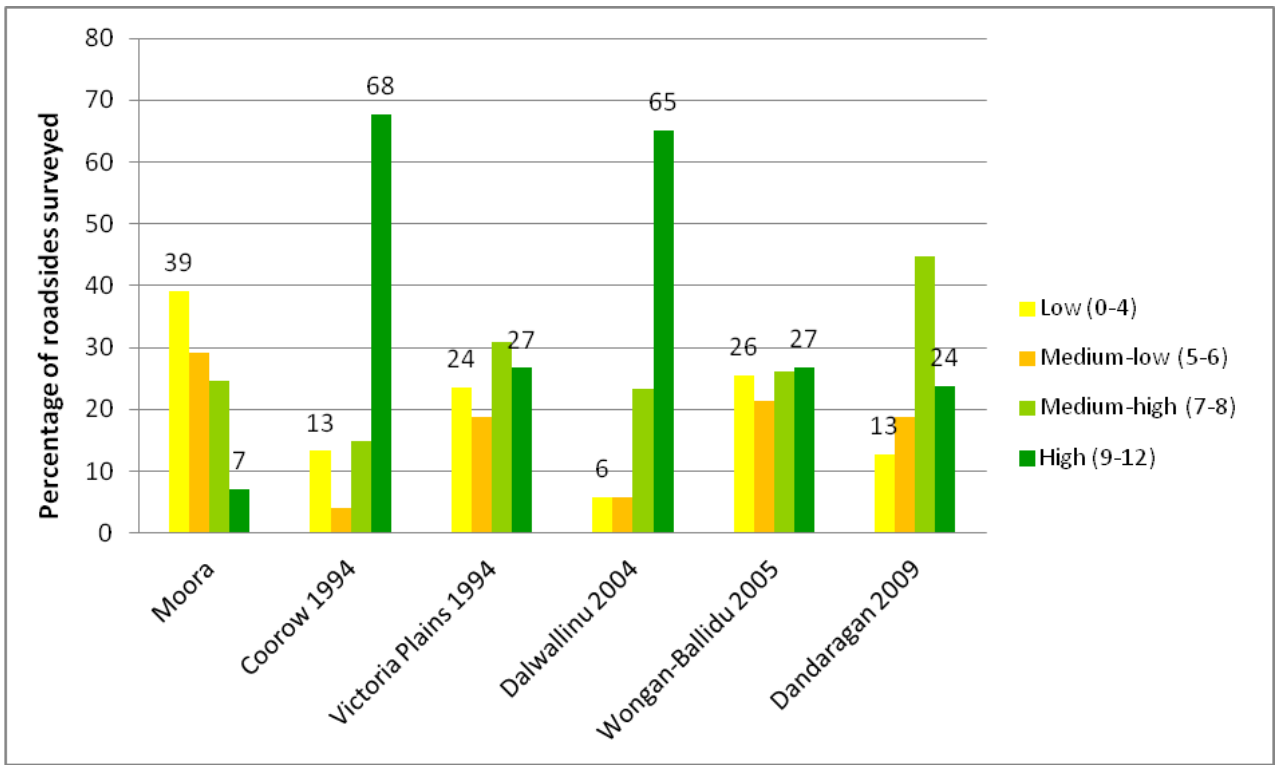


Figure 17. Comparison of the Shire of Moora's conservation status with nearby shires with roadside mapping.

3.4 Flora Roads

A Flora Road is one which has special conservation value because of the vegetation contained within the road reserve. The Roadside Conservation Committee has prepared *Guidelines for the Nomination and Management of Flora Roads* (Appendix 3).

There are currently no Flora Roads in the Shire of Moora. The roadside survey and the 2014 RCV map highlight some roadsides that have the potential to be declared as Flora Roads. Roadsides determined as having high conservation value in the Shire of Moora include:

- Boundary Road

Roads with large sections of medium to high conservation value vegetation can also become Flora Roads. In some cases these roads can be targets for weed control or revegetation to improve the consistency of conservation value. These roadsides in the Shire of Moora include:

- Kiaka Road
- Koojan West Road
- Masons Road
- Namban West Road
- Prices Road
- Watheroo West Rd

Boundary Rd, Moora - potential Flora Road
Photos: K. Payne, RCC

Boundary Rd - Ideal habitat for native fauna. A number of echidnas have been spotted along this road.

Photo: R.Walmsley, Moore Catchment Council

The following roads have significant sections of low value vegetation, but also high value sections which may be long enough (minimum 2 km) to be considered for Flora Road nomination. These roadsides also have sections which could be targeted for revegetation.

- Airstrip Road
- Cattady Road
- Old Geraldton South Road
- Toodyay Bindi Bindi Road

Pear-fruited mallee on Masons Rd. This road has some high conservation value sections and some weedy sections which could be targeted for weed control and revegetation.
Photo: K. Payne, RCC

There may be other roads in the shire which could also be considered for Flora Road nomination. If nominated as a Flora Road, these roadsides would be assessed by the RCC to determine their suitability with regard to landscape, tourism, access and other factors, in addition to their high roadside conservation value.

Prices Rd, Moora - potential Flora Road, lovely wildflowers in spring including purple dampiera (left) and cauliflower, *Verticordia eriocephala* (right)
Photos: R. Walmsley, Moore Catchment Council

PART D

ROADSIDE MANAGEMENT RECOMMENDATIONS

1.0 Management recommendations

The primary aim of road management is the creation and maintenance of a safe, efficient road system. However, there are often important conservation values within the road reserve and thus this section provides general management procedures and recommendations that will assist in retaining and enhancing roadside conservation values, where possible.

The Executive Officer of the Roadside Conservation Committee is also available to provide assistance on all roadside conservation matters, and can be contacted on (08) 9334 0423. The following RCC publications provide guidelines and management recommendations that will assist Local Government Authorities:

- *Guidelines for Managing Special Environmental Areas in Transport Corridors*
- *Handbook of Environmental Practice for Road Construction and Maintenance Works*
- *Biodiversity Conservation and Fire in Road and Rail Reserves: Management Guidelines*

They are available for download from the RCC website (www.dpaw.wa.gov.au/rcc), or as hardcopy from the RCC on request.

1.1 Protect high conservation value roadsides by maintaining the native plant communities.

This can be achieved by:

- retaining remnant vegetation
- minimising disturbance to existing roadside vegetation
- minimising disturbance to soil
- preventing or controlling the introduction of weeds.

1.2. Promote and raise awareness of the conservation value associated with roadside vegetation by:

- establishing a register of Shire roads important for conservation
- declaring suitable roadsides as Flora Roads
- incorporating Flora Roads into tourist, wildflower and/or scenic drives.

1.3 Improve sections of medium to low conservation value roadside by:

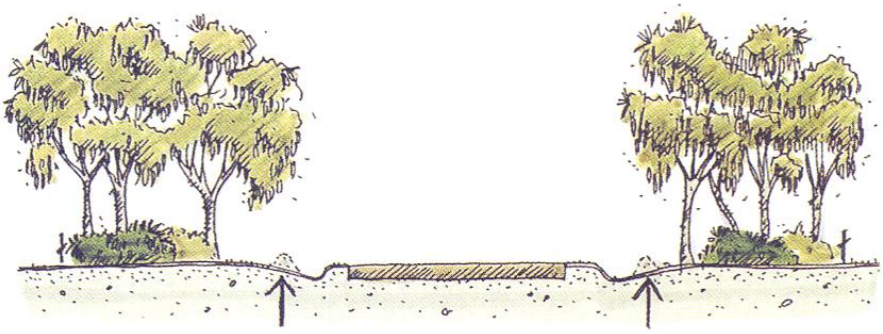
- minimising disturbance caused by machinery, adjoining land practices and fire
- retaining remnant trees and shrubs
- encouraging regeneration or revegetation projects by adjacent landholders.
- carrying out a targeted weed control program, ideally followed by measures to increase native plant cover to suppress future weeds
- where good native cover exists, allow natural regeneration
- where natives are a bit sparse, spread local native seed to encourage regeneration
- where natives are very patchy to non-existent, more intensive planting would be needed to provide suppressive native cover.

Revegetation area
Photo: K. Payne, RCC.

2.0 Minimising disturbance

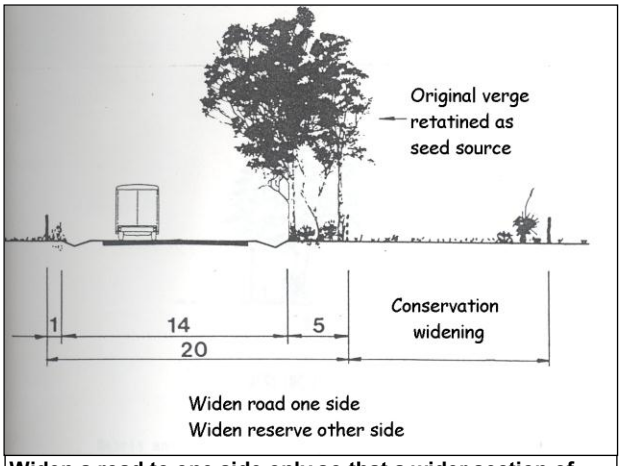
Some methods of minimising disturbance include:

- adopting a road design that occupies the minimum space;
- diverting the line of a table drain to avoid disturbing valuable flora;
- removing minimum material necessary for sightlines to be maintained, such as lowering height of shrubby vegetation by slashing rather than removing altogether;
- pruning branches rather than removing the whole tree or shrub;
- not dumping cleared vegetation or pushing spoil into areas of native flora;
- applying the Fire and Roadside Assessment before burning roadside vegetation and using methods other than fuel reduction burns to reduce fire threat. Refer to the Management Strategies recommended in '*Biodiversity Conservation and Fire in Road and Rail Reserves: Management Guidelines'*;
- following good hygiene practices like machinery clean-down to prevent spread of Phytophthora dieback and weeds
- encouraging adjacent landholders to set back fences to allow roadside vegetation to proliferate;
- encouraging adjacent landholders to plant windbreaks or farm tree lots adjacent to roadside vegetation to create a denser windbreak or shelterbelt; and
- encouraging revegetation projects by adjacent landholders.



Avoid windrowing drain material into vegetation

Creative solutions: A high value Flora Road in the Shire of Plantagenet. Passing lanes were established at various locations along the road to eliminate the need for widening the whole road.
Photo: C. Macneall, RCC.



Widen a road to one side only so that a wider section of roadside vegetation is retained on the other side of the road reserve.

3.0 Planning for roadsides

The RCC is able to provide examples of Roadside Management Plans and encourages all Shires to adopt this practice of planning for roadside conservation.

The following actions greatly enhance the likelihood of a plan which 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 (WALGA has templates that can assist with this);
- Community education - use of innovative and relevant material can increase community understanding of roadside values; and
- 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 value sites and/or current projects and works. For training enquiries please contact the RCC Executive Officer on (08) 9334 0423.

4.0 Setting objectives

The objective of all roadside management should be to:

- **Protect**
  - road users
  - native vegetation
  - rare or threatened flora or fauna
  - cultural and heritage values
  - community assets from fire
- **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
- **Enhance**
  - native vegetation communities
  - fauna habitats and corridors
  - visual amenity

5.0 Specific recommendations for Shire of Moora roadsides

5.1 Weed management

- Target the six chosen weeds, African lovegrass (*Eragrostis curvula*), fountain grass (*Cenchrus setaceus*), Paterson's curse (*Echium plantagineum*), spiny rush (*Juncus acutus*), veldt grass (*Ehrharta* sp.) and wild radish (*Raphanus raphanistrum*), as the highest priority for control. Work first on roadsides which have high conservation value followed by roadsides of medium high conservation value. Refer to *Florabase*, *Bushland Weeds* and *Southern Weeds* for practical suggestions for their control and management, or seek additional information from the RCC.

Masons Rd, Gunyidi. Spiny rush dominates this roadside near a creek crossing.

- Identify five to ten other weeds to target for control in high value areas such as Flora Roads and high conservation value roads. For example, wild oats, capeweed, annual grasses, brome grass, barley grass and afghan melon occur on such roads in the Shire of Moora.

Boundary Rd, Moora. False bamboo above and Victoria tea tree and annual grasses below. A small weedy section in an otherwise high conservation value road.

Photos: K. Payne, RCC

- Identify five to ten weeds with small infestations on one or a small number of roadsides to target for eradication. (See graph in Appendix 8 'Extent of additional weeds covering less than 5km of roadside'). For example:
    - cape tulip & freesia on Merewana Road,
    - tambookie grass on Barberton East Road,
    - evening primrose on Moora-Miling Road,
    - false bamboo on Boundary, Clarke, Coomberdale East and Miling North Roads,
    - pepper tree on Toodyay Bindi-Bindi Road
    - cotton bush on Carot Well Road
    - Victorian teatree on Boundary Road.

Refer to the weed overlays provided with the RCV Map, the graphs in Part C and Appendix 8 of the Report, the comprehensive data sheet on the CD and the RCC Environmental Roadside Weed List (available at www.dpaw.wa.gov.au/images/documents/conservation-management/off-road-conservation/rcc/environmental-roadside-weed-list---august-2012.pdf for information to guide choices.

Refer to the DPaW website for information on control methods and resources www.dpaw.wa.gov.au/plants-and-animals/plants/weeds/155-how-to-control-weeds

5.2 Revegetation

Identify five to ten areas on high value roads suitable for revegetation. For example:

- medium low and low conservation sections along Airstrip, Koojan West, Kiaka, Old Geraldton South and Prices Roads.
- also sections along Clarke, Gabalong West, Nadji Mia, Lyons East, Taylors Toodyay Bindi Bindi and Urquhart Roads
- small sections on other roads suggested as potential Flora Roads on page 44 of this report.

Lyons East Road, has some high conservation sections interspersed by low and medium low conservation sections which could be targeted for revegetation
Photo: E. McLaughlin, RCC

Refer to the RCV Map and look for small low conservation value sections in otherwise high to medium-high conservation value roads. In most of these sections the revegetation would need to be preceded by weed control (see Section 5.1).

5.3 Carnaby's cockatoos

Retain all large eucalypt trees, unless they are a public safety hazard.

Continue to plant banksia, grevillea and hakea species near known Carnaby's black-cockatoo breeding areas to provide a food source close by, predominantly in the western and southern parts of the shire and around the Moora townsite.

Work with the Carnaby's cockatoo recovery team to install cockatoo signage on roads where multiple Carnaby's deaths have occurred due to being hit by vehicles.

Female Carnaby's cockatoo at entrance to hollow. Recently hatched chick in roadside tree hollow north of Moora
Photos: R. Dawson, DPaW

Roadside Carnaby's cockatoo signage
Photo: K.Payne, RCC

6.0 Conclusion

The Shire of Moora has a few high conservation roadsides with intact native vegetation with a high diversity of species and habitat for native fauna. Selective weed management near these areas is a priority to ensure they remain intact; otherwise they will gradually decline in condition. Many of the low and medium low conservation roadsides have been taken over by weeds causing a greater fire hazard and smothering threatened plants which are often found on these roadsides as well. The scarcity of native vegetation on these roadsides may also be contributing to salinity and erosion problems.

The Roadside Conservation Value scores for the Shire of Moora were slightly lower than expected. The survey method may have underestimated species diversity due to the type and structure of vegetation (predominantly shrubland rather than woodlands) and surveys being conducted from a car, making identification of different shrub species difficult. The same survey method is used throughout the state which may favour shires which have more trees. However, the scores give a good indication of roadside condition relative to the other roads surveyed in the shire. Many roads had sections with high conservation value and these sections are a priority for management. Low conservation sections adjacent to these would be a priority for revegetation.

The environmental, landcare, aesthetic, tourism and cultural values of roadside vegetation cannot be overestimated. It is a priceless resource that once removed or degraded requires considerable effort, time and expense to replace.

Dandaragan Road
Photo: K. Payne, RCC

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